

Research Article

Prevalence of Signs and Symptoms of Temporomandibular Disorders in Patients with Different Rheumatic Diseases

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Abstract

Objective: To compare the prevalence and severity of Temporomandibular Disorders (TMD) among seropositive and seronegative rheumatic patients shortly after diagnosis and before any medical treatment.

Material and Method: We conducted a prospective study involving 88 patients with rheumatic diseases: 49 seropositive patients with rheumatoid arthritis and 39 seronegative patients with psoriatic arthritis or ankylosing spondylitis. Patients were diagnosed with rheumatic disease based on the criteria of the American College of Rheumatology. The study protocol included recording of medical history, clinical examination, serological evaluation and radiographic assessment. Immediately following diagnosis, patients underwent TMD assessment, including examination for signs and symptoms and recording of anamnestic and clinical indices. Chi-square tests ($p < 0.05$) were used to compare characteristics between the two groups using SPSS software.

Results: No statistically significant differences were observed in TMD prevalence or severity among patients with rheumatic diseases. Clicking and deviation did not differ significantly between groups. However, seropositive patients exhibited significantly increased limitations of movement ($p = 0.002$) and muscular pain ($p = 0.030$) compared to seronegative patients. No significant differences were observed in TMJ pain or pain on movement.

Conclusion: No statistically significant differences in TMD prevalence between seropositive and seronegative patients with rheumatic diseases were detected. Nevertheless, limitations of movement and muscular pain appeared significantly increased in seropositive patients in the early stage of the disease before any therapeutic intervention.

Keywords: Temporomandibular Disorders; Rheumatic Diseases; Seropositive Patients; Seronegative Patients; Initial Diagnosis

Introduction

Research on Temporomandibular Joint (TMJ) involvement in rheumatic diseases has primarily focused on Rheumatoid Arthritis (RA), with less attention given to ankylosing Spondylitis (SpA) and Psoriatic Arthritis (PA). The reported prevalence of TMJ involvement varies widely across studies, ranging from 2% to 88% in RA 11% to 35% in SpA and 29% to 60% in PA [1-8].

A 256-patient study by Sostmann, et al., found that subjective symptoms of Temporomandibular Disorders (TMD) were present in 41% of RA patients, 29% of PA patients and 20% of SpA patients [6]. Conversely, Helenius, et al., reported that TMD symptoms were more prevalent in SpA patients (37%) than in other rheumatic patients, in a study of 80 participants [5]. A separate study by the same group found that TMD symptoms in PA patients were less frequent and less severe than those in RA and SpA patients [3]. Kononen, et al., observed that a mixed sample of 183 rheumatic patients with RA and PA exhibited more frequent and more severe TMD signs and symptoms compared to SpA patients [9]. A radiographic evaluation of 183 patients by

Wenneberg, et al., revealed that TMJ involvement was more pronounced in RA patients compared to PA and SpA [10]. Miles, et al., found that erosions on the condyle were prevalent in PA patients, similar to those observed in the RA group [11]. The discrepancies in research findings among investigators may be attributed to a combination of factors, including wide variations in sample size, diverse patient selection methods (randomized or selective samples based on age, sex or ethnological characteristics), presence or absence of a control group, variability in diagnostic criteria, heterogeneity in clinical and radiographic examination/serological evaluation practices, differences in the type of rheumatic disease under investigation, variation in disease duration and activity, diversities in medication regimens prescribed [4,12,13].

While previous studies have investigated the prevalence and severity of TMD in patients with rheumatic diseases, they have not specifically addressed the appearance and severity of TMD signs and symptoms during the initial diagnosis phase, the critical period immediately following the onset of rheumatic symptoms and when patients first seek medical attention. The objective of this study was to comparatively assess the prevalence and severity of TMD signs and symptoms in a cohort of patients shortly after their initial diagnosis of seropositive (positive RF and anti-CCP) and seronegative (negative RF and anti-CCP) rheumatic diseases and before initiating any medical intervention.

Material and Methods

The study enrolled a total of 88 patients, divided into two sequential cohorts: a seropositive group (49 patients diagnosed with RA) [RF+] and a seronegative group (39 patients diagnosed with either PA or SpA) [RF-]. The study was conducted from September 2019 to June 2020.

