

## Temporomandibular Joint Disorders in Postmenopausal Women

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### Abstract.

This work introduces a taxonomic classification for temporomandibular disorders (TMD), aiming to systematize the understanding and management of these complex conditions. The proposed classification comprises musculoskeletal disorders, including myofascial pain syndrome and non-inflammatory muscle disorders, and joint disorders, encompassing internal derangements, osteoarthritis, and arthralgia. Etiological considerations distinguish between traumatic and non-traumatic TMD, with subtypes such as stress-related and idiopathic TMD. This structured framework provides clinicians and researchers with a systematic approach to categorize TMD, facilitating diagnosis and treatment planning. Stress-related TMD highlights the psychosocial aspect, while idiopathic TMD acknowledges the multifactorial nature of these disorders. As a dynamic tool, this classification accommodates future refinements, contributing to improved patient care and the advancement of TMD research. Overall, the proposed taxonomy serves as a valuable guide in navigating the diverse landscape of temporomandibular disorders.

**Keywords.** temporomandibular disorders, TMD, taxonomic classification, musculoskeletal disorders, joint disorders, etiology, traumatic TMD, non-traumatic TMD, stress-related TMD, idiopathic TMD, diagnosis, treatment planning, research, patient care, psychosocial aspect.

### I. Introduction

Temporomandibular Joint Disorders (TMD) have long been a subject of extensive research and clinical exploration, delving into the intricate mechanisms that govern the health and functionality of the temporomandibular joint (TMJ). While TMD can affect individuals across various demographics, there exists a compelling connection between TMD and hormonal dynamics, particularly in the context of postmenopausal women. This comprehensive exploration aims to unravel the complex interplay between hormonal changes, notably estrogen deficiency, and the development of TMD in postmenopausal women.

The temporomandibular joint, a bilateral diarthrodial joint, plays a pivotal role in facilitating both sliding and hinge movements essential for various oral functions, including chewing and speaking. Its disc, primarily composed of collagen and elastin, is a critical component susceptible to alterations in the presence of TMD symptoms. As we embark on this exploration, it becomes evident that changes in collagen and elastin synthesis are intricately linked to sex hormones, particularly estrogen. The TMJ's possession of estrogen receptors and responsiveness to the hormone progesterone highlights the influence of sexual hormones on bone volume, extracellular matrix remodeling, and joint structure.

Estrogen, a key player in the intricate ballet of hormonal regulation, exerts a profound impact on the collagen and protein content of the TMJ disc. The matrix composition of fibrocartilage within the TMJ undergoes significant modifications in response to estrogen levels, establishing a direct link between hormonal fluctuations and structural changes in the joint. The consequences of estrogen deficiency are far-reaching, inducing degenerative changes in the TMJ, such as cartilage thickening and the formation of osteophytes. These

alterations contribute to the pathologic changes in the TMJ, affecting not only the disc but also the synovial membrane.

Further delving into the molecular level, it becomes apparent that estrogen's influence extends to articular chondrocytes, the cells responsible for maintaining cartilage integrity. The chondroprotective actions of estrogen include stimulating chondrocyte proliferation and shielding them from spontaneous death, thereby preventing the onset of conditions like osteoarthritis. This nuanced relationship between locally produced estrogen and cartilage function sheds light on the intricate mechanisms underlying the development and progression of TMD.

Temporomandibular disorders encompass a broad spectrum of clinical illnesses characterized by pain and dysfunction within the masticatory system. This multifaceted category includes internal joint derangements, myofascial pain, