European Journal of Public Health Studies
ISSN: 2668 - 1056
ISSN-L:2668 - 1056
Available on-line at: www.oapub.org/hlt

DOI: 10.46827/ejphs.v8i4.244 Volume 8 | Issue 4 | 2025

DETERMINANTS OF STRUCTURAL DAMAGE IN TEMPOROMANDIBULAR JOINT INVOLVEMENT OF RHEUMATOID ARTHRITIS: AN MRI-BASED CROSS-SECTIONAL STUDY

Manolya İlhanlı[i],
Peruze Çelenk
Ondokuz Mayis University,
Faculty of Dentistry,
Türkiye

Abstract:
Rheumatoid arthritis (RA) commonly affects the temporomandibular joint (TMJ); however, the determinants of structural damage remain unclear. This study aimed to investigate the factors associated with the degenerative burden of the TMJ using magnetic resonance imaging (MRI) in patients with RA. This cross-sectional study included 44 patients diagnosed with RA according to the 2010 ACR/EULAR criteria. Clinical variables, including age, disease duration, disease activity score (DAS28), rheumatoid factor (RF), and anti-cyclic citrullinated peptide (anti-CCP) were recorded. TMJ structural abnormalities were evaluated using MRI. Degenerative burden was defined as the total number of distinct degenerative findings (cortical irregularity/resorption, flattening, osteophyte formation, joint space narrowing, and effusion), ranging from 0 to 5. Multivariate linear regression analysis was performed to identify factors associated with degenerative burden. The mean age of the patients was 47.73 ± 13.65 years, and the median disease duration was 84 months. The regression model explained 18.8% of the variance in degenerative burden ($R^2 = 0.188$), but was not statistically significant ($p = 0.145$). Among the independent variables, disease duration showed a trend toward association with degenerative burden ($\beta = 0.278$, $p = 0.092$). No significant associations were found for age ($p = 0.188$), RF positivity ($p = 0.163$), anti-CCP positivity ($p = 0.592$), or DAS28 ($p = 0.948$). Degenerative changes in the TMJ of patients with RA appear to be more closely related to disease chronicity rather than current disease activity. Although no independent predictors reached statistical significance, disease duration demonstrated a trend toward increased structural damage. These findings highlight the importance of long-term monitoring of TMJ involvement in RA patients.

[i] Correspondence: email manolya.ilhanli@omu.edu.tr

Keywords: rheumatoid arthritis, temporomandibular joint, MRI, degeneration, disease duration

1. Introduction

Rheumatoid arthritis (RA) is a chronic, systemic inflammatory disease characterized by progressive joint destruction and functional impairment. It primarily affects synovial joints and commonly presents with symmetrical polyarthritis (Colquhoun *et al.*, 2022). The global prevalence of RA is approximately 0.5–1%, and the disease is more common in women than in men (Finckh *et al.*, 2022). Although RA predominantly involves small joints of the hands and feet, it may also affect larger joints and extra-articular structures, including the temporomandibular joint (TMJ) (Savtekin & Şehirli, 2018).

The TMJ is a unique synovial joint that plays a crucial role in mastication, speech, and daily functional activities (Roberts & Goodacre, 2020). Involvement of the TMJ in RA has been reported in approximately 50–75% of patients during the course of the disease (Helenius *et al.*, 2005; Atsü & Ayhan-Ardic, 2006; Aliko *et al.*, 2011). Despite its relatively high prevalence, TMJ involvement is often overlooked in routine clinical evaluation, as symptoms may be mild or masked by more prominent peripheral joint complaints (Kurtoglu *et al.*,2016; Hız *et al.*, 2012; Savtekin & Şehirli, 2018).

Magnetic resonance imaging (MRI) is considered the gold standard for the evaluation of TMJ due to its ability to visualize both soft tissue and osseous structures. MRI allows detailed assessment of articular disc position, joint effusion, synovial changes, and degenerative alterations such as cortical irregularity, condylar flattening, osteophyte formation, and joint space narrowing (Helenius *et al.*, 2006). Previous studies have primarily focused on describing these imaging findings in RA patients, demonstrating a high frequency of both inflammatory and degenerative changes.

The presence of TMJ involvement has been well documented, but the factors contributing to the severity of structural damage remain unclear. Structural alterations observed on MRI may reflect cumulative disease burden rather than current inflammatory activity, but the relationship between clinical parameters and degenerative changes remains unclear. The role of disease length, disease activity, and serologic markers in determining the extent of TMJ degeneration is still a matter of debate.

Few studies have specifically investigated the determinants of TMJ degenerative burden in patients with rheumatoid arthritis (Sem *et al*., 2017; Pantoja *et al*., 2019), and the factors contributing to structural damage remain insufficiently understood. Identifying these determinants is clinically important, as progressive structural damage may lead to functional limitation, chronic pain, and reduced quality of life.

Therefore, the aim of this study was to investigate the factors associated with degenerative burden in the temporomandibular joint in patients with rheumatoid arthritis using MRI findings, with a particular focus on the relationship between clinical, laboratory, and imaging parameters.

2. Material and Methods

2.1 Study Design and Participants

This cross-sectional study included 44 patients diagnosed with rheumatoid arthritis (RA) according to the 2010 ACR/EULAR classification criteria. All patients were referred with temporomandibular joint (TMJ)-related complaints and evaluated at a tertiary care center.

Patients with additional systemic diseases or contraindications to magnetic resonance imaging (MRI) were excluded. A total of 88 TMJs (right and left) were assessed.

2.2 Clinical and Laboratory Assessment

The following variables were recorded for each patient:

- Age (years),
- Disease duration (months),
- Disease activity score (DAS28),
- Rheumatoid factor (RF) positivity,
- Anti-cyclic citrullinated peptide (anti-CCP) positivity,

Clinical examination included TMJ pain, joint sounds, and limitation of mouth opening, as well as masticatory muscle tenderness.

2.3 MRI Evaluation and Definition of Degenerative Burden

MRI examinations were performed using a 1.5 Tesla scanner (Siemens, Erlangen, Germany). The following structural abnormalities were evaluated:

- Cortical irregularity and/or resorption,
- Flattening of the mandibular condyle,
- Osteophyte formation,
- Joint space narrowing,
- Effusion.

Each finding was recorded as a binary variable (0 = absent, 1 = present).

Degenerative burden was defined as the total number of different degenerative MRI findings detected in each patient, with a possible range of 0 to 5.

2.4 Statistical Analysis

Statistical analyses were performed using SPSS version 22 (IBM Corp., Chicago, IL, USA). Descriptive statistics were presented as mean ± standard deviation or median (minimum–maximum), depending on data distribution.

A multivariate linear regression analysis was conducted to identify factors associated with degenerative burden. The dependent variable was degenerative burden score, and independent variables included age, disease duration, DAS28, RF positivity and Anti-CCP positivity.

Collinearity diagnostics were evaluated using tolerance and variance inflation factor (VIF) values. A p-value < 0.05 was considered statistically significant.

2.5 Ethical Statement

This study was derived from the doctoral thesis of the corresponding author and conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Ondokuz Mayıs University Clinical Research Ethics Committee (Decision No: 2020/539, Date: 28.12.2020), and all participants provided informed consent prior to inclusion in the study.

3. Results

3.1 Participant Characteristics

A total of 44 patients (40 females, 4 males) were included in the study. The mean age was 47.73 ± 13.65 years, and the median disease duration was 84 months.

3.2 Multivariate Regression Analysis

Multivariate linear regression analysis was performed to determine factors associated with degenerative burden.

The overall model explained 18.8% of the variance in degenerative burden (R^2 = 0.188; adjusted R^2 = 0.081). However, the model did not reach statistical significance (F = 1.758, p = 0.145).

Among the independent variables, disease duration showed a trend toward association with degenerative burden (β = 0.278, p = 0.092), indicating that longer disease duration may be related to increased structural damage.

No statistically significant associations were found for age (β = 0.207, p = 0.188), RF positivity (β = −0.292, p = 0.163), Anti-CCP positivity (β = 0.113, p = 0.592) and DAS28 (β = −0.010, p = 0.948).

3.3 Collinearity and Model Diagnostics

Collinearity analysis showed acceptable values (VIF range: 1.038–2.037), indicating no significant multicollinearity among independent variables.

Residual analysis demonstrated a normal distribution, with standardized residuals ranging between −1.919 and 1.675, suggesting that model assumptions were met.

4. Discussion

In this study, we investigated the determinants of structural damage in the temporomandibular joint (TMJ) in patients with rheumatoid arthritis (RA) using MRI-based findings. The primary finding of this study is that degenerative changes in the TMJ appear to be more closely related to disease chronicity rather than current inflammatory activity.

Although the multivariate regression model did not reach overall statistical significance, disease duration demonstrated a trend toward association with

degenerative burden. This finding suggests that cumulative exposure to chronic inflammation may play a more important role in TMJ structural damage than acute disease activity. In contrast, DAS28, which reflects current systemic inflammatory status, was not associated with degenerative changes. This supports the hypothesis that TMJ involvement in RA reflects a long-term, progressive process rather than transient inflammatory fluctuations.

The lack of association between DAS28 and structural damage is consistent with previous studies indicating that imaging findings in RA may not always correlate with clinical disease activity (Hız *et al.,* 2012; Kretapirom *et al*., 2013). Structural changes such as osteophyte formation, cortical irregularity, and joint space narrowing are likely the result of prolonged inflammatory and biomechanical processes, which may persist even when systemic disease activity is controlled.

Similarly, serological markers such as RF and anti-CCP did not show a significant independent association with degenerative burden in the multivariate model. Although RF positivity has been associated with more aggressive disease in the literature (Kim *et al.*, 2018; Youssef Mohamed *et al.*, 2020), our findings suggest that its contribution to TMJ structural damage may be indirect or mediated through disease duration and cumulative disease severity.

Another important observation is that age did not emerge as a significant predictor of degenerative burden. This indicates that TMJ degeneration in RA patients may be more disease-specific rather than simply age-related. This distinction is clinically relevant, as it suggests that TMJ involvement should not be considered a normal aging phenomenon in RA patients but rather a disease-related complication.

The relatively low explanatory power of the regression model ($R^2 = 0.188$) suggests that TMJ degeneration is likely multifactorial. Factors not included in this study, such as occlusal characteristics, parafunctional habits (e.g., bruxism), mechanical loading, and treatment history, may contribute to the development of TMJ structural changes. Future studies incorporating these variables may provide a more comprehensive understanding of TMJ involvement in RA.

From a clinical perspective, these findings highlight the importance of early and routine TMJ assessment in RA patients, particularly in those with longer disease duration. Since structural damage appears to accumulate over time and may not be directly reflected by disease activity scores, clinicians should consider TMJ evaluation as part of long-term disease monitoring.

This study has several limitations. First, the sample size was relatively small, which may have limited the statistical power of the regression analysis. Second, the cross-sectional design precludes causal inference. Third, MRI evaluation did not include contrast-enhanced imaging, which may have limited the assessment of active synovitis. Additionally, potential contributing factors such as occlusion, bruxism, and treatment regimens were not included in the regression model.

5. Recommendations

Routine TMJ assessment should be considered in RA patients, especially in long-standing disease, as structural damage may not correlate with disease activity. Future longitudinal studies including additional clinical and behavioral factors are needed to better understand TMJ degeneration. Increasing clinical awareness may improve early diagnosis and patient outcomes.

6. Conclusion

In conclusion, TMJ structural damage in RA appears to be more strongly associated with disease chronicity than with current disease activity. These findings emphasize the need for long-term monitoring of TMJ involvement in RA patients, regardless of their current inflammatory status.

Funding Statement
None.

Data Availability
Available upon reasonable request.

Conflict of Interest Statement
The authors declare no conflict of interest.

About the Author(s)
Manolya İlhanlı,, Dentist, PhD, Ondokuz Mayis University, Faculty of Dentistry, Türkiye.
Peruze Çelenk, Dentist, Prof. Dr., Ondokuz Mayis University, Faculty of Dentistry, Supervisor, Türkiye.

References

Aliko, A., Ciancaglini, R., Alushi, A., Tafaj, A., & Ruci, D. (2011). Temporomandibular joint involvement in rheumatoid arthritis, systemic lupus erythematosus and systemic sclerosis. *International journal of oral and maxillofacial surgery*, 40(7), 704-709. https://doi.org/10.1016/j.ijom.2011.02.026

Atsü, S. S., & Ayhan-Ardic, F. (2006). Temporomandibular disorders seen in rheumatology practices: a review. *Rheumatology international*, 26(9), 781-787. https://doi.org/10.1007/s00296-006-0110-y

Colquhoun, M., Gulati, M., Farah, Z., & Mouyis, M. (2022). Clinical features of rheumatoid arthritis. *Medicine*, *50*(3), 138-142. https://doi.org/10.1016/j.mpmed.2018.01.008

Finckh, A., Gilbert, B., Hodkinson, B., Bae, S. C., Thomas, R., Deane, K. D., ... & Lauper, K. (2022). Global epidemiology of rheumatoid arthritis. *Nature Reviews Rheumatology*, 18(10), 591-602. https://doi.org/10.1038/nature01096

Helenius, L. M. J., Hallikainen, D., Helenius, I., Meurman, J. H., Könönen, M., Leirisalo-Repo, M., & Lindqvist, C. (2005). Clinical and radiographic findings of the temporomandibular joint in patients with various rheumatic diseases. A case-control study. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 99(4), 455-463. https://doi.org/10.1016/j.tripleo.2004.06.079

Helenius, L. M. J., Tervahartiala, P., Helenius, I., Al-Sukhun, J., Kivisaari, L., Suuronen, R., ... & Leirisalo-Repo, M. (2006). Clinical, radiographic and MRI findings of the temporomandibular joint in patients with different rheumatic diseases. *International journal of oral and maxillofacial surgery*, 35(11), 983-989. https://doi.org/10.1016/j.ijom.2006.08.001

Hız, O., Ediz, L., Özkan, Y., & Bora, A. (2012). Clinical and magnetic resonance imaging findings of the temporomandibular joint in patients with rheumatoid arthritis. *Journal of Clinical Medicine Research*, 4(5), 323–331. https://doi.org/10.4021/jocmr1044w

Kim, J. R., Jo, J. H., Chung, J. W., & Park, J. W. (2018). Antinuclear antibody and rheumatoid factor positivity in temporomandibular disorders. *Head & Face Medicine*, 14(1), 26. https://doi.org/10.1186/s13005-018-0183-3

Kretapirom, K., Okochi, K., Nakamura, S., Tetsumura, A., Ohbayashi, N., Yoshino, N., & Kurabayashi, T. (2013). MRI characteristics of rheumatoid arthritis in the temporomandibular joint. *Dentomaxillofacial Radiology*, 42(4), 31627230. https://doi.org/10.1259/dmfr/31627230

Kurtoglu, C., Kürkçü, M., Sertdemir, Y., Özbek, S., & Gürbüz, C. (2016). Temporomandibular disorders in patients with rheumatoid arthritis: A clinical study. *Nigerian Journal of Clinical Practice*, *19*(6), 715–721. https://doi.org/10.4103/1119-3077.183303

Pantoja, L. L. Q., de Toledo, I. P., Pupo, Y. M., Porporatti, A. L., De Luca Canto, G., Zwir, L. F., & Guerra, E. N. S. (2019). Prevalence of degenerative joint disease of the

temporomandibular joint: a systematic review. *Clinical oral investigations*, 23(5), 2475-2488. https://doi.org/10.1007/s00784-018-2664-y

Roberts, W. E., & Goodacre, C. J. (2020). The temporomandibular joint: a critical review of life-support functions, development, articular surfaces, biomechanics and degeneration. *Journal of Prosthodontics*, *29*(9), 772-779. https://doi.org/10.1111/jopr.13203

Savtekin, G., & Şehirli, A. Ö. (2018). Rheumatoid arthritis in temporo-mandibular joint: A review. *Nigerian Journal of Clinical Practice*, *21*(10), 1243-1246. https://doi.org/10.4103/njcp.njcp_268_17

Sem, J. P. C. J., van der Leeden, M., Visscher, C. M., Britsemmer, K., Turk, S. A., Dekker, J., ... & Lobbezoo, F. (2017). Prevalence, course, and associated factors of pain in the temporomandibular joint in early rheumatoid arthritis: results of a longitudinal cohort study. *J Oral facial Pain headache*, *31*(3), 233-239. https://doi.org/10.11607/ofph.1606

Youssef Mohamed, M. M., Dahaba, M. M., Farid, M. M., & Ali Elsayed, A. M. (2020). Radiographic changes in TMJ in relation to serology and disease activity in RA patients. *Dentomaxillofacial Radiology*, *49*(1), 20190186. https://doi.org/10.1259/dmfr.20190186