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Pain intensity and pain catastrophizing in individuals with chronic temporomandibular disorders with and without neck pain: a cross-sectional study

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ABSTRACT

Aims: The aim of this study was to compare pain intensity and pain catastrophizing between individuals with chronic temporomandibular disorders (TMD) with and without accompanying neck pain.

Methods: Twenty-two individuals diagnosed with chronic TMD participated in this cross-sectional study. Participants were allocated into two groups: a TMD-only group (n=12) and a TMD with neck pain group (n=10). Pain intensity was assessed using the Numeric Rating Scale (NRS), and pain catastrophizing was assessed using the Pain Catastrophizing Scale (PCS).

Results: No statistically significant differences were observed between the TMD-only and TMD with neck pain groups in TMD-related jaw pain intensity at rest, during chewing and functional activities, or at night, or in PCS total and subscale scores (all $p>0.05$). Moderate effect sizes were observed for pain during chewing and functional activities, pain at rest, and PCS helplessness, while the remaining comparisons showed small effect sizes.

Conclusion: Accompanying neck pain was not associated with statistically significant differences in TMD-related jaw pain intensity or pain catastrophizing in individuals with chronic TMD. However, the moderate effect sizes observed for pain at rest, pain during chewing and functional activities, and PCS helplessness suggest that these outcomes may warrant further investigation in larger samples.

Keywords: Temporomandibular joint disorders, neck pain, pain measurement, catastrophization, temporomandibular joint

INTRODUCTION

Temporomandibular dysfunction (TMD), as defined within the diagnostic criteria for temporomandibular disorders (DC/TMD) framework,[1] encompasses a group of disorders affecting the masticatory system. In the classification of TMD, it is divided into two main groups: muscle-related (extra-articular) dysfunctions, such as myofascial pain, and joint-related (intra-articular) dysfunctions, such as disc displacements.[2] TMD has been identified as a common health problem affecting approximately 15–20% of the adult population. It has been reported in the literature that symptoms most frequently peak between the ages of 20 and 40, and the prevalence is higher in females than in males.[3]

TMD can cause pain severe enough to require a multidisciplinary approach in patients. It is considered that TMD may become an increasing problem today due to stress and the improper use of the masticatory system. One of its contributing factors is stress, which has a destructive effect on all components of the masticatory system and may lead to TMD.[4] In TMD, pain may have an etiological structure that is classified as either central (centralized) or peripheral, as demonstrated in the study by Yin et al.[5] in 2020. Various physiotherapy and rehabilitation approaches aimed at reducing pain intensity in individuals with TMD have been reported to be beneficial.[6]

Temporomandibular joint disorders (TMDs) are complex musculoskeletal problems that should be considered within the integrity of the craniocervical mandibular system, as they are frequently associated with cervical spine dysfunctions.[7] Clinical studies have shown that, in the majority of patients diagnosed with TMD, neck pain and restricted cervical movements coexist.[8] Alterations in craniocervical biomechanics, cervical mobility, muscle performance, and neck disability have also been reported in individuals with TMD.[9] From a biomechanical perspective, postural alterations in the cervical region, such as anterior head posture, have been suggested to be associated with changes in the position of the hyoid bone and muscle tone in the muscles responsible for mastication, which may influence the resting position of the mandible and its movement mechanics.[10] At the deeper level of anatomical connection,

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the convergence of the afferent fibers of the trigeminal nerve and the upper cervical nerves (C1–C3) within the trigeminocervical nucleus in the brainstem constitutes the main neurophysiological mechanism underlying the referral of pain originating from the cervical region to the orofacial region.[11] Therefore, evaluation of the cervical region should also be included in the management of craniomandibular pain and dysfunction.[12] The interaction between cervical and orofacial nociceptive inputs may contribute to the overall pain experience in individuals with TMD.[13] In persistent pain conditions, accompanying neck pain may further influence the interaction between nociceptive mechanisms and cognitive and emotional responses to pain, including pain catastrophizing.