Patients presenting at the Rheumatology Clinic of the University Hospital of Heraklion, Crete, Greece, were evaluated by two rheumatologists. At this initial visit, patients had not yet received any prior treatment or complementary alternative medication for their symptoms. A comprehensive patient assessment involving medical history, clinical examination, serological evaluation and radiographic examination was conducted. All patients were diagnosed with a rheumatic disease based on the American Rheumatism Association's revised classification criteria for RA [14] and the European Spondyloarthropathy Study Group criteria for SpA and PA [15]. Both rheumatologists independently reached the same diagnosis in every case (kappa coefficient:1). Patients were further classified into seropositive and seronegative groups using the criteria of the American College of Rheumatology.

Serological assessment for all patients included: general Blood Count (CBC), Erythrocyte Sedimentation Rate (ESR), Rheumatoid Factor (RF), Anti-Cyclic Citrullinated Peptide (ACCP), C Reactive Protein (CRP), Antinuclear Antibodies (ANA), Anti-Neutrophil Cytoplasmic Antibodies (ANCA), C3, C4, extractable nuclear antigen antibodies (anti-ENA), anti-double stranded DNA (anti-dsDNA), anti-Ro (SSA), anti-La (SSB).

Before the oral examination, all participants were fully informed about the nature and purpose of the research. Written informed consent was obtained from each individual and the study protocol was approved by the Research Ethics Committees of the University Hospital of Heraklion at the Medical School of the University of Crete and the School of Dentistry at the Aristotle University of Thessaloniki. Once the participants had provided their consent, they underwent a comprehensive TMD examination, conducted by a specialized prosthodontist with expertise in orofacial pain diagnosis, before any treatment for their underlying rheumatic condition commenced.

A standardized assessment protocol was implemented for each participant, encompassing the collection of comprehensive personal and demographic data, a thorough examination for signs and symptoms of TMD and the documentation of Helkimo anamnestic and clinical dysfunction indices to assess the severity of TMD symptoms [16,17]. Helkimo indices were selected for this study due to their validation and adjustment for use in the Greek population, unlike other indices, such as RDC/TMD or DC/TMD, which remain under review.

Inclusion criteria comprised an age 18 or older, excluding juvenile rheumatoid arthritis, the absence of a history of head and neck or mandibular trauma, the absence of rhinal, sinus or otic problems and no prior or ongoing radiotherapy on the head and neck (Fig. 1).

