

Research Article

Correlation of Prevalence and Symptom Severity of Temporomandibular Disorders Among Healthy Individuals and Patients with Newly Diagnosed Rheumatic Diseases

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Abstract

Objective: The objective of this study was to assess the prevalence and severity of temporomandibular disorders in patients with rheumatic diseases at the initial stage of diagnosis, prior to any medication and to compare their findings with those of healthy individuals.

Design: The study included 92 patients with rheumatic diseases and 94 healthy dental patients. Clinical examinations were performed and anamnestic and clinical dysfunction indices were recorded. Chi-square and t-tests were used to compare characteristics between the control and experimental groups ($p < 0.05$).

Results: The findings revealed a statistically significant difference between the two groups in both subjective and objective measures of temporomandibular disorders. In the rheumatic group, 63% of patients reported subjective symptoms, while 93.5% exhibited clinical dysfunction. There were no significant differences in clicking or deviation between the groups. However, movement limitation was significantly higher in the experimental group (71.8%). No significant difference was observed between rheumatic patients and healthy controls regarding muscular pain, temporomandibular joint pain or pain during movement.

Conclusion: In conclusion, severe clinical dysfunction of the temporomandibular joint is twice as common in rheumatic patients compared with healthy individuals. A significantly higher limitation of movement was observed in newly diagnosed rheumatic patients, who are not undergoing any therapeutic intervention.

Keywords: Temporomandibular Disorders; Prevalence of Symptoms; Severity of Symptoms; Rheumatic Diseases; Initial Diagnosis

Abbreviations

TMD: Temporomandibular Disorders; TMJ: Temporomandibular Joint; RA: Rheumatoid Arthritis; CBC: General Blood Count; ESR: Erythrocyte Sedimentation Rate; RF: Rheumatoid Factor; Anti-CCP: Anti-Cyclic Citrullinated Peptide; CRP: C Reactive Protein; ANA: Antinuclear Antibodies; ANCA: Anti-Neutrophil Cytoplasmic Antibodies; Anti-ENA: Extractable Nuclear Antigen Antibodies; Anti-DSDNA: Anti-Double Stranded DNA; SSA: Anti-Ro; SSB: Anti-La

Introduction

The occurrence of Temporomandibular Disorders (TMD) in patients with rheumatic diseases has long been a topic of scientific investigation, with Garrod's observations in 1859 marking the beginning of this interest [1]. Epidemiological studies have reported a wide range of prevalence estimates for Temporomandibular Joint (TMJ) involvement in Rheumatoid Arthritis (RA), ranging from 2 to 88% [2-5]. However, discrepancies exist among researchers regarding the presentation, severity and correlation

between TMJ involvement, clinical manifestations, radiographic findings and serological markers of rheumatic diseases. This wide divergence in prevalence estimates can be attributed to methodological differences among studies, including variations in sample size, patient selection criteria (randomized or selective, considering age and sex), control group inclusion, diagnostic criteria employed, clinical and radiographic examination methods, serological evaluations performed, type of rheumatic disease analyzed, disease duration and activity and individual patient medication regimens [5]. Despite these methodological variations, the overarching objective of these studies remains consistent: to facilitate the early identification and diagnosis of TMJ involvement in patients with rheumatic diseases, enabling prompt and appropriate management of TMD [6,7].

Aim

The primary objective of this study was to evaluate the prevalence and severity of TMD in patients with rheumatic diseases at the very onset of their diagnosis, prior to the initiation of any medication and compare these findings to a control group of healthy individuals. This approach aimed to shed light on the "pure" prevalence and severity of TMD uninfluenced by the effects of medications.

Material and Methods

This study enrolled two randomly selected, sequential populations comprising a total of 186 participants. The rheumatic diseases group (RG) consisted of 92 patients, who visited the Clinic of the Department of Rheumatology, University Hospital of Heraklion, Crete, Greece. Specifically, the patients were examined by 2 rheumatologists (kappa coefficient:1) and were initially diagnosed with rheumatic disease, according to the American Rheumatism Association revised criteria for the classification of RA, to the European Spondylarthropathy Study Group preliminary criteria for the classification of spondylarthropathy and to the 2019 [9]. European League Against Rheumatism/American College of Rheumatology Classification Criteria for Systemic Lupus Erythematosus [8-10]. Serological assessment for all patients included: general blood count (CBC), Erythrocyte Sedimentation Rate (ESR), Rheumatoid Factor (RF), Anti-Cyclic Citrullinated Peptide (anti-CCP), 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). The Control Group (CG) was comprised of 94 healthy dental patients, residing and working in the same geographical area as the RG patients, who visited the Dental Clinic.