From a neurophysiological perspective, pain catastrophizing is not only a cognitive condition but also a phenomenon associated with dysfunction of the pain modulation pathways in the central nervous system. Quantitative sensory testing studies conducted in healthy individuals have shown that high levels of pain catastrophizing are associated with a significant reduction in the effectiveness of the endogenous pain inhibition mechanism known as "diffuse noxious inhibitory control" (DNIC), or, as it is currently referred to, "conditioned pain modulation" (CPM).[14] When the prognosis of patients with chronic TMD is evaluated, pain emerges as one of the major factors negatively affecting the symptoms of the disorder, accompanied by increased pain catastrophizing scores.[15]

To the best of our knowledge, a review of the literature revealed no study investigating both neck pain accompanying chronic TMD and pain catastrophizing parameters together in patients with TMD. Previous studies have shown that both neck pain and pain catastrophizing are independently associated with TMD. Age and gender may also be associated with TMD and pain-related outcomes and should therefore be considered as potential confounding factors when interpreting these relationships. Therefore, the aim of this cross-sectional study was to compare TMD-related jaw pain intensity and pain catastrophizing between individuals with TMD with and without accompanying neck pain. We hypothesized that individuals with TMD and accompanying neck pain would have higher TMD-related jaw pain intensity and pain catastrophizing scores than individuals with TMD without neck pain.

METHODS

This study was approved by the Non-interventional Clinical Researches Ethics Committee at the Kırıkkale University (Date: 22.10.2025, Decision No: 2025.10.36). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Present study is a cross-sectional comparative study involving two groups. The study was conducted between January 2026 and May 2026. Patients with a previous diagnosis of TMD who presented to the Department of Physiotherapy and Rehabilitation at Kırıkkale University were included in the study.

Volunteers aged between 18 and 65 years who had been diagnosed with chronic TMD, had not previously undergone surgical intervention or similar treatment related to TMD, and had experienced pain persisting for more than 6 months were included in the study. Participants were allocated to the TMD with neck pain group based on their self-reported presence of neck pain. No specific duration criterion was defined for neck pain; participants were classified according to the presence or absence of accompanying neck pain. The exclusion criteria of our study were determined as the presence of systemic musculoskeletal diseases (such as fibromyalgia, rheumatoid arthritis, etc.), neurological disorders, a history of acute trauma to the face or jaw region, a history of psychiatric disorders, pregnancy, and a previous history of surgical intervention involving the temporomandibular joint (TMJ) or the cervical region.

The socio-demographic and clinical characteristics of the participants were recorded, including age, height, weight, gender, occupation, smoking and alcohol consumption, exercise habits, sleep duration, mandibular deviation, limitation of jaw movements or the presence of joint sounds and locking during movement, presence or absence of bruxism, morning stiffness in the jaw.

Pain related to the TMJ, the duration of pain, pain intensity, and pain catastrophizing were evaluated. The numeric rating scale (NRS-11) was used to determine the participants' pain levels. The Pain Catastrophizing Scale (PCS) was used to assess the participants' pain catastrophizing scores. Due to the nature of the study design, the researcher performing the assessments could not be blinded to group allocation. Pain intensity was recorded based on the participants' self-reported responses. All questionnaire items were completed, with no missing responses.

Assessment of Pain Intensity

The pain levels of the participants (at rest- pain during chewing and functional activities, at night) were determined using the NRS-11 due to its ease of application and practicality in clinical settings. The NRS-11 is an 11-point scale ranging from 0 to 10, where 0 indicates no pain and 10 indicates the worst imaginable pain.[16]

Assessment of Pain Catastrophizing

The pain catastrophizing levels of the participants were determined using the PCS, which consists of 13 items. Participants were asked to evaluate their cognitive and emotional responses to pain using a 5-point Likert scale ranging from 0 ("not at all") to 4 ("all the time"). The PCS assesses three main dimensions of pain catastrophizing: rumination, magnification, and helplessness.[17] The Turkish version of the questionnaire has demonstrated validity and reliability.[18]