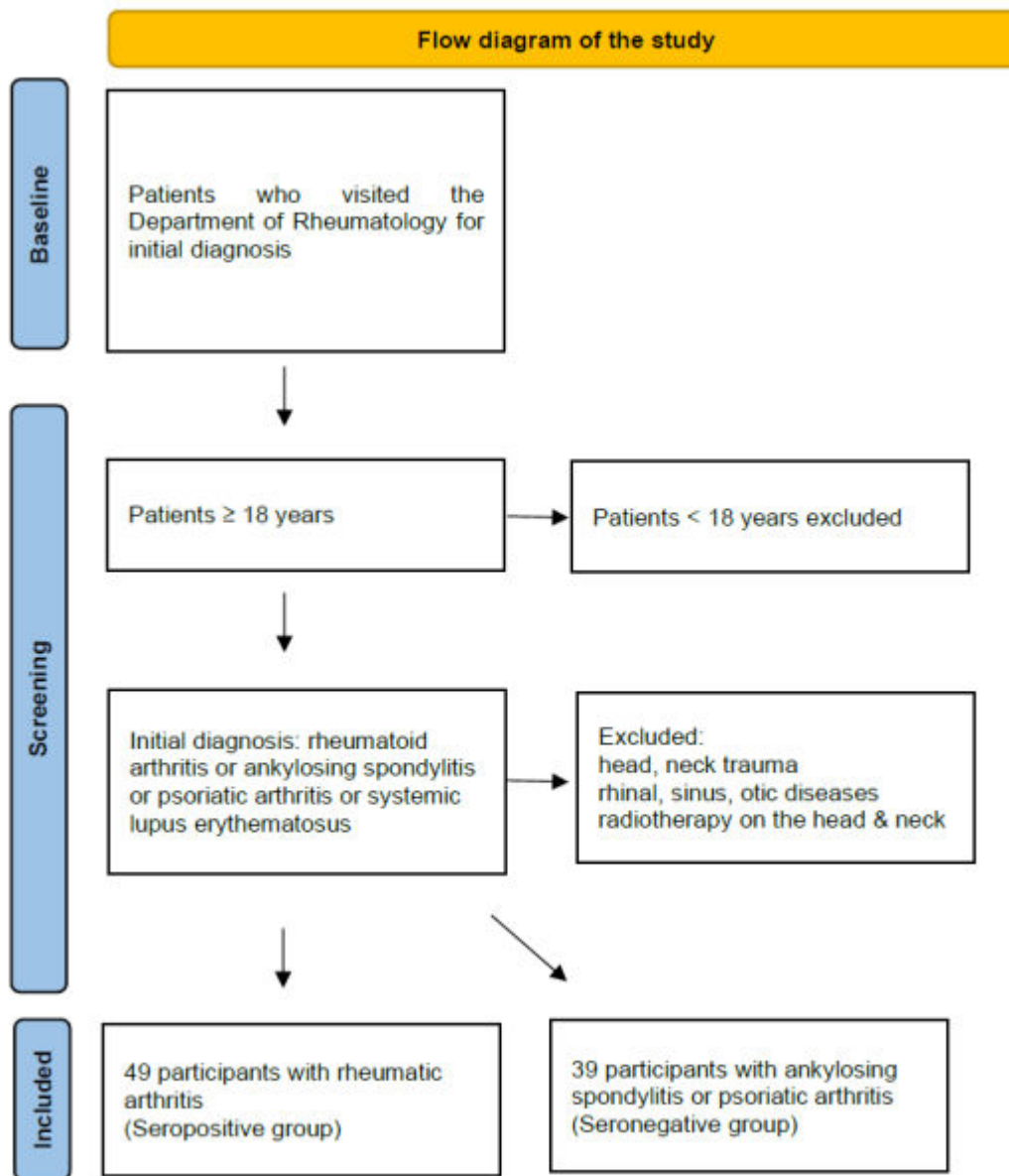


Figure 1: Flow diagram of the study.

Statistical Analysis

Categorical clinical parameters were calculated and presented as observed frequencies and corresponding proportions. To compare characteristics between the two groups, the chi-square test of independence was employed. A p-value less than 0.05 was deemed statistically significant. Statistical analyses were conducted using SPSS version 20.0 software (SPSS Inc, Chicago, IL). All statistical tests were two-tailed.

Results

The mean age of the patients was 48.6 ± 14.9 years, with a female-to-male ratio of 3:1 in RA, 1.2:1 in PA and 1:2.1 in SpA. The presence and severity of TMD symptoms (anamnesic dysfunction index - Ai) and signs (clinical dysfunction index - Di) were recorded and analyzed in Table 1. No statistically significant differences were observed between the two groups. Overall, 65.3% of seropositive and 58.9% of seronegative patients exhibited TMD symptoms ($p=0.830$), with 28.6% and 25.6%, respectively, experiencing severe symptoms (AII).

The clinical dysfunction index revealed that 95.9% of seropositive and 89.7% of seronegative patients displayed signs detected by the examiner ($p=0.119$). Based on the clinical index, 24.5% and 20.5% of the totals, respectively, were classified as severely dysfunctional (DIII). However, while a large majority (71.4%) of seropositive patients showed at least moderate to severe signs, seronegative patients did not exhibit the same severity, with only 46.1% displaying such signs.

Regarding individual signs and symptoms, the prevalence of clicking and movement deviation are presented in Table 2. There were no statistically significant differences between the groups for clicking ($p=0.653$) or movement deviation ($p=0.842$). A statistically significant difference in muscular pain was observed between seropositive (71.4%) and seronegative (48.7%) patients ($p = 0.030$) (Table 2). Analysis revealed that 61.0% of seropositive and 43.6% of seronegative patients exhibited at least one palpable painful muscle area. Of the total participants, 10.2% and 5.1%, respectively, were classified as exhibiting severe muscular dysfunction.

