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Periodontal Health as Perceived by Rheumatologists and Rheumatoid Arthritis Patients

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Abstract: The aim of the present study is to assess the knowledge and attitudes towards periodontal health among rheumatologists and rheumatoid arthritis (RA) patients. Two questionnaires comprising questions on demographics, knowledge, and attitudes towards periodontal health were created via Qualtrics survey software. A link to the survey was sent via email to rheumatologists registered under the Australian Rheumatology Association (ARA) practising in Western Australia, and a separate survey was distributed to patients via Arthritis and Osteoporosis WA social media pages. Seven and 76 responses were received from rheumatologists and RA patients, respectively. Statistically significant results ($p < 0.05$) were found between the length of RA diagnosis and signs of periodontal disease, as well as the type of RA diagnosis and knowledge levels. Employed and retired participants attended the dentist more regularly, and a higher percentage believed that maintaining good oral hygiene is important for overall health. A significant correlation was found between patients who thought improving oral hygiene would impact their RA and whether they received periodontal treatment. No significant differences were found for rheumatologists; however, younger practitioners more frequently asked about their patients' oral health and performed oral exams. There is a deficit in knowledge about the relationship between periodontal disease and RA among both rheumatoid patients and rheumatologists. The high prevalence of periodontitis and the two-way relationship between RA and periodontal disease would benefit from improved knowledge in relation to their association and could have significant benefits in their clinical and public health implications.

Keywords: periodontal disease; rheumatoid arthritis; rheumatologists; knowledge; attitudes

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1. Introduction

Periodontal diseases are infection-inflammatory conditions that lead to the destruction of connective tissue and bone, and that can systemically impact on the overall health of individuals [1] and interfere with other pathologies and their recovery. Periodontitis has been associated with different types of autoimmune diseases including rheumatoid arthritis (RA), as both diseases share common immunological features as well as common risk factors, one of particular importance being smoking [1,2]. Both RA and periodontitis are characterized by self-sustaining inflammation in a fluid-filled compartment adjacent to bone, in which inflammatory cells and other phlogistic factors lead to common clinical manifestations (pain, swelling, tenderness) and, eventually, to destruction of the adjacent bone [1–3].

A recent 2022 study aimed at determining the perceptions held by people with RA relating to their oral health found that people with RA have unique oral health perceptions and experience significant challenges with oral health care, thus requiring adaptation of oral hygiene recommendations and professional oral care delivery [4]. However, few studies have investigated the knowledge and attitudes of rheumatologists and rheumatoid arthritis patients towards periodontal health. The existing information indicates the periodontal health knowledge of medical practitioners is somewhat inadequate, and a closer interaction between medical doctors and dentists is needed. A study of 222 general practitioners

(GPs) found that respondents had a much poorer knowledge of the relationship between periodontal disease and joint disease (43%) compared to other systemic diseases such as diabetes mellitus (72%) and cardiovascular disease (CVD) (55%) [5]. Their attitude regarding periodontal status was also assessed by asking how often they performed an oral examination, whether they asked their patients about gingival bleeding, or whether they receive regular dental care and if they would refer patients with systemic diseases to a dentist [5]. The results showed a severe deficit in knowledge and attitudes among GPs toward the association between periodontal disease and RA.

Similarly, a regionwide survey in the north of France found that GPs had poor knowledge of the association between periodontitis and RA, with only 35.18% of surveyed GPs identifying it as a possible risk factor [6]. This study also inquired as to whether GPs asked their patients about any dental pain or tooth mobility, or advised regular follow-ups with their dental surgeon [6]. A qualitative study interviewing patients with RA found that despite acknowledging the importance of maintaining good oral hygiene, it was not a priority compared to the burden of the comorbidity they had to live with [7]. The debilitating nature of RA meant that maintaining proper oral hygiene was an added burden, being especially difficult when RA flare-ups occurred [7]. This added comorbidity limited the patients' mobility, made transport to their dental appointments much more difficult, and compounded their risk of poor oral hygiene and subsequent periodontal disease, which would potentially further increase the incidence and severity of RA in a continuing vicious cycle.

The high prevalence of periodontitis in the adult population worldwide and in Australia [3] and the likely two-way relationship between RA and periodontal disease [2], would benefit from improved knowledge in relation to their association, and could potentially have significant benefits in their clinical and public health implications. Further investigation between their links such as their pathophysiology, diagnosis, impact, and management would aid in the development of appropriate educational courses to improve on these gaps in knowledge, leading to appropriate and effective management of both diseases.

Aims and Objectives

The aim of the present study was to assess the knowledge, attitudes, behaviours, practices, and education preferences about periodontal health and disease among rheumatoid arthritis patients and rheumatologists.

2. Materials and Methods

2.1. Study Design and Data Collection

All aspects of the project were conducted in line with the ethical principles as stated by the World Medical Association Declaration of Helsinki and were submitted to and approved by the Human Research Ethics Committee of UWA (2021/ET000558).

Full disclosure of the aims and methods of the study was provided to the participants. The participants were given the right to accept or decline their participation in the survey, including the right to not answer specific questions. The participants had the decisional capacity to answer the survey and understood that by participating in the survey there may be no direct self-benefit. All participant details remained confidential and were only be used for the purpose of the study. Participant details were not distributed or used for any other circumstances. Informed consent was required by the participants to ensure their understanding of the above.

Two questionnaires, one for rheumatologists and another for rheumatoid arthritis patients, were designed using an online survey software, Qualtrics. The questionnaires included demographic items, items about knowledge, attitudes and behaviour about periodontal health and disease, as well as information about training and preferences regarding further education in the area. A link to the survey was provided via email to

participants. It was estimated that the survey would take a maximum of ten minutes to complete. All responses were anonymous.

Multiple choice questions, binary response, and Likert scale questions were employed. The questionnaire tools were validated by iterative feedback from periodontic specialists.

2.2. Subjects/Samples

2.2.1. Rheumatologists

Rheumatologists who were registered under the Australian Rheumatology Association (ARA) practising in Western Australia were contacted by email and phone and invited to complete an online self-administered questionnaire. The online questionnaire was distributed via email.

2.2.2. Rheumatoid Arthritis Patients

RA patients were invited to complete a separate questionnaire specifically designed for patients, which was advertised through the social media pages of the Arthritis and Osteoporosis WA organisation. A lower age limit of 18 was required to participate.

2.3. Statistical Analysis

Appropriate statistical analysis was performed using Chi-squared and Fishers exact tests to measure significant differences in categorical variables. A p value equal to or less than 0.05 was considered statistically significant.

3. Results

3.1. Demographic Characteristics of Rheumatoid Arthiritis Patients

Rheumatoid arthritis patients across Western Australia were contacted via the Australian Arthritis and Osteoporosis WA social media pages. They were targeted with images allowing them to scan a QR code to provide a link to the survey.

Of the 87 returned questionaries, 76 were continued beyond the initial consent page, with many responders leaving at least one question with no response. Table 1 shows the demographic characteristics of the respondents. The sample was comprised of 95% females, with the majority of responses being from the middle-older age group. The age bracket with the most responses was the 51–60 years, comprising 29% of the responses. Overall, 95% of the responses were from Caucasian patients, and a relatively generalised spread of education levels was attained. Of the patients surveyed, 82% were involved in some form of employment and more than half (55%) did not have their rheumatoid arthritis diagnosed recently, but instead had been diagnosed for more than 5 years. Despite this, only 42% of patients knew their type of rheumatoid arthritis diagnosis, and the majority of patients (67%) had never received a diagnosis for periodontal disease.

3.2. Rheumatoid Arthitis Patients' Knowledge of Relationships between Rheumatoid Arthritis and Periodontal Disease

The second part of the questionnaire aimed to evaluate the knowledge of rheumatoid arthritis patients about the relationship between their systemic RA condition and periodontal disease. Table 2 shows that knowledge about the link between periodontal health and susceptibility to systemic diseases was low; however, most RA patients reported experiencing signs of periodontal disease including bleeding, sore or swollen gums, bad breath, or mobile teeth (59%). Despite many patients revealing their attitudes towards the importance of oral hygiene in Table 2, the majority (79%) did not know its impact on their rheumatoid arthritis condition. When asked if they were interested in increasing their knowledge about the relationships between systemic disease and periodontal disease, almost 75% of participants answered yes, with the most common format being via monthly emails, as outlined in Figure 1.

Table 1. Population Profiles Rheumatoid Arthritis Patients and Rheumatologists.