All study participants were provided with comprehensive information about the objectives of the research. Written informed consent was obtained from each participant and the study's ethical conduct was approved by the research ethics committees of the University Hospital of Heraklion and the School of Dentistry at Aristotle University of Thessaloniki. Before commencing any treatment regimen for their rheumatic disease, all RG patients underwent thorough examination for TMD by a prosthodontist. Helkimo anamnestic and clinical dysfunction indices were employed to assess the severity of TMD symptoms [11,12]. The same assessment protocol was implemented for the CG group. Helkimo indices were selected for this study as they have been rigorously validated and adapted for use in the Greek population, unlike other indices such as RDC/TMD or DC/TMD, which remain under review. The study was conducted from September 2019 to June 2020 and all assessments were performed by the same researcher-examiner. Inclusion criteria for the study were as follows: a) Age above 18 years - to exclude juvenile rheumatoid arthritis, b) No prior history of head, neck or mandible trauma, c) No history of rhinal, sinus or otic diseases, d) No prior or ongoing radiotherapy on the head and neck.

Statistical Analysis

Demographics and clinical characteristics of the patients were thoroughly documented. Continuous variables were presented as mean values $\pm$ Standard Deviation (SD), while categorical variables were presented as observed frequencies and proportions within each group. Comparisons between the characteristics of CG and RG patients were conducted using either the chi-square test of independence or the student t-test, depending on the nature of the data (categorical or continuous). Two-tailed p-values were obtained and a p-value of < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 20.0 software (SPSS Inc., Chicago, IL).

Results

The mean age of the RG patients was 48.64 ± 14.85 years, whereas the CG group members averaged 36.53 ± 12.07 years. Table 1 also depicts the gender distribution among participants from both groups. The results indicate a statistically significant

difference.

Table 2 presents the recordings of TMD manifestations and dysfunction severity, revealing a statistically significant difference between the two groups for both subjective and objective findings. Specifically, 63% of RG patients exhibited subjective findings, with the majority experiencing severe symptoms. In contrast, only 54% of healthy controls reported at least one symptom.

The dysfunction clinical index was found to be statistically elevated in rheumatic patients, with 93% of them displaying symptoms as assessed by the examiner. Severe clinical dysfunction (DII, DIII, DIV) occurred twice as frequently in the RG group (61.6%) compared to the CG (32%). Regarding individual symptoms, the occurrence of clicking is presented in Table 3 and shows no significant difference. The same applies to the deviation between patients and healthy controls (Table 3). Significantly increased mandibular movement limitation was observed in RG patients ($p < 0.001$) compared to the CG (Table 3). On the other hand, TMJ pain after palpation, pain on movement and muscle tenderness or pain (Table 3) did not exhibit substantial significance. Specifically, 62% of RG patients displayed at least one tender muscle area after palpation, while 8.7% were classified as experiencing extensive muscle tenderness.

	Rheumatic Group	Control Group	Total	p-value
Age				0.000
Average (SD)	48.6 (± 14.9)	36.5 (± 12.1)		
Sex / Gender				0.027
Female	55 (59,8%)	41 (43.6%)	96 (51.6%)	
Male	37 (40.2%)	53 (56.4%)	90 (48.4%)	
Total	92 (100%)	94 (100%)	186 (100%)	

Table 1: Age and sex/gender distribution.

	Rheumatic Group	Control Group	Total	p-value
Anamnestic Index - Subjective findings				0.000
A ₀	34 (37.0%)	39 (41.5%)	73 (39.2%)	
A _I	33 (35.9%)	51 (54.3%)	84 (45.2%)	
A _{II}	25 (27.2%)	4 (4.3%)	29 (15.6%)	
Total	92 (100%)	94 (100%)	186 (100%)	
Clinical Index - Objective findings				0.000
D ₀	6 (6.6%)	25 (26.6%)	31 (16.8%)	
D _I	29 (31.9%)	39 (41.5%)	68 (36.8%)	
D _{II}	34 (37.4%)	23 (24.5%)	57 (30.8%)	
D _{III3}	21 (23.1%)	6 (6.4%)	27 (14.6%)	
D _{III4}	1 (1.1%)	1 (1.1%)	2 (1.1%)	
Total	92 (100%)	94 (100%)	186 (100%)	

Table 2: Anamnestic index (Ai) and Clinical index (Di).

	Rheumatic Group	Control Group	Total	p-value
TMJ Sounds				0.074
No	64 (69.6%)	76 (80.9%)	140 (75.3%)	
Yes	28 (30.4%)	18 (19.1%)	46 (24.7%)	
Mandibular Deviation				0.953
No	79 (85.9%)	81 (86.2%)	160 (86.0%)	
Yes	13 (14.1%)	13 (13.8%)	26 (14.0%)	

Movement Limitation				0.000
No	26 (28.3%)	57 (60.6%)	83 (44.6%)	
Moderate	42 (45.7%)	36 (38.3%)	78 (41.9%)	
Severe	24 (26.1%)	1 (1.1%)	25 (13.4%)	
TMJ pain				0.492
No pain	43 (46.7%)	50 (53.2%)	93 (50.0%)	
Lateral palpation	14 (15.2%)	16 (17.0%)	30 (16.1%)	
Posterior palpation	35 (38.0%)	28 (29.8%)	63 (33.9%)	
Pain on mandibular movement				0.074
No pain	67 (72.8%)	81 (86.2%)	148 (79.6%)	
Moderate	15 (16.3%)	7 (7.4%)	22 (11.8%)	
Severe	10 (10.9%)	6 (6.4%)	16 (8.6%)	
Muscle tenderness/pain				0.436
No pain	35 (38.0%)	35 (37.2%)	70 (37.6%)	
1-3 areas	49 (53.3%)	55 (58.5%)	104 (55.9%)	
4 areas	8 (8.7%)	4 (4.3%)	12 (6.5%)	

Table 3: Signs and symptoms of TMD.

Discussion

In this study, patients with rheumatic diseases were examined at the very onset of their diagnosis to assess the prevalence of TMD and the severity of symptoms without the influence of confounding factors such as "disease duration" and/or "antirheumatic therapy".

Our study investigates the appearance of signs and symptoms of TMD in patients with newly diagnosed rheumatic disease, prior to the initiation of any treatment. This contrasts with previous research that typically assesses TMD prevalence in patients already receiving antirheumatic treatment or hospitalized for their condition [13,14]. This distinction is crucial, as treatment may influence the presentation and severity of TMD symptoms, potentially masking their true prevalence and characteristics in untreated patients [15].

The mean age of the rheumatic diseases group (RG) patients, 48.6 years $\pm$ 14.9 years, was significantly higher than that of the healthy Control Group (CG), 36.5 years $\pm$ 12.1 years ($p < .001$). This aligns with findings from other studies indicating that most patients with rheumatic diseases are diagnosed between the ages of 40 and 50 [16]. However, the initial diagnosis may not reflect the actual onset of the disease, as patients may experience symptoms before seeking medical attention [5].

The gender/sex distribution in the Rheumatic diseases Group (RG) was significantly different from that of the healthy Control Group (CG), with a female-to-male ratio of 3:2. This finding aligns with previous research indicating that TMJ involvement in RA is also more prevalent in women, with a ratio of 3:1 though this difference may diminish with a later age of onset and approach a 2:1 ratio [3,16,17].

In this study, the RG group comprised patients with various rheumatologic conditions, including RA, Psoriatic Arthritis (PA), Ankylosing Spondylitis (AS) and Systemic Lupus Erythematosus (SLE). The gender distribution among healthy controls appeared to be influenced by the sampling method and differed from previous findings in the Greek population [18]. This discrepancy may be attributed to the fact that the CG included randomly selected dental patients who were presented for TMD evaluation, rather than individuals visiting a TMD clinic for treatment [19]. The recording process revealed a significant increase in the prevalence and severity of TMD symptoms among patients with Rheumatic Diseases (RG) compared to healthy controls (CG). This was evident in the anamnestic index (Ai: RG - 63.1% vs CG - 58.6%) and clinical index (Di: RG - 93.5% vs CG - 73.5%).

Researchers have proposed various theories to explain the association between rheumatic diseases and TMJ involvement. While

most studies have found a higher prevalence of TMD among patients with rheumatic diseases, others have reported no significant differences between RG and CG [5,20-27]. This discrepancy could be attributed to ethnological differences among study populations [5,24,28].

Ettala-Ylitalo, et al., suggest that RA is a predisposing factor for TMD, while Nuray-Bayar, et al., consider TMJ involvement to be almost pathognomonic of RA [2,29]. In contrast, Wright, et al., argue that rheumatic diseases are not the primary cause of TMD [6]. Studies have shown that TMJ involvement is more severe in patients with RA compared to healthy individuals, due to the more rapid progression of inflammatory and degenerative changes in rheumatic patients [2,20,30]. The severity of TMD symptoms in patients with RA is associated with the duration and severity of the disease or with the duration of active inflammation rather than the total duration of the disease [2,3,31,32]. While Kroese, et al., found no significant difference in the prevalence of TMD between patients with RA and healthy individuals, they observed a higher prevalence of TMD-related pain diagnoses among seronegative RA patients compared to seropositive RA patients [5,33].

Similarly, a correlation between TMJ involvement and disease severity has been observed for patients with PA and AS [34-36]. found that patients with PA have more frequent and severe subjective and clinical TMD findings than healthy controls, having examined a sample of 110 psoriatic patients. Dervis, et al., reported clinical dysfunction rates of 60% and 39.7% in patients with PA and psoriasis, respectively [37]. Crincoli, et al., found that 68.8% of psoriatic patients reported symptoms of TMD, while 44.3% had signs of TMD [38].

The onset of TMD remains a subject of debate. Some studies suggest that TMJ involvement occurs at early stages of rheumatic disease, while others indicate that the TMJ is often one of the last joints to be affected [39,40]. A study by Lin, et al., sheds light on this variability, demonstrating that among 56 rheumatic patients, 29.6% developed TMD within 1 year of experiencing general symptoms, 18.5% exhibited TMD before developing generalized symptoms and 22.2% did not experience TMD until ≥ 5 years after the onset of RA [5].

Individual symptoms recorded in the dysfunction clinical index were also analyzed in the present study. The occurrence of TMJ sounds, although higher in RG (30.4%) compared to healthy individuals (19.1%), did not exhibit a statistically significant difference. This contradicts previous studies that demonstrated a clear distinction between TMJ sound patterns in patients and healthy controls [23,41]. Epidemiological studies have documented a frequency of unilateral clicking of ~35% during mouth opening, ranging from 27.5% to 53.3% during protrusion and lateral excursions and approximately 16% for bilateral clicking in RA patients [2,28]. A study by Bessa-Noqueria, et al., found a correlation between TMJ sounds and the presence of edematous joints [24]. This correlation supports the hypothesis that the low prevalence of TMJ sounds observed in our study participants is likely related to the early stage of their disease.

Functional deviation of the mandible was not significantly different between the two groups (13%). Literature reports indicate that functional deviation can reach up to 45% in patients with longer disease duration [16,38]. Similarly, there was no statistically significant difference in muscle tenderness or pain between the control group (59%) and RG patients (62%).

There is considerable variation in the prevalence of muscle pain in the masticatory system among patients with rheumatic diseases, which is likely due to differences in study design and sample size [28]. Some studies have found significant differences in muscle pain between healthy individuals and rheumatic patients, while others have reported no differences [3,23,42].

Significantly higher rates of movement limitations (71.8%) were observed in RG patients. One in four RG patients experiences severe movement limitation, primarily affecting protrusive and lateral movements rather than maximal mouth opening [23]. Restricted maximal mouth opening and limitations in mouth opening, protrusion and lateral movements characterize impaired TMJ range of motion or function [1,22]. Clinical studies have reported varying percentages for the prevalence of TMJ movement limitation in rheumatic patients with some studies finding higher rates than control and others showing no significant differences [5,17,26,31,35,43,44]. Helenius, et al., suggest that reduced TMJ movement may indicate structural damage, while Moen, et al., propose that impaired range of motion and function are more likely associated with degenerative joint changes rather than inflammatory processes [3,4].

Pain on palpation of the TMJ (53.2% in RG vs. 46.8% in CG) and pain on movement (27.2% in RG vs. 13.8% in CG) did not differ significantly between the two groups [2,20]. Regardless of group, one-third of individuals reported pain on posterior palpation. The present study did not find evidence of TMJ tenderness or stiffness but did observe pain during lateral and posterior palpation of the joint. Previous studies by Wolfe, et al. and Bono, et al., reported varying prevalence rates of jaw pain in RA patients, ranging from 19% to 57.9% [45,46]. However, a recent Netherlands cohort study of 264 newly diagnosed RA patients observed a lower prevalence of 10.6% meeting the criteria for TMJ pain have found an association between lateral joint tenderness and synovitis of the TMJ in patients with RA [15,29]. Bessa-Noqueira, et al., reported association between pain on the TMJ and total number of painful joints [24]. Ahmen, et al., suggest that pain perception, muscular strength and overestimation of joint function may influence the patient's response to pain [47]. Our study found pain during movement in 27.2% of RG patients, while previous studies have reported a range of 4.9% to 66.7% [22,48,49]. The lack of significant differences in pain may be attributed to factors such as the early stage of rheumatic disease, the unique structure of the TMJ with its rich vascularity and retrodiscal tissue, which may help remove inflammatory exudates and reduce pain and the movement limitations experienced by many patients, which may protect the joint by limiting joint function (e.g., avoiding speech or hard foods) and reducing the release of destructive mediators that can cause TMJ degradation [5,50,51].

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 rheumatic disease group into four 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 patient cohorts are required to validate these findings.

Conclusion

Severe clinical dysfunction, as measured by the clinical index, is twice as common in patients with rheumatic diseases as in healthy dental patients. Severe subjective symptoms, as measured by the anamnestic index, are significantly more prevalent among patients with rheumatic diseases than in healthy dental patients. Rheumatic diseases affect women at a disproportionately high rate, with the majority of patients falling between the ages of 40 and 50. Only movement limitation was significantly different between the early-stage rheumatic patients -without any therapeutic intervention- and the healthy control group.

Conflict of Interests

The authors have no conflict of interest to declare.

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