Statistical Analysis

Data analyses were performed using IBM SPSS Statistics, version 31.0 (IBM Corp., Armonk, NY, USA). The normality of distribution for continuous variables was assessed using both visual methods (histograms and Q-Q plots) and analytical methods (the Shapiro-Wilk test). Descriptive statistics were presented as frequency and percentage for categorical variables, and as median and 25^{th}–75^{th} percentile for continuous variables. Fisher's Exact Test was used instead

of the Chi-square test for the comparison of independent categorical variables, as the expected cell frequency was below 5 in at least one cell for every comparison. The Mann-Whitney U test was used for the comparison of continuous variables between independent groups, as the assumption of normal distribution was not met;[19,20] the median difference between groups was calculated and reported together with the corresponding 95% confidence interval. Effect sizes were calculated as the r coefficient, obtained by dividing the Z statistic by the square root of the sample size ($r=|Z|/\sqrt{N}$); r values below 0.10 were interpreted as small, values around 0.30 as moderate, and values above 0.50 as large effect sizes.[21] For all analyses, a type I error level below 5% was considered statistically significant.

RESULTS

A total of 31 individuals diagnosed with chronic TMD were assessed for eligibility. Of these, seven individuals were excluded because they had received botulinum toxin treatment, and two individuals declined to participate (Figure). Twelve participants were included in the TMD-only group, while ten participants were included in the TMD with neck pain group.

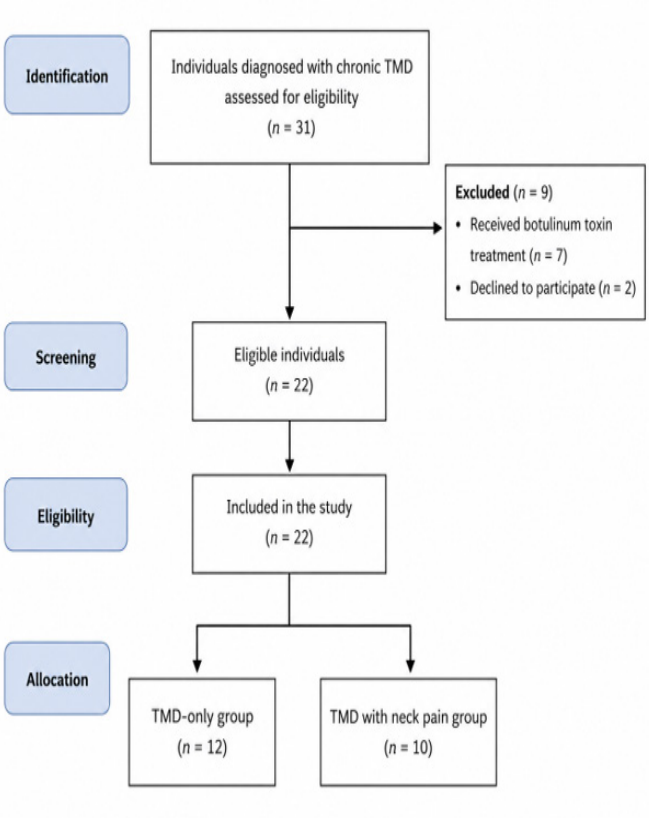

Figure. Flow chart
TMD: Temporomandibular disorders

The demographic and clinical characteristics of the participants are presented in Table 1. No statistically significant differences were found between the TMD-only and TMD+Neck Pain groups regarding age, body mass index, or duration of TMJ pain (all p>0.05). Similarly, no statistically significant differences were observed between groups for gender distribution, smoking status, alcohol consumption, exercise habits, mandibular deviation, bruxism, morning jaw stiffness, jaw motion limitation, TMJ sounds, or locking/sticking episodes (all p>0.05, Table 1).