Rheumatoid Patients			**Rheumatologists**		
Variables	***n***	**%**	**Variables**	***n***	**%**
Demographic Information			Demographic Information		
Gender			Gender		
Female	72	94.74	Female	1	14.3
Male	3	3.95	Male	5	71.4
Other/Not specified	0	0	Other/Not specified	1	14.3
Age, y			Age, y		
21–30	3	3.95	21–30	0	0
31–40	3	3.95	31–40	0	0
41–50	6	7.89	41–50	3	42.9
51–60	22	28.95	51–60	0	0
61–70	17	22.37	61–70	1	14.3
>70	17	22.37	>70	3	42.9
Identity			Identity		
Caucasian	72	94.74	Caucasian	3	42.9
Aboriginal or Torres Strait Islander	0	0	Aboriginal or Torres Strait Islander	0	0
Asian	0	0	Asian	4	57.1
Other	3	3.95	Other	0	0
Marital Status			Professional Career		
Never married	19	25	Years practising		
Married	37	48.68	<5	0	0
Separated	5	6.58	6–10	3	42.9
Divorced	9	11.84	>10	4	57.1
Widowed	5	6.58	Up to date with literature		
Highest level of education			Yes	7	100
Less than high school	3	3.95	No	0	0
Highschool graduate	17	22.37			
TAFE or diploma	24	31.58			
Undergraduate degree	10	13.16			
Postgraduate degree	10	13.16			
Masters degree	10	13.16			
Doctorate	1	1.32			
Current employment status					
Full time	18	23.68			
Part time	15	19.74			
Not working due to disability	7	9.21			
Retired	29	38.16			
Unemployed and not looking for work	2	2.63			
Unemployed and looking for work	1	1.32			
Student	3	3.95			
Rheumatoid Arthritis					
Length of diagnosis, y					
<1	6	7.89			
1–5	20	26.32			
6–10	10	13.16			
>10	32	42.11			
Type of RA known					
Yes	32	42.11			
No	37	48.68			
Periodontal disease					
Yes	14	18.42			
No	51	67.11			

Table 2. Knowledge regarding periodontal disease.

Rheumatoid Patients		
Variables	***n***	**%**
Knows there is a Link between oral and systemic diseases		
Yes	33	43.42
No	43	56.58
Experiences one or more signs of periodontal disease		
Yes	45	59.21
No	31	40.79
Knows they are more susceptible to poor dental health		
Yes	33	43.42
No	43	56.58
Knows that oral hygiene can impact rheumatoid arthritis		
Yes	16	21.05
No	60	78.95
Rheumatologist's		
Variables	***n***	**%**
Good oral health is important to overall health?		
Strongly agree	6	85.7
Agree	1	14.3
Neutral	0	0
Disagree	0	0
Strongly disagree	0	0
No response	1	0
Oral disease (periodontal disease) can be linked to systemic disease and vice versa		
Strongly agree	2	28.6
Agree	3	42.9
Neutral	2	28.6
Disagree	0	0
Strongly disagree	0	0
No response	1	0
Patients with rheumatoid arthritis are at an increased risk of severe periodontal disease		
Strongly agree	2	28.6
Agree	5	71.4
Neutral	0	0
Disagree	0	0
Strongly Disagree		0
No response	1	0

3.3. Rheumatoid Arthiritis Patients' Attitudes and Behaviours towards Periodontal Disease

Beyond rheumatoid arthritis patients' knowledge surrounding periodontal disease, the survey also asked about their attitudes and behaviours towards their oral health, which is outlined in Table 3. A very high proportion regarded maintaining good oral health as very or extremely important (82%), which was represented by the majority (72%) of patients attending the dentist regularly, which was considered at least once annually. However, a significant proportion of respondents reported only attending the dentist when a problem arose (26%). Even though there is an association between rheumatoid arthritis and periodontal disease, only 25% of respondents were receiving treatment for periodontal disease.

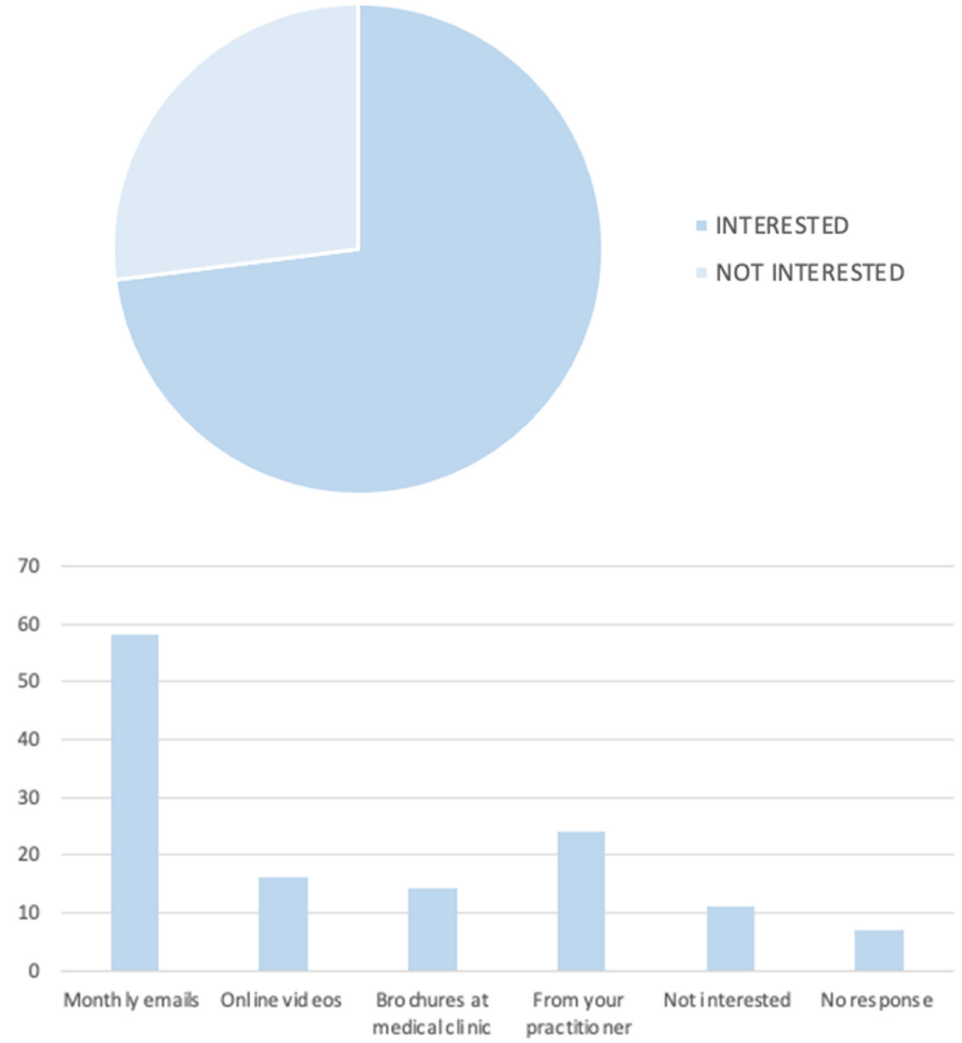

Figure 1. Rheumatoid arthritis patients Education Preferences.

Table 3. Attitude and behaviours regarding periodontal disease.

Rheumatoid Patients		
Variables	***n***	**%**
How often attends the dentist (65 responses)		
Never	1	1.54
Only when a problem arises	17	26.15
1–2 times per year	27	41.54
>2 times per year	20	30.78
Receiving treatment for periodontal disease (65 responses)		
Yes	16	24.62
No	49	75.38
Importance of maintaining good oral hygiene (66 responses)		
Not at all important	0	0
Slightly-moderately important	12	18.18
Very-extremely important	54	81.82

Table 3. *Cont.*

Rheumatologist's		
Variables	***n***	**%**
How often do you ask about your patient's oral hygiene or oral health status		
Always	1	14.3
Most of the time	0	0
About half the time	0	0
Sometimes	5	71.4
Never	1	14.3
No response	0	0
How often do you perform an oral exam on your patients?		
Always	1	14.3
Most of the time	0	0
About half the time	0	0
Sometimes	3	42.9
Never	3	42.9
No response	1	0
How often do you refer your patients to a dental specialist		
Always	0	0
Most of the time	0	0
About half of the time	1	14.3
Sometimes	6	85.7
Never	0	0
No response	1	0

3.4. Relationships between Knowledge Regarding Oral Systemic Link and Sociodemographic Characteristics of Rheumatoid Arthritis Patients

To assess whether sociodemographic factors were associated with knowledge levels amongst patients with rheumatoid arthritis, we compared each correct response with their gender, age, highest level of education attained, employment status, length, and type of rheumatoid arthritis diagnosis, as shown in Table 4. The results show that a higher percentage of females answered correctly for all knowledge questions, but this finding was not significant ($p > 0.05$). A higher rate of correct knowledge answers was found in the younger age group with responders younger than 40, except in relation to the impact of oral hygiene on their rheumatoid arthritis condition. The proportion of correct responses amongst various levels of education as well as between those employed and unemployed were relatively similar and did not have any significant correlation ($p > 0.05$). A positive correlation was found between the length of rheumatoid arthritis diagnosis and the experience of certain oral signs associated with periodontal disease ($p = 0.0459$). There was also a positive correlation between the patients' type of rheumatoid arthritis diagnosis and their knowledge about the link between oral and systemic diseases ($p = 0.0441$).

Table 4. Association between sociodemographic factors of rheumatoid arthritis patients and their knowledge, attitudes, and behaviours regarding the association between systemic and periodontal diseases.

	Sociodemographics																	
	Gender			**Age**				**Highest Level of Education**			**Employment Status**			**Length of RA Diagnosis**			**Type of RA Diagnosis**		
	Female	**Male**	***p*-Value**	**£40**	**40–60**	**>60**	***p*-Value**	**High School or Less**	**Undergraduate Qualification**	**Postgraduate Qualification**	***p*-Value**	**Employed or Retired**	**Unemployed or Student**	***p*-Value**	**0–5 Years**	**>5 Years**	***p*-Value**	**Known**	**Unknown**	***p*-Value**
									Knowledge											
Link between oral and systemic diseases	33 (46)	0	0.2508	4 (67)	13 (46)	15 (47)	0.6457	8 (38)	15 (44)	10 (50)	0.4410	27 (44)	6 (46)	0.8634	11 (42)	20 (48)	0.6691	19 (59)	13 (35)	0.0441
Experience one or more signs of periodontal disease	44 (61)	1 (33)	0.5602	3 (50)	17 (61)	19 (59)	0.8884	11 (52)	23 (68)	11 (55)	0.6383	36 (58)	9 (69)	0.4549	13 (50)	31 (74)	0.0459	20 (63)	24 (65)	0.8285
Susceptibility for poor dental health due to existing rheumatoid arthritis condition	33 (46)	0	0.2562	4 (67)	12 (43)	14 (44)	0.5481	8 (38)	15 (44)	10 (50)	0.2959	25 (40)	7 (54)	0.3701	11 (42)	20 (48)	0.6691	17 (53)	15 (41)	0.2959
Oral hygiene impact on rheumatoid arthritis	16 (22)	0	1	1 (17)	5 (18)	9 (21)	0.5962	3 (14)	9 (26)	4 (20)	0.2661	14 (23)	2 (15)	0.5647	2 (50)	13 (31)	0.1515	6 (19)	10 (27)	0.4166
									Attitudes & Behaviours											
Attends dentist regularly	46 (64)	1 (33)	0.2837	3 (50)	16 (57)	23 (72)	0.3808	12 (60)	22 (65)	13 (62)	0.9387	43 (69)	4 (31)	0.0089	15 (58)	30 (71)	0.2446	22 (69)	25 (68)	0.9163
Receiving treatment for periodontal disease	16 (22)	0	1	1 (17)	4 (14)	6 (19)	0.8983	3 (15)	9 (26)	4 (19)	0.5833	15 (24)	1 (8)	0.1867	3 (12)	12 (29)	0.0997	5 (16)	11 (30)	0.1662
Importance of maintaining good oral hygiene	51 (71)	2 (67)	0.8766	2 (33)	21 (75)	24 (75)	0.0993	14 (70)	23 (68)	9 (43)	0.1208	48 (77)	6 (46)	0.0224	19 (73)	34 (81)	0.4466	27 (84)	27 (73)	0.2522

Note: rheumatoid arthritis is abbreviated to RA. Responses of neutral, disagree, or strongly disagree, as well as incomplete responses, were considered to be incorrect. Those responses that agreed or strongly agreed were considered correct responses to the knowledge questions. The breakdown of levels of education was chosen so that undergraduate qualifications or equivalent included a bachelor's degree, diploma, or certificate; postgraduate qualifications included a master's degree or doctoral degree.

3.5. Relationships between Attitudes and Behaviours Regarding Oral Systemic Link and Sociodemographic Characteristics of Rheumatoid Arthritis Patients

To assess whether sociodemographic factors were associated with the attitudes and behaviours amongst patients with rheumatoid arthritis, Fisher's exact tests were performed with each correct response against the patient's gender, age, highest level of education attained, employment status, length, and type of rheumatoid arthritis diagnosis, as shown in Table 4. No significant differences were found between patients' gender, age, highest level of education, length of RA diagnosis or type of RA. However, patients that had been diagnosed for a longer period of time, greater than five years, answered a higher percentage of questions correctly than those who had been more recently diagnosed across all attitude and behaviour questions. A significant correlation ($p > 0.05$) was found between those who were employed or retired compared with those who were unemployed or a student. Employed and retired participants attended the dentist more regularly: 69% compared with 31% ($p = 0.089$). A higher percentage of employed and retired participants also believed that maintaining good oral hygiene is important for overall health, with 77% agreeing or strongly agreeing compared with 46% of unemployed or student participants ($p = 0.0224$).

3.6. Relationships between Attitudes and Behaviours Regarding Oral Systemic Link and Knowledge of Rheumatoid Arthritis Patients

Rheumatoid arthritis patients' knowledge was tested to see the correlation between their attitudes and behaviours. Fishers exact testing was performed at a $p > 0.05$ significance level. The patients' knowledge did not affect their dental attendance or the importance of their oral health. However, a significant value was found between patients who thought improving oral hygiene would impact their rheumatoid arthritis and whether they received periodontal treatment (Table 5). In total, 44% of patients who received treatment answered yes to this question, compared with only 18% of those that did not receive treatment.

Table 5. Association between rheumatoid arthritis patients' knowledge and their attitudes and behaviors towards oral disease.

	Attitudes & Behaviours								
	Dentist Attendance			**Receiving Periodontal Treatment**			**Oral Health Importance to Patient**		
	Regularly >1–2 Times/Year (47)	**Never/Only When There Is a Problem (18)**	***p*-Value**	**Yes (16)**	**No (49)**	***p*-Value**	**Extremely/Very Important (54)**	**Moderately/Not at All Important (12)**	***p*-Value**
					Knowledge				
Link between oral and systemic diseases	27 (57)	6 (33)	0.0818	8 (50)	25 (51)	0.9435	40 (74)	8 (67)	0.6022
Experience one or more signs of periodontal disease	30 (64)	13 (72)	0.5222	14 (88)	30 (61)	0.0510	35 (65)	9 (75)	0.4984
Susceptibility for poor dental health due to existing rheumatoid arthritis condition	24 (51)	9 (50)	0.9388	9 (56)	24 (49)	0.6135	26 (48)	7 (58)	0.5232
Oral hygiene impact on rheumatoid arthritis	13 (28)	3 (17)	0.3572	7 (44)	9 (18)	0.0407	‘13 (24)	3 (25)	0.9460

Note: Responses of neutral, disagree or strongly disagree as well as incomplete responses were considered to be incorrect and those responses that agreed or strongly agreed were considered correct responses to the knowledge questions.

3.7. Demographic Characteristics of Rheumatologists

Rheumatologists across Western Australia were contacted via email. A total of 28 rheumatologists were contacted via phone to discuss the survey and then emailed with a link to Qualtrics to access and complete the survey. We received eight responses

from 28 rheumatologists (28.57% response rate). One response did not make it past the demographic questionnaire, and this response was disregarded for statistical analysis. Table 1 shows that 71.4% of participants were male. The participants were all over 40 years of age, with 42.9% being Caucasian and 57.1% Asian. All practitioners had been practising for at least six years, and all kept up to date with current literature.

3.8. Rheumatologists' Knowledge of Relationships between Rheumatoid Arthritis and Periodontal Disease

The second part of the questionnaire aimed to evaluate the knowledge of rheumatologists on the relationship between their patients' RA condition and periodontal disease. Table 2 shows that rheumatologists had high self-reported knowledge about the importance of oral health on overall health, with 100% participants strongly agreeing or agreeing. The rheumatologists also had high self-reported knowledge about the links between rheumatoid arthritis and periodontal disease. When asked if they were interested in increasing their knowledge about the relationships between systemic disease and periodontal disease, almost 75% of participants answered yes, with the most common format being via monthly emails and online videos, as outlined in Figure 2.

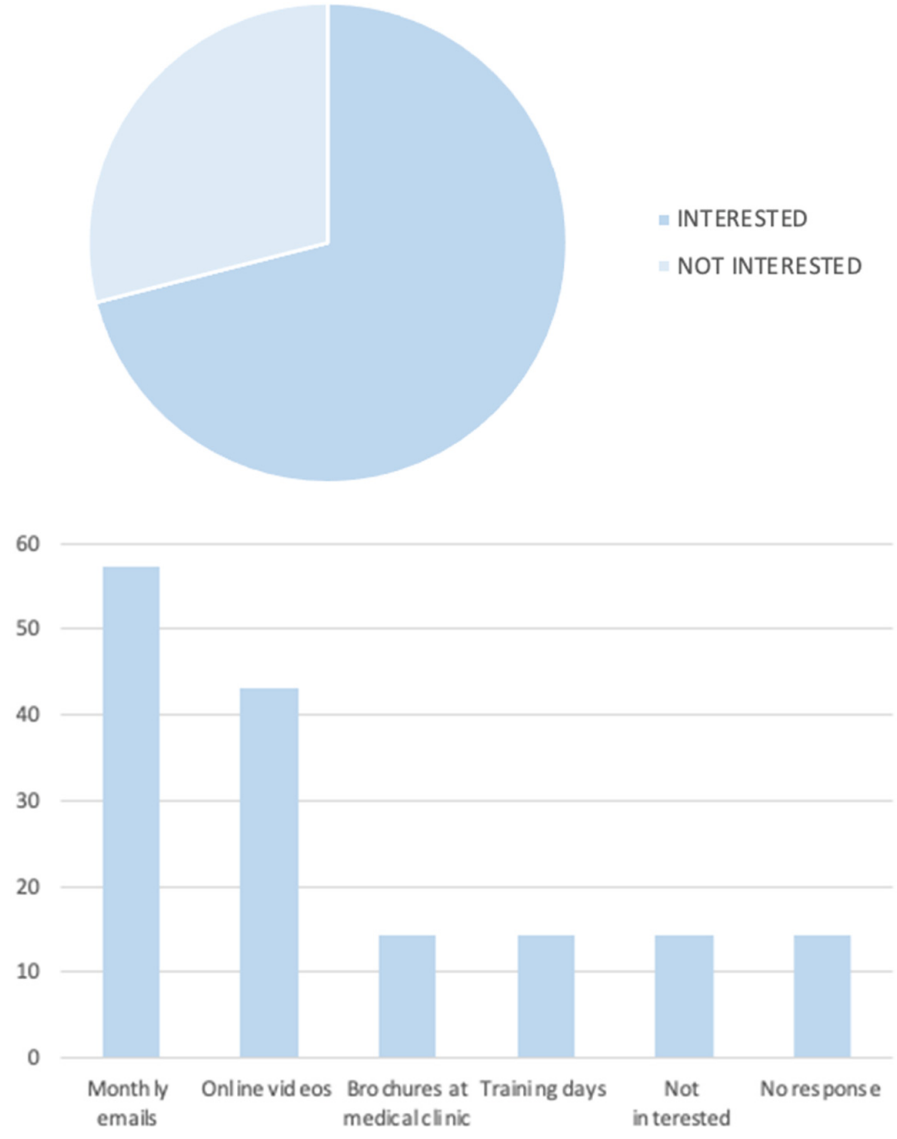

Figure 2. Rheumatologists' Education Preferences.

3.9. Rheumatologists' Attitudes and Behaviours towards Periodontal Disease

We aimed to assess the attitudes and behaviours of rheumatologists. Although the participants reported a high level of knowledge concerning the links between RA and PD and the importance of oral health and overall health, this knowledge translated poorly into practice, as shown in Table 3. Only 14.3% of respondents reported always asking about their patients' oral hygiene or oral health status, or to performing an oral examination on their patients. The majority of practitioners (85.7%) only sometimes referred patients to a dental specialist.

3.10. Relationships between Knowledge Regarding Oral Systemic Link and Sociodemographic Characteristics of Rheumatologists

To assess whether sociodemographic factors were associated with the knowledge levels of rheumatologists, we compared sociodemographic questions to knowledge-based questions as shown in Table 5. There was no significant difference between any sociodemographic and knowledge-based questions. However, a higher percentage of practitioners younger than 60 and those that had graduated more recently agreed that oral disease could be linked to systemic disease and vice versa compared with those older than 60 and those that had graduated over 10 years ago, despite 100% of practitioners reporting that they keep up to date with current medical literature.

3.11. Relationships between Attitudes and Behaviours Regarding Oral Systemic Link and Sociodemographic Characteristics of Rheumatologists

To assess whether sociodemographic factors were associated with the attitudes and behaviours of rheumatologists, we compared the sociodemographic questions to the attitude and behaviour-based questions. There was no significant difference between any sociodemographic factors, attitudes, and behaviour-based questions. However, younger practitioners and those that had graduated more recently reported that they more frequently asked about their patients' oral health and performed oral exams on their patients, compared with older practitioners and those that had graduated over 10 years ago, as shown in Table 6.

Table 6. Association between rheumatologists' sociodemographic factors and their knowledge, attitudes, and behaviours towards the association between systemic and periodontal diseases.

	Sociodemographic								
	Gender			**Age**			**Years Practicing**		
	Male (5)	**Female (1)**	***p* Value**	**<60 (3)**	**60+ (4)**	***p* Value**	**6–10 (3)**	**10+ (4)**	***p* Value**
				Knowledge					
Is good oral health important to overall health?	5 (100)	1 (100)	1	3 (100)	4 (100)	1	3 (100)	4 (100)	1
Oral disease (periodontal disease) can be linked to systemic disease and vice versa	4 (80)	0	0.33	3 (100)	2 (50)	0.4286	3 (100)	2 (50)	0.4286
Patients with rheumatoid arthritis are at an increased risk of severe periodontal disease	5 (100)	1 (100)	1	3 (100)	4 (100)	1	3 (100)	4 (100)	1

Table 6. *Cont.*

	Sociodemographic								
	Gender			Age			Years Practicing		
	Male (5)	**Female (1)**	***p* Value**	**<60 (3)**	**60+ (4)**	***p* Value**	**6–10 (3)**	**10+ (4)**	***p* Value**
Attitudes & Behavior									
Ask about patient's oral hygiene or oral health status	4 (80)	1 (100)	1	3 (100)	3 (75)	1	3 (100)	3 (75)	1
Perform an oral exam on their patients	2 (40)	1 (100)	1	2 (67)	2 (50)	1	2 (67)	2 (50)	1
Refers patients to a dental specialist	5 (100)	1 (100)	1	3 (100)	4 (100)	1	3 (100)	4 (100)	1

Note: Responses of neutral, disagree, or strongly disagree, as well as incomplete responses were considered to be incorrect. Responses that agreed or strongly agreed were considered correct responses to the knowledge question.

3.12. Relationships between Attitudes and Behaviours Regarding Oral Systemic Link and Knowledge of Rheumatologists

To assess whether knowledge was associated with the attitudes and behaviours of rheumatologists, we compared the responses to knowledge questions to the attitude and behaviour-based questions. No significant values were found at the $p < 0.05$ level. However, rheumatologists who agreed that periodontal disease can be linked to RA disease and vice versa reported asking about their patients' oral hygiene and performing oral exams more frequently than those who did not hold this belief.

4. Discussion

This study aimed to assess the knowledge and attitudes towards periodontal health among rheumatologists and RA patients. We found that there was a deficit in knowledge about the relationship between periodontal and systemic diseases among both rheumatoid patients and rheumatologists. Rheumatoid arthritis patients who knew what type of RA diagnosis they had were more likely to know about this relationship, and patients that have been living with their diagnosed condition for a longer period were more likely to experience signs of periodontal disease. Those that believed oral hygiene could impact their rheumatoid arthritis were more likely to receive periodontal treatment. Patients who were unemployed visited the dentist less frequently and did not value their oral hygiene as highly as those that were employed.

When evaluating the responses of rheumatologists, a trend was found for those aged 60 and over and those who had been graduated for longer. This group did not agree that oral disease could be linked to systemic disease, and they also less frequently asked patients about their oral hygiene and less frequently performed oral exams. Rheumatologists who agreed oral disease can be linked to systemic disease more frequently asked about patients about their oral hygiene and more frequently performed oral exams.

These results are comparable to results obtained from similar survey studies in different populations. For example, in the 2017 study by Alexia et al. [5], the main finding was that there is a severe deficit in knowledge about the relationship between periodontal and systemic diseases among GPs [5]. To evaluate how this was reflected in the GPs' clinical practices, participants were asked about the frequency they performed oral examinations. Overall, 75% and 15% of answers fell in the sometimes or never categories, respectively, with only 20% answering always [5]. These findings are consistent with our results, which found that 71% and 15% of GPs answered sometimes or never, respectively, and only 14% answered always. When evaluating RA patients' responses, 56% of participants did not know of the link between oral and systemic diseases, and 79% did not know that oral hygiene can impact RA. A 2022 study by Protudjer et al. [4], also found that patients had

limited knowledge regarding the associations between arthritis and oral disease, and many participants were not aware of the importance of oral health to their RA [4]. Another study also highlighted the limited knowledge regarding the association between arthritis and oral diseases among patients with rheumatoid arthritis and the challenges they faced in maintaining oral hygiene due to their condition. In fact, the patients in this study thought that any oral symptoms were the result of the medications alone [3]. This finding is alarming, as it has been shown that RA patients exhibit an OHRQoL that is significantly worse and independent of their oral health status when compared to a control group of patients not presenting with RA [8].

The limitations in our study would be the potential sources of bias introduced by self-administered questionnaires and the low response rates obtained. The rheumatologist survey received seven responses out of a WA population size of 28, and the rheumatoid arthritis survey only received 76 responses. Despite several reminders, low response rates can be attributed to a lack of interest, invalid email addresses, failure of receptionists in charge of practice emails to pass messages on to rheumatologists, or lack of social media use by the patients.

The results of our study are important to providing a baseline for the current knowledge levels of rheumatologists and RA patients in Western Australia. This study hopes to influence participants to seek out further educational resources to expand their knowledge on periodontal disease and oral health, with the aim that further studies will encourage better integration of oral health in the management of rheumatoid arthritis and aid in bridging the gap between periodontal disease and rheumatoid arthritis. We hope that this study and others in the future will result in the production of educational resources that can be easily accessed and utilised to further improve knowledge and result in overall better health outcomes.

5. Conclusions

Our study showed a deficit in knowledge among both rheumatoid patients and their rheumatologist about the relationship between systemic diseases, in particular rheumatoid arthritis, with oral diseases such as periodontitis. Our findings highlight the importance of providing adequate educational resources in order to raise awareness and knowledge on the topic, and to promote continued education on the matter for both rheumatologists and their patients.

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