

“Beyond the Jaw: Gender Differences in Stress Perception and Somatic Responses in Temporomandibular Disorders”

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Abstract: Temporomandibular disorders (TMDs) represent a heterogeneous group of musculoskeletal and neuromuscular conditions affecting the temporomandibular joint, masticatory muscles, and associated structures. TMDs are among the most common chronic orofacial pain conditions and demonstrate a pronounced gender disparity, with women being disproportionately affected compared to men. Emerging evidence suggests that differences in stress perception, neuroendocrine responses, psychosocial vulnerability, and somatic symptom expression play a critical role in shaping this gender imbalance. Stress is recognized as both a precipitating and perpetuating factor in TMD, influencing pain sensitivity, muscle hyperactivity, inflammatory pathways, and central sensitization mechanisms. Importantly, men and women differ significantly in how stress is perceived, processed, and expressed somatically, which has direct implications for the onset, severity, and chronicity of TMD symptoms.

This review synthesizes current evidence on gender differences in stress perception and somatic responses in individuals with TMD. It explores biological, psychological, and sociocultural determinants contributing to gender-specific pain experiences, including hormonal influences, hypothalamic-pituitary-adrenal (HPA) axis regulation, autonomic nervous system responses, coping styles, and pain modulation pathways. The review also highlights the clinical implications of these differences, emphasizing the need for gender-sensitive assessment and multidisciplinary management strategies. Understanding these gender-based variations is essential for improving diagnostic accuracy, personalizing interventions, and optimizing outcomes in patients with TMD.

Keywords: Temporomandibular disorders; Gender differences; Stress perception; Somatic symptoms; Orofacial pain; Psychoneuroendocrinology; Nursing management

Introduction

Temporomandibular disorders (TMDs) constitute a major public health concern due to their high prevalence, chronic nature, and substantial impact on quality of life. Characterized by pain in the temporomandibular joint (TMJ), masticatory muscles, and surrounding structures, TMDs often coexist with headaches, neck pain, sleep disturbances, and psychological distress. Epidemiological studies consistently demonstrate that TMDs are significantly more prevalent in women than in men, with female-to-male ratios ranging from 2:1 to 4:1, particularly during reproductive years [1]. This marked gender disparity has prompted extensive investigation into biological, psychological, and social mechanisms underlying differential vulnerability.

Stress is widely acknowledged as a critical factor in the etiology and progression of TMD. Psychological stress can trigger parafunctional behaviors such as bruxism and jaw

clenching, increase muscle tension, alter pain perception, and exacerbate inflammatory responses. However, stress is not a uniform experience; it is perceived, appraised, and expressed differently across genders. Women generally report higher stress sensitivity and emotional reactivity, while men may exhibit stress through behavioral or physiological pathways rather than verbal or emotional expression [2].

Somatic responses to stress—manifesting as muscle pain, fatigue, gastrointestinal symptoms, or headaches—are also more frequently reported by women. In the context of TMD, these somatic expressions may amplify pain intensity, prolong symptom duration, and increase the likelihood of chronic pain development. Understanding gender-specific stress perception and somatic symptomatology is therefore essential for a comprehensive understanding of TMD and for designing effective, individualized treatment approaches.

Overview of Temporomandibular Disorders

Temporomandibular disorders encompass a spectrum of conditions affecting the TMJ, masticatory muscles, and associated anatomical structures. The most common forms include myofascial pain, disc displacement disorders, and degenerative joint diseases such as osteoarthritis [3]. Clinical manifestations typically include jaw pain, restricted mouth opening, joint sounds, facial pain, and referred pain to the head and neck region.

TMDs are multifactorial in origin, involving biomechanical factors, occlusal discrepancies, trauma, parafunctional habits, psychological stress, and neurobiological dysregulation. Contemporary models emphasize the biopsychosocial framework, recognizing that psychological stress and emotional factors interact with physiological mechanisms to influence pain perception and disease progression [4].

Gender differences in TMD presentation are well documented. Women not only experience higher prevalence rates but also report greater pain intensity, longer symptom duration, and higher levels of disability. These differences cannot be fully explained by anatomical or biomechanical factors alone, highlighting the importance of stress-related and psychosocial influences.

Stress Perception: Conceptual Framework and Gender Differences

Stress perception refers to the individual's subjective appraisal of stressors and their perceived ability to cope with environmental demands. According to the transactional model of stress, stress arises when perceived demands exceed perceived coping resources [5]. Gender plays a significant role in this appraisal process.

Women tend to report higher levels of perceived stress and emotional distress in response to similar stressors compared to men. This heightened perception has been linked to greater emotional awareness, social role expectations, and differences in cognitive appraisal styles. Women are more likely to internalize stress, leading to emotional and somatic manifestations, whereas men often externalize stress through behavioral responses such as aggression or substance use [6].

Neurobiological evidence suggests that women exhibit greater activation of limbic structures, including the amygdala and hippocampus, during stress processing. These brain regions are closely associated with emotional regulation and

pain perception, potentially explaining increased vulnerability to stress-related pain conditions such as TMD [7].

Neuroendocrine Responses to Stress and Gender Variations

The hypothalamic-pituitary-adrenal (HPA) axis plays a central role in stress regulation by controlling the release of cortisol and other stress hormones. Dysregulation of the HPA axis has been implicated in chronic pain conditions, including TMD [8].

Gender differences in HPA axis functioning are well established. Women generally exhibit greater cortisol reactivity to psychosocial stressors, particularly during specific phases of the menstrual cycle. Estrogen and progesterone modulate cortisol secretion and glucocorticoid receptor sensitivity, influencing stress responsiveness and inflammatory processes [9].

In TMD patients, altered cortisol rhythms and blunted stress responses have been observed, particularly among women with chronic symptoms. These abnormalities may contribute to sustained muscle tension, impaired tissue repair, and central sensitization, thereby exacerbating pain and dysfunction [10].

Autonomic Nervous System and Somatic Stress Responses

The autonomic nervous system (ANS), comprising the sympathetic and parasympathetic branches, mediates physiological responses to stress. Chronic stress is associated with sympathetic overactivity and reduced parasympathetic tone, leading to muscle hyperactivity, vasoconstriction, and increased pain sensitivity.

Women with TMD often demonstrate heightened sympathetic activity and reduced heart rate variability, indicating impaired autonomic regulation [11]. This dysregulation may contribute to persistent muscle tension in the jaw and cervical regions, reinforcing pain cycles. Men, in contrast, may exhibit more transient autonomic responses, potentially explaining differences in symptom chronicity.

Somatic responses to stress, such as muscle pain, fatigue, and headaches, are more frequently reported by women. In TMD, these responses may manifest as widespread pain, increased tenderness, and comorbid conditions such as fibromyalgia or irritable bowel syndrome, which are also more prevalent in women [12].

Psychological Factors and Coping Styles

Psychological characteristics, including anxiety, depression, and coping strategies, significantly influence stress perception and pain outcomes in TMD. Women with TMD report higher levels of anxiety and depressive symptoms, which are strongly associated with increased pain intensity and disability [13].

Coping styles differ by gender, with women more likely to use emotion-focused coping strategies such as rumination and seeking social support, while men tend to adopt problem-focused or avoidant coping mechanisms. While social support can be protective, excessive rumination may amplify stress perception and pain awareness in women [14].

Catastrophizing, defined as an exaggerated negative orientation toward pain, is more commonly observed in women and has been identified as a key mediator between stress and pain severity in TMD. This cognitive pattern intensifies emotional distress and enhances central pain processing, contributing to chronicity [15].

Hormonal Influences and Pain Modulation

Sex hormones play a crucial role in pain modulation and stress responsiveness. Estrogen influences nociceptive processing by interacting with opioid receptors, serotonin pathways, and inflammatory mediators. Fluctuations in estrogen levels across the menstrual cycle have been associated with variations in TMD pain intensity [16].

Women often report exacerbation of TMD symptoms during the luteal phase or periods of hormonal instability, such as pregnancy or menopause. These hormonal effects may partly explain the higher prevalence and severity of TMD in women of reproductive age [17].

Men, with more stable testosterone levels, may experience different pain modulation mechanisms. Testosterone has been shown to exert protective effects against pain by enhancing endogenous opioid activity and reducing inflammatory responses [18].

Central Sensitization and Gender Differences

Central sensitization refers to increased responsiveness of the central nervous system to sensory input, leading to heightened pain sensitivity and persistence. This phenomenon is a key mechanism in chronic TMD and is more prevalent in women [19].

Stress plays a pivotal role in central sensitization by altering neurotransmitter systems, reducing inhibitory pain pathways, and enhancing excitatory signaling. Women's greater stress

sensitivity and emotional reactivity may predispose them to central sensitization, resulting in widespread pain and reduced treatment responsiveness [20].

Clinical Implications for Assessment and Management

Recognizing gender differences in stress perception and somatic responses has important clinical implications for TMD management. Assessment should extend beyond physical examination to include evaluation of psychological stress, coping styles, hormonal status, and comorbid conditions.

Gender-sensitive management strategies are essential. Women may benefit from interventions targeting stress reduction, emotional regulation, and cognitive restructuring, such as cognitive-behavioral therapy, mindfulness-based stress reduction, and relaxation techniques. Men may respond better to approaches emphasizing behavioral modification and physical rehabilitation [21].

Role of Nurses in Gender-Sensitive TMD Care

Nurses play a pivotal role in the holistic management of patients with TMD. Through comprehensive assessment, patient education, and psychosocial support, nurses can address gender-specific stressors and somatic responses. Nursing interventions may include stress management education, relaxation training, lifestyle modification counseling, and referral to multidisciplinary care teams [22]. By adopting a gender-informed approach, nurses can enhance patient engagement, improve adherence to treatment plans, and contribute to better pain outcomes and quality of life.

Future Directions and Research Implications

Despite growing evidence, gaps remain in understanding the complex interactions between gender, stress, and TMD. Future research should focus on longitudinal studies examining hormonal fluctuations, stress biomarkers, and gender-specific treatment responses. Integrating psychoneuroendocrinological perspectives may yield novel insights and therapeutic targets [23].

Conclusion

Gender differences in stress perception and somatic responses play a critical role in the development and progression of temporomandibular disorders. Women's heightened stress sensitivity, hormonal influences, and propensity for somatic symptom expression contribute to increased vulnerability and chronicity of TMD. Men, while

less frequently affected, exhibit distinct stress and pain processing patterns that warrant tailored approaches. Understanding these differences is essential for advancing gender-sensitive assessment, management, and nursing care, ultimately improving outcomes for individuals living with TMD.

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