Limitation of jaw movement was more pronounced in seropositive patients (81.6%) compared to seronegative patients (56.4%) ($p = 0.002$). A severe limitation was observed in 36.7% of RF+ patients. The limitation was primarily evident in protrusive and lateral movements rather than maximum mouth opening (Table 2). No significant difference was observed in the prevalence of TMJ pain on palpation (seropositive 59.2% - seronegative 46.2% - $p = 0.205$) or pain on movement (seropositive 26.5% - seronegative 28.2% - $p = 0.278$) between the two groups (Table 2). About half of the total patients reported TMJ pain and 38% experienced pain on posterior palpation.

	Seropositive Patients	Seronegative Patients	Total	<i>p</i> -Value
Anamnestic Index (Ai) - Subjective findings				0.830
A ₀ (no symptoms)	17 (34.7%)	16 (41.0%)	33 (37.5%)	
A _I (mild symptoms)	18 (36.7%)	13 (33.3%)	31 (35.2%)	
A _{II} (severe symptoms)	14 (28.6%)	10 (25.6%)	24 (27.3%)	
Total	49 (100%)	39 (100%)	88 (100%)	
Clinical Index (Di) - Objective findings				0.119
D ₀ (no signs)	2 (4.1%)	4 (10.3%)	6 (6.8%)	
D _I (mild signs)	12 (24.5%)	17 (43.6%)	28 (33.0%)	
D _{II} (moderate signs)	23 (46.9%)	10 (25.6%)	33 (37.5%)	
D _{III} (severe signs)	12 (24.5%)	8 (20.5%)	20 (22.7%)	
Total	49 (100%)	39 (100%)	88 (100%)	

Table 1: Anamnestic index (Ai) and Clinical index (Di).

	Seropositive Patients	Seronegative Patients	Total	<i>p</i> -Value
Clicking				0.653
No	33 (67.3%)	28 (71.8%)	61 (69.3%)	
Yes	16 (32.7%)	11 (28.2%)	27 (30.7%)	
Mandibular deviation				0.842
No	42 (85.7%)	34 (87.2%)	76 (86.4%)	
Yes	7 (14.3%)	5 (12.8%)	12 (13.6%)	
Movement limitation				0.002
No limitation	9 (18.4%)	17 (43.6%)	26 (29.5%)	
Moderate	22 (44.9%)	19 (48.7%)	41 (46.6%)	
Severe	18 (36.7%)	3 (7.7%)	21 (23.9%)	
TMJ pain				0.205
No pain	20 (40.8%)	21 (53.8%)	41 (46.6%)	

Lateral palpation	10 (20.4%)	3 (7.7%)	13 (14.8%)	
Posterior palpation	19 (38.8%)	15 (38.5%)	34 (38.6%)	
Pain on mandibular movement				0.278
No pain	36 (73.5%)	28 (71.8%)	64 (72.7%)	
Moderate	10 (20.4%)	5 (12.8%)	15 (17.0%)	
Severe	3 (6.1%)	6 (15.4%)	9 (10.2%)	
Muscle tenderness/pain				0.030
No	14 (28.6%)	20 (51.3%)	34 (38.6%)	
Yes	35 (71.4%)	19 (48.7%)	54 (61.4%)	

Table 2: Signs and symptoms of TMD.

Discussion

To eliminate the confounding effects of disease duration and antirheumatic therapy, this study recruited a sample of rheumatic patients at the initial stage of the diagnostic process, before any treatment. The focus was on examining the differences in TMD presentation and symptom severity among these patients. Our study investigates the unseen emergence of TMD signs and symptoms in newly diagnosed rheumatic patients before any treatment commences. Prior studies on TMD prevalence in rheumatic patients often involve individuals already receiving treatment or in hospital settings and not newly diagnosed, untreated patients [18,19]. The time elapsed between initial rheumatic disease diagnosis and recording TMD could affect the differentiation and severity of TMD symptoms, potentially obscuring the genuine prevalence in untreated patients [20].

Rheumatoid Factor (RF) and Anti-Cyclic Citrullinated Peptide Antibodies (ACCP) are commonly employed in diagnosing various rheumatic diseases. Both offer good sensitivity (up to 80%) and specificity (RF up to 95% - ACCP up to 98%). More recently, Anti-Citrullinated Protein Antibodies (ACPA) have emerged as an indicator for rheumatic disease diagnosis, boasting both high sensitivity (up to 80%) and exceptional specificity (around 99%) [21,22].

In our study, the mean age of the participants was 48.6 years, consistent with findings from previous studies that indicate a peak onset of rheumatic diseases between the ages of 40 and 50 [23-26]. The distribution of TMD prevalence according to sex also corroborates previous research. The reported ratio for RA (RF+) is 1:3 for females to males [2,24], while the prevalence in PA (RF-) ranges from 1:1 to 1:1.4 [27,28]. In contrast, the prevalence ratio for SpA (RF-) is 1:3, indicating a higher incidence among males [29].

A comparison of the Helkimo anamnestic (Ai) and clinical (Di) indices revealed no statistically significant differences in the appearance or severity of dysfunction between seropositive and seronegative patients. This finding could be attributed to the early stage of rheumatic disease, as the development of moderate to severe TMD typically takes time, while subclinical dysfunction may be less noticeable and less bothersome to patients. In their recent work, Kroese et al. [30] found that there was no statistically significant difference in the prevalence of TMD between rheumatic patients and healthy individuals, while seronegative patients had pain more often than seropositive patients. However, their sample of 50 RA patients was composed of hospitalized patients, who were receiving medication. This raises the possibility that the medication the patients were taking might have influenced their TMD status.

Studies investigating serological markers and TMD present inconsistent findings. Jalal, et al., observed a statistically significant correlation between ESR and TMD symptoms, while Mortazavi, et al., found a similar association with anti-CCP, specifically in RA patients [19,31]. However, another similar study did not identify a statistically significant correlation between RF and TMJ radiographic changes in RA individuals [32].

Various studies have suggested that RA, PA SpA may act as mitigating factors in the development of TMD [9,33-36]. Bayar, et al., even proposed that TMJ involvement is almost pathognomonic of RA [1]. Jonsson, et al., found that 66.7% of their Systemic Lupus Erythematosus (SLE) patients reported a history of severe TMD symptoms, while Aceves-Avila, et al., found a statistically

significant association between SpA and TMD [37,38]. However, others, such as Wright, et al., have argued that rheumatic disease is not the primary cause of TMD [39].

Regarding individual TMD signs and symptoms, clicking was found to be equally prevalent among seropositive (32.7%) and seronegative (28.2%) patients. This aligns with epidemiological studies that have reported unilateral clicking rates of ~35% during mouth opening, 27.5% to 53.3% during protrusion and lateral excursions and ~16% for bilateral clicking in patients with RA [1,24,40]. A study by Bessa-Noqueria, et al., found a correlation between jaw sounds and the number of swollen joints in patients with rheumatic disease [41]. This suggests that the absence of sounds, as observed in our patients, may be an indicator of an earlier stage of the disease.

In our study, the prevalence of functional jaw deviation was similar between seropositive (14.3%) and seronegative (12.8%) patients. Previous studies have reported deviation percentages as high as 45%, but these findings were derived from populations with more advanced disease (substantial disease duration) [40,42].

Seropositive patients had significantly higher rates of muscle tenderness and pain (71.4%) compared to seronegative patients (48.7%) [$p=0.030$]. The variation in reported muscle pain among rheumatic patients is likely due to the diverse characteristics and sizes of the study populations [6,25,33]. D'Apuzzo, et al., reported a statistically significant correlation between muscle pain and ACPA negativity in RA patients [43]. Several studies suggest a close association between TMD and spinal involvement in SpA patients, potentially indicating a correlation [13,44]. Additionally, postural imbalances and proximity between the chin and neck have been proposed to contribute to TMD by affecting masticatory muscle function [44,45].

The movement limitation appears to be more prevalent among seropositive patients (severe limitation 36.7%). A statistically significant difference ($p=0.002$) was observed compared to seronegative patients (severe limitation 7.7%). The reported percentages of movement limitation in other studies vary widely. They have reported movement limitation in 14-57% of patients with SpA, with the highest percentages observed in studies with more advanced disease [13,25,33,46,47]. According to Helenius et al., decreased movement often indicates structural damage on the TMJ [3]. Moen, et al., report that impaired range of movement and impaired function of the TMJ appear to be related more to degenerative changes in the joint rather than on an inflammatory process [2]. In our study, significant differences in movement limitation were observed among rheumatic disease patients. Seropositive patients exhibited more frequent movement limitations compared to seronegative patients. Regardless of RF and anti-CCP presence, thorough assessment of limitations in maximum mouth opening and protrusive and lateral movements is crucial during clinical evaluations of TMD. This meticulous assessment is essential to prevent diagnostic errors and ensure proper evaluation of joint functional integrity [5,38].

Regarding pain, there was no evidence of tenderness or stiffness in the TMJ. However, pain was observed during lateral and posterior palpation of the joint in both groups. In a study by Sostmann et al., TMJ pain was found to be a common symptom of TMD in rheumatic disease, often associated with the total number of affected and painful joints and the severity of the disease [6,7,41]. In a histological study by Bjornland, et al., changes in vascular supply, perivascular cellular infiltration, disc destruction and fibrosis of soft tissues were observed in a high percentage of examined joints from 15 patients with different rheumatic diseases [49]. Gynther, et al., reported a strong association between lateral joint tenderness and TMJ synovitis in patients with RA [50]. Regarding the onset of pain, it appears that for some patients with acute inflammatory TMJ, pain occurs early [44]. However, the pain subsides and is eventually followed by severe limitation of movement [34,35,51], which in rare cases can lead to TMJ ankylosis. This may explain the higher percentage of pain on lateral palpation in seropositive patients. Another significant factor for patients with PA is trauma. Even mild trauma in PA patients can trigger an acute localized onset of PA, known as the "Koebner effect" [27,28,34].

In our study, pain on movement was reported in approximately one-quarter of patients in both groups. Literature reports show significant variability in this measure, ranging from 4.9% to 66.7% [25,47,52,53]. The occurrence of TMJ pain and bone destruction is associated with the accumulation of serum inflammatory markers [54-58]. The administration of medications can influence the levels of these markers and consequently the manifestation of pain [56]. Alstergren, et al., found that patients with positive RF exhibit higher systemic inflammation but experience less TMJ pain during movement [53]. This suggests that there may be

distinct mechanisms of pain activation and pressure pain thresholds in seropositive patients [59,60]. Additionally, the use of antirheumatic medications can alter the clinical presentation of TMD altogether [20,61]. The absence of a statistically significant difference in TMJ pain prevalence between the two groups in the present study can likely be attributed to the early stages of the respective diseases and the high frequency of movement limitation observed in the study participants. Limited movement likely reduces functional stress on the joint (by avoiding strenuous activities such as speaking or chewing hard foods), leading to decreased production of destructive mediators that contribute to TMJ degradation [62,63].

Strengths and Limitations

Strengths of this study include the unambiguous initial diagnosis of rheumatic disease and the absence of any confounding factors arising from ongoing medication. However, a potential limitation is the subdividing of the seronegative rheumatic disease group into two subgroups, which resulted in a reduced sample size per subgroup. This could potentially limit the generalization of the findings to the wider Greek population of rheumatic patients. Therefore, further studies involving larger rheumatic disease patient cohorts are required to validate these findings.

Conclusion

Clinical dysfunction, as measured by the clinical index (Di), appears to be more pronounced in patients with rheumatic diseases (seropositive: 95.9%, seronegative: 89.7%), but could not reach statistical significance. Subjective symptoms, as measured by the Anamnestic index (Ai), did not differ significantly between patients with rheumatic diseases (seropositive: 65.3%, seronegative: 58.9%). Movement limitation and muscle pain showed significant differences among patients in the initial diagnosis of rheumatic disease before the administration of medication.

Conflict of Interests

The authors have no conflict of interest to declare.

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Authors Contribution

AZ and CL contributed to the analysis and interpretation of data, writing and revising drafts and the final approval of the version to be published. AB and MK contributed to the concept and design of the study, analysis and interpretation of data, writing and revising drafts and final approval of the version to be published. PG contributed to the revising drafts and the final approval of the version to be published.

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