Table 1. Comparison of demographic and clinical characteristics between groups

	TMD-only (n=12)	TMD+NP (n=10)	p
Age (years)	30.50 (24.50/37.00)	26.00 (23.00/30.00)	0.155
BMI (kg/m²)	24.23 (22.66/26.42)	21.78 (21.31/24.38)	0.106
Duration of TMJ pain (years)	2.00 (1.00/8.00)	3.00 (2.00/4.00)	0.895
Gender			
Male	3 (25.00)	2 (20.00)	1.000
Female	9 (75.00)	8 (80.00)	
Smoking			
Yes	3 (25.00)	6 (60.00)	0.192
No	9 (75.00)	4 (40.00)	
Alcohol consumption			
Yes	4 (33.33)	6 (60.00)	0.391
No	8 (66.67)	4 (40.00)	
Exercise habit			
Yes	11 (91.67)	6 (60.00)	0.135
No	1 (8.33)	4 (40.00)	
Mandibular deviation			
Yes	3 (25.00)	7 (70.00)	0.084
No	9 (75.00)	3 (30.00)	
Bruxism			
Yes	9 (75.00)	9 (90.00)	0.594
No	3 (25.00)	1 (10.00)	
Morning jaw stiffness			
Yes	9 (75.00)	7 (70.00)	1.000
No	3 (25.00)	3 (30.00)	
Jaw motion limitation			
Yes	3 (25.00)	5 (50.00)	0.378
No	9 (75.00)	5 (50.00)	
TMJ sounds			
Yes	7 (58.33)	6 (60.00)	1.000
No	5 (41.67)	4 (40.00)	
Locking or sticking			
Yes	3 (25.00)	4 (40.00)	0.652
No	9 (75.00)	6 (60.00)	

Data are presented as median (25^{th}/75^{th} percentile) or n (%). TMD: Temporomandibular disorder, TMJ: Temporomandibular joint, NP: Neck pain, BMI: Body-mass index, n: Number, %: Percentage. Continuous variables were compared using the Mann-Whitney U test; categorical variables were compared using Fisher's Exact Test.

Comparisons of pain intensity, and pain catastrophizing between groups are presented in Table 2. None of the assessed variables, including NRS scores at rest, during activity, and at night, the PCS subscale and total scores, demonstrated a statistically significant between-group difference (all p>0.05). Effect sizes (r) ranged from 0.099 to 0.353; NRS during activity (r=0.353), NRS at rest (r=0.324), and PCS helplessness (r=0.324) reached a moderate magnitude, whereas the remaining comparisons showed small effects.

Table 2. Comparison of pain severity, and pain catastrophizing between groups

		TMD-only (n=12)	TMD+NP (n=10)	Δ (95% CI)	p	ES
NRS	At rest	2.00 (0.25/2.00)	2.50 (1.00/4.00)	1.00 (0.00/3.00)	0.128	0.324
	Activity	5.00 (4.00/6.00)	7.00 (4.00/7.00)	1.00 (0.00/3.00)	0.098	0.353
	Night	2.00 (1.00/3.50)	2.50 (2.00/4.00)	1.00 (-1.00/2.00)	0.400	0.179
PCS	Rumination	3.50 (1.00/7.00)	5.00 (1.00/8.00)	1.00 (-3.00/4.00)	0.642	0.099
	Magnification	6.00 (4.00/7.00)	4.50 (3.00/6.00)	-1.00 (-3.00/1.00)	0.170	0.293
	Helplessness	7.50 (3.50/11.00)	12.00 (7.00/14.00)	3.00 (-1.00/8.00)	0.128	0.324
	Total	16.50 (10.50/24.50)	22.50 (13.00/26.00)	3.00 (-6.00/12.00)	0.448	0.162

Data are presented as median (25th/75th percentile). TMD: Temporomandibular disorder, NP: Neck pain, NRS: Numeric Rating Scale, PCS: Pain Catastrophizing Scale, Δ: Represents the median difference between the TMD+NP and TMD-only groups; CI: Confidence interval, ES: Effect size, p: Mann-Whitney U test.

DISCUSSION

The present study investigated the association of accompanying neck pain with TMD-related jaw pain intensity and pain catastrophizing in individuals with TMD. No statistically significant differences in TMD-related jaw pain intensity or pain catastrophizing were observed between individuals with TMD with and without accompanying neck pain.

Previous studies have consistently reported that TMD are frequently accompanied by cervical dysfunction. Jaw dysfunction has been shown to be associated with neck disability and tenderness of the cervical and masticatory muscles in individuals with chronic TMD.[8] Alterations in craniocervical biomechanics, cervical range of motion, muscle performance, and neck disability have also been reported in individuals with TMD.[9] The biomechanical relationship between the cervical spine and the TMJ has been described within the craniocervical-mandibular system.[10] Neurophysiological convergence within the trigeminocervical complex provides a mechanism through which cervical pain may be perceived as orofacial pain.[11] The association between cervical pain and TMD pain has been demonstrated in previous studies.[22] No statistically significant differences were observed between the groups with respect to pain intensity at rest or during activity. However, the moderate effect sizes observed for both resting and activity-related pain suggest that the intervention may have a clinically meaningful effect on pain intensity. The absence of statistical significance may be attributable to the limited sample size and, consequently, insufficient statistical power.

Pain catastrophizing is considered an important psychological factor influencing pain perception in chronic musculoskeletal disorders.[17] Psychological factors are recognized as important contributors to the development and persistence of chronic pain, including chronic TMD pain.[23] Experimental studies have shown that higher pain catastrophizing is associated with impaired endogenous pain inhibition mechanisms.[14] Higher pain catastrophizing levels have also been associated with greater pain severity and poorer clinical outcomes in patients with TMD.[15] A previous study reported that individuals with TMD exhibited higher levels of pain catastrophizing.[24] Another previous study comparing individuals with neck pain and cervico-craniofacial pain found no significant differences in pain catastrophizing scores between the groups.[25] Although no statistically significant between-group differences were observed in pain catastrophizing, the helplessness subscale demonstrated a moderate effect size, whereas the magnification, rumination, and total PCS scores showed only small effects.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the sample size was determined by pragmatic participant availability during the study period rather than an a priori power calculation. A sensitivity analysis indicated that, with the present sample size (n1=12, n2=10) and a two-tailed alpha of 0.05, the study had 80% power to detect only a large effect (r≥0.53), whereas the observed effect sizes for the primary outcomes (r=0.324–0.353) fell below this threshold; this should be taken into account when interpreting the non-significant between-group comparisons, as the study may have been underpowered to detect effects of a smaller magnitude. Second, participants were classified according to the presence or absence of neck pain using a binary approach, without quantifying its severity or associated functional disability, which may have obscured a potential dose-response relationship between neck pain and pain catastrophizing. Third, although the age range of participants was broad (18–65 years) and no formal age-matching procedure was applied between groups, the median age did not differ significantly between the TMD-only and TMD+Neck pain groups. The cross-sectional design also limits the interpretation of causal relationships. Objective assessment of cervical posture and function was not performed, representing another limitation of the present study. In addition, psychological factors such as anxiety and depression, which may influence pain perception and pain catastrophizing, were not evaluated. Furthermore, central sensitization, which is considered an important mechanism underlying chronic pain conditions, was not assessed. Despite these limitations, the present study contributes to the literature by examining pain intensity and pain catastrophizing together in patients with chronic TMD and accompanying neck pain, within an analytical framework that reports effect sizes and confidence intervals alongside p-values. Future prospective studies with larger, a priori sample-size-justified cohorts and comprehensive cervical and psychological assessments are needed to clarify these relationships.

CONCLUSION

This study investigated the effect of accompanying neck pain on pain intensity and pain catastrophizing in individuals with TMD. In this cross-sectional study, no statistically significant differences in TMD-related jaw pain intensity

or pain catastrophizing were observed between individuals with chronic TMD with and without accompanying neck pain. Therefore, the study hypothesis was not supported. These findings should be interpreted cautiously considering the small sample size. Assessment of the cervical region may be beneficial during the evaluation and management of individuals with TMD.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was approved by the Non-interventional Clinical Researches Ethics Committee at the Kırıkkale University (Date: 22.10.2025, Decision No: 2025.10.36).

Informed Consent

Written informed consent was obtained from all individual participants prior to their inclusion in the study. Participants were fully informed about the study's aims, procedures, potential risks and benefits, and their rights—including the right to withdraw at any time without consequence. All participants voluntarily signed a written informed consent form.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Financial Disclosure

The authors received no financial support for the conduct or publication of this research.

Author Contributions

Concept: EG, ESE; Design: EG, ESE; Control: EG, ESE; Data Collection and/or Processing: EG; Analysis and/or Interpretation: EG, ESE; Literature Review: EG; Writing the Article: EG; Critical Review: ESE.

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