

Prevalence and factors contributing to temporomandibular joint dysfunction in the population of Makhachkala, considering postural disorders and psychoemotional stress. A cross-sectional study

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ABSTRACT

Introduction: Temporomandibular joint dysfunction (TMD) is a complex and prevalent condition associated with psychoemotional stress, postural abnormalities, and structural joint changes. These factors often lead to chronic pain, restricted jaw movement, and reduced quality of life. Postural deviations, such as kyphotic posture and lateral head tilt, and psychoemotional factors like high anxiety and depression, play critical roles in the pathogenesis of TMD. Modern instrumental diagnostics, including magnetic resonance imaging (MRI) and axiography, have advanced the understanding of structural and functional changes in TMD, enabling more precise management strategies.

Aim: This study aimed to determine the prevalence of TMD among the population of Makhachkala and evaluate the contributing roles of psychoemotional stress and postural abnormalities.

Materials and methods: The study included 500 participants aged 18–60 years who underwent a comprehensive evaluation. Data were collected through questionnaires assessing TMD symptoms, stress levels (using the Perceived Stress Scale), and psychoemotional status (using HADS and MBI scales). Clinical examinations, including mandibular movement assessment and palpation of masticatory muscles, were standardized using RDC/TMD criteria. Postural analysis was conducted using stabilography and PostureScreen software. Instrumental diagnostics involved MRI to evaluate structural joint changes and axiography to assess mandibular kinematics. Statistical analyses included correlation and regression methods performed with SPSS software.

Results: TMD symptoms were identified in 38% of participants, with pain (68%) and restricted movement (52%) being the most common complaints. High stress levels were significantly associated with TMD (72% in patients with TMD vs. 32% in controls). Clinical examinations revealed mandibular asymmetry in 75% and restricted jaw opening (<30 mm) in 48% of TMD patients. Postural abnormalities, such as kyphotic posture (45%) and lateral head tilt (32%), were prevalent in the TMD group. Instrumental diagnostics confirmed structural joint changes, with MRI identifying disc displacement in 45% and disc thinning in 27% of TMD patients. Axiography revealed abnormal joint kinematics in 63% of cases.

Conclusion: TMD is highly prevalent in Makhachkala, with psychoemotional stress and postural abnormalities playing significant roles in its development. Comprehensive management approaches, including postural correction, stress management, and instrumental diagnostics, are essential for personalized treatment and improved patient outcomes.

Keywords: Temporomandibular joint dysfunction, postural abnormalities, psychoemotional stress, MRI, axiography, mandibular kinematics, RDC/TMD.

INTRODUCTION

Temporomandibular joint dysfunction (TMJ dysfunction) is a complex multifactorial condition characterized by impairments in the function of joint surfaces, muscles, and ligaments. This disorder is widely prevalent and often manifests with symptoms such as pain in the joint area, restricted or asymmetric movement of the lower jaw, as well as clicking or crepitus upon mouth opening.^{1,2}

Modern studies emphasize the importance of identifying factors that contribute to the development of TMJ dysfunction. Among these, considerable attention is given to psychoemotional stress, which serves as a trigger for pathologi-

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cal changes in joint function. High levels of stress influence the tone of masticatory and cervical muscles, exacerbating the condition and potentially leading to the development of chronic pain.³

Another key aspect is the role of postural disorders, including poor posture and muscle imbalances in the cervical region. These changes directly affect the kinematics of the temporomandibular joint by altering the biomechanical relationships between the skull, cervical spine, and lower jaw.⁴

Additional factors, such as hypodynamia, prolonged use of electronic devices, and disruptions in chewing and breathing habits, also significantly contribute to the formation of TMJ dysfunction. Instrumental diagnostic methods, including magnetic resonance imaging (MRI) and axiography, provide deeper insights into the mechanisms of this pathology, paving the way for new preventive and therapeutic strategies.⁵

The study of the prevalence and contributing factors of TMJ dysfunction, particularly under the influence of stress and postural disorders, is a crucial task in modern medicine. This condition significantly affects patients' quality of life by hindering eating, communication, and daily activities.

The objective of this study is to determine the prevalence of TMJ dysfunction among the population of Makhachkala.

MATERIALS AND METHODS

The study involved 500 participants aged 18 to 60 years, all of whom had been living in urban environments for at least five years. The sample was formed using stratified random sampling to account for variables such as gender, age, and professional activity. The sample size was determined based on logistical feasibility and the need to capture sufficient variability across age, sex, and occupational subgroups. While no formal sample size calculation was performed, the number of 500 participants allowed for adequate statistical analysis and subgroup comparisons. All participants provided informed consent before participating in the study. This study was approved by the Institutional Ethics Committee of Dagestan State Medical University (Approval No: DSMU/IEC/2024/09, dated June 15, 2024). Written informed consent was obtained from all participants prior to data collection.

A comprehensive methodology was employed to assess the

prevalence of temporomandibular joint dysfunction (TMD) and identify associated risk factors. In the first stage, a questionnaire was administered. It included questions regarding complaints of TMJ pain, restricted jaw movement, joint clicking or crepitus, and data on stress levels, lifestyle, physical activity, and habits. To quantify stress levels, the validated Perceived Stress Scale (PSS) was used, enabling the assessment of emotional tension. The second stage involved a clinical examination, which included visual assessment of the face, palpation of the masticatory muscles and TMJ, and evaluation of jaw movement ranges and joint sounds. To standardize data collection, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were utilized. Postural analysis was conducted using computer-based stabilography, which assessed participants' static and dynamic balance and identified postural deviations, including asymmetry in head and neck positioning. Additionally, a photographic postural analysis was performed using the PostureScreen software, providing an objective evaluation of biomechanical alterations. To evaluate psychoemotional status, the Hospital Anxiety and Depression Scale (HADS) and the Maslach Burnout Inventory (MBI) were employed, allowing for the determination of anxiety levels, depressive symptoms, and chronic stress among participants. Instrumental diagnostics included magnetic resonance imaging (MRI) of the TMJ to obtain detailed insights into the condition of the articular disk, joint surfaces, and the extent of any damage. Electronic axiography was also employed to analyze the kinematics of mandibular movements and identify abnormalities in joint function.

For data analysis, a comprehensive statistical approach was applied. Correlation analysis was used to determine associations between risk factors and the severity of TMD, while regression analysis identified the most significant predictors of pathology development. All statistical calculations were performed using SPSS software, version 26.0.

RESULTS

The questionnaire survey allowed for the identification of key symptoms and subjective complaints associated with temporomandibular joint dysfunction (TMD). Among the participants, 38% (190 individuals) reported various manifestations of this pathology. The most common complaint among patients

Table 1: Distribution of complaints across participant groups

Complaints	Patients with TMD (n=190)	Patients without TMD (n=310)	Total Sample (n=500)
Pain in the joint area	129 (68%)	34 (11%)	163 (32.6%)
Restricted jaw movements	99 (52%)	18 (6%)	117 (23.4%)
Joint sounds (clicking/crepitus)	116 (61%)	21 (7%)	137 (27.4%)
High stress level (PSS)	137 (72%)	99 (32%)	236 (47.2%)

Table 2: Results of clinical examination

Clinical Parameters	Patients with TMD (n=190)	Patients without TMD (n=310)	Total Sample (n=500)
Mandibular asymmetry	143 (75%)	41 (13%)	184 (36.8%)
Tenderness of masticatory muscles	118 (62%)	27 (9%)	145 (29%)
Restricted mouth opening (<30 mm)	91 (48%)	15 (5%)	106 (21.2%)
Joint sounds (clicking/crepitus)	120 (63%)	28 (9%)	148 (29.6%)

with TMD was pain in the joint area, which was observed in 68% of this group. This pain typically intensified during chewing and speaking, significantly reducing the quality of life. Additionally, restricted jaw movements were reported by 52% of respondents with TMD. These restrictions included difficulties in fully opening the mouth as well as lateral movements of the mandible, creating additional challenges in daily life. Notably, joint sounds such as clicking or crepitus, characteristic of TMD, were reported by 61% of patients, indicating a high frequency of functional joint impairments. Special attention was given to the psychoemotional state of participants. According to the results, a high level of stress measured by the Perceived Stress Scale (PSS) was recorded in 72% of patients with TMD, which was significantly higher compared to 32% in the group without pathology. This underscores that stress is one of the leading factors exacerbating the development and severity of TMD symptoms (Table 1).

Analysis of the survey data revealed that patients with TMD reported a significantly higher frequency of key symptoms compared to those without the pathology. This was particularly evident when comparing stress levels: in the TMD group, stress levels were more than twice as high. This highlights the importance of psychoemotional factors in the progression of the disorder. A high prevalence of joint pain, restricted movements, and joint sounds further emphasizes the severity of the pathology among a substantial portion of patients.

The clinical examination revealed significant differences in physiological characteristics between patients with TMD and those without the condition. Among the TMD group, 75% of participants were found to have mandibular asymmetry, manifested as deviation of the jaw either at rest or during movement. These findings indicate a disruption of craniofacial biomechanics, often associated with functional joint impairments. Tenderness upon palpation of the masticatory muscles was noted in 62% of patients with TMD. This symptom reflects the development of myofascial pain syndrome, which can be both a cause and a consequence of TMD. Restricted mouth opening to less than 30 mm was observed in 48% of patients, complicating essential daily functions such as eating and speaking. This limitation is frequently associated with joint inflammation and movement discoordination. Joint sounds such as clicking or crepitus were identified in 63% of patients with TMD. These symptoms are indicative of discoordination of the articular disk and irregularity in joint movement, pointing to structural changes in the joint (Table 2).

The clinical findings demonstrated that hallmark signs of

TMD are significantly more prevalent among patients with the disorder than in those without it. The high frequency of mandibular asymmetry, masticatory muscle tenderness, restricted mouth opening, and joint sounds underscores the critical need for early diagnosis and targeted therapeutic interventions in managing TMD.

The postural analysis revealed that a significant portion of patients with temporomandibular joint dysfunction (TMD) exhibit pronounced postural abnormalities, which play an important role in the pathogenesis of the condition. Among patients with TMD, 65% demonstrated various body alignment deviations associated with altered biomechanics and load distribution on the joint. One of the most common abnormalities identified was kyphotic posture, observed in 45% of patients. This condition is characterized by an increased thoracic kyphosis, leading to a shift in the center of gravity and additional stress on the TMJ. Lateral head tilt, identified in 32% of patients with TMD, also emerged as a frequent postural issue. This deviation is linked to asymmetry in cervical muscle function and results in altered mandibular movement trajectories. Another significant finding was shoulder girdle asymmetry, observed in 24% of patients with TMD. This condition affects overall body balance and increases load on one side of the craniofacial joint, potentially exacerbating the pathology (Table 3).

The data confirm that postural abnormalities are more common in patients with TMD compared to those without the condition. Kyphotic posture, lateral head tilt, and shoulder girdle asymmetry are key indicators that may worsen TMD symptoms, such as pain and restricted jaw movement.

The results of psychoemotional testing demonstrated a significant impact of anxiety and depressive states on the development and manifestations of TMD. Among patients with TMD, 60% showed elevated anxiety levels, which was considerably higher than the 20% observed in the group without TMD. High anxiety levels, measured using the Hospital Anxiety and Depression Scale (HADS), were closely correlated with subjective pain perception and functional limitations typical of TMD. Depressive symptoms were identified in 47% of patients with TMD. This condition was associated with a reduction in quality of life, motivation, and cognitive functioning, which could further exacerbate the progression of TMD. In contrast, depressive symptoms were reported in only 11% of participants without TMD. Emotional burnout, assessed using the Maslach Burnout Inventory (MBI), was observed in 41% of patients with TMD.

Table 4: Results of psychoemotional testing

Indicator	Patients with TMD (n=190)	Patients without TMD (n=310)	Total Sample (n=500)
High anxiety (HADS)	114 (60%)	62 (20%)	176 (35.2%)
Depressive symptoms (HADS)	89 (47%)	34 (11%)	123 (24.6%)
Emotional burnout (MBI)	78 (41%)	38 (12%)	116 (23.2%)

Table 3: Types of postural abnormalities among participants

Type of Postural Abnormality	Patients with TMD (n=190)	Patients without TMD (n=310)	Total Sample (n=500)
Kyphotic posture	85 (45%)	37 (12%)	122 (24.4%)
Lateral head tilt	61 (32%)	29 (9%)	90 (18%)
Shoulder girdle asymmetry	46 (24%)	18 (6%)	64 (12.8%)



This condition, often associated with chronic stress and persistent tension, can increase muscle tone in the cervical-facial area, contributing to the development or worsening of TMD symptoms (Table 4).

The findings demonstrate a strong relationship between patients' psychoemotional state and the severity of TMD symptoms. High levels of anxiety, depressive symptoms, and emotional burnout underscore the importance of incorporating psychological support and stress management strategies into TMD treatment plans.

Instrumental diagnostic methods confirmed the presence of significant structural and functional changes in the temporomandibular joints (TMJs) of patients with dysfunction. Magnetic resonance imaging (MRI) revealed abnormalities in the articular disc in 72% of patients with TMJ dysfunction. Among these, disc displacement was identified in 45% of patients, making it the most common anomaly. This condition is often associated with biomechanical disturbances in the joint and is accompanied by symptoms such as clicking, crepitus, and restricted mandibular movement. Disc thinning, observed in 27% of patients, indicates progressive degenerative changes, which may lead to the development of osteoarthritis and chronic pain. Axiography, employed for the analysis of joint kinematics, demonstrated abnormal mandibular movement trajectories in 63% of patients with dysfunction. These abnormalities included movement asymmetry, joint instability, and limited mobility. In the group without dysfunction, such changes were significantly less frequent, highlighting the diagnostic value of this method (Table 5).

The results of instrumental diagnostics confirmed that patients with TMJ dysfunction exhibit pronounced structural changes in the articular disc, including displacement and thinning, which occur significantly more frequently than in patients without pathology. Abnormal joint kinematics, identified through axiography, indicate functional instability that is characteristic of TMJ dysfunction. These findings underline the critical role of instrumental methods, such as MRI and axiography, in the accurate diagnosis and management of TMJ disorders.

DISCUSSION

The results of this study demonstrate the significant impact of psychoemotional and biomechanical factors on the development of temporomandibular joint dysfunction (TMD) among urban residents. The identified patterns underscore the relevance of this issue in modern urbanized environments and

highlight the necessity of a multidisciplinary approach to the diagnosis and treatment of this pathology.

Contemporary research confirms that stress acts not only as a trigger but also as a key pathogenetic factor in the development of functional disorders of the temporomandibular joint. Yin Y et al. reported that stress responses, including activation of the sympathetic nervous system, increase muscle tone, particularly in the masticatory and cervical muscles. This hypertonicity often progresses to myofascial pain syndrome and coordination disorders in the TMJ.⁷

In our study, emotional burnout was found to play a significant role, exacerbating chronic pain and reducing the body's compensatory capacities. The findings align with the work of Dos Santos et al., who established that patients with high levels of anxiety have a twofold increased risk of developing TMD, consistent with our data. Thus, psychoemotional stress should be regarded as a factor that worsens the disease course and hinders successful treatment.⁸

Postural disorders also occupy a central role in the pathogenesis of TMD. Postural deviations, such as kyphotic posture and lateral head tilt, disrupt body biomechanics, directly impacting TMJ function. These findings are supported by Demerjian et al., who demonstrated that changes in head and neck position redistribute load on joint surfaces and lead to functional instability. Chronic tension in cervical muscles associated with poor posture alters mandibular kinematics. Sorokina et al. found that postural deviations were observed in 70% of patients with TMD, which aligns with our observations. Moreover, correcting posture through physiotherapy reduces TMD symptoms, including pain and restricted mobility.⁹

Modern instrumental diagnostic methods, such as magnetic resonance imaging (MRI) and axiography, have demonstrated high accuracy in detecting structural and functional changes in the TMJ. De Melo et al. highlighted that disc displacement detected on MRI is an early marker of progressive degenerative changes in the joint.¹⁰

These changes can remain asymptomatic in the early stages, emphasizing the importance of regular diagnostics. Axiography has also proven its value in evaluating functional disorders of the TMJ. This technique not only assesses mandibular movement trajectories but also detects subclinical forms of dysfunction, making it crucial for early diagnosis. In our study, axiography demonstrated high diagnostic value, identifying kinematic abnormalities even in patients with minimal clinical symptoms. The findings underline the importance of integrating various approaches in the diagnosis and treatment of TMD. Studies by Paço et al. and Minervini et al. confirm that effective treatment is possible only when both physical and psychoemotional factors are addressed. Postural correction, physiotherapy, and cognitive-behavioral therapy, combined with pharmacological treatment, significantly reduce symptom severity.^{11,12}

This study has several limitations. First, its cross-sectional design does not allow for establishing causal relationships between temporomandibular joint dysfunction and the associated factors. Second, the use of self-reported questionnaires to assess stress and psychoemotional status may introduce subjective bias into the data. Additionally, the study was conducted within a single urban population, which limits the generaliz-

Table 5: Results of instrumental diagnostics

Indicator	Patients with TMJ Dysfunction (n=190)	Patients without TMJ Dysfunction (n=310)	Total Sample (n=500)
Disc displacement	85 (45%)	8 (3%)	93 (18.6%)
Disc thinning	51 (27%)	5 (2%)	56 (11.2%)
Abnormal joint kinematics	120 (63%)	14 (4%)	134 (26.8%)

ability of the findings to other geographic or cultural contexts. Furthermore, potentially significant factors such as dental occlusion, parafunctional habits, and genetic predisposition were not included in the analysis.

Despite these limitations, the findings have important clinical implications. Healthcare providers should consider postural deviations and the psychoemotional state of the patient as integral components of the diagnostic process for temporomandibular joint dysfunction. A multidisciplinary treatment approach involving a dentist, physiotherapist, and mental health specialist may enhance the effectiveness of therapy. Early identification and correction of stress and postural abnormalities may also serve as an effective strategy for preventing the progression of TMD.

CONCLUSION

Temporomandibular joint dysfunction (TMD) is characterized by high prevalence and is associated with psychoemotional stress, postural abnormalities, and structural joint changes. The identified high levels of anxiety and depression emphasize the need for a comprehensive treatment approach that includes postural correction and management of psychoemotional factors. Instrumental diagnostic methods, such as magnetic resonance imaging (MRI) and axiography, have proven effective in detecting structural and functional changes, enabling personalized treatment and improved outcomes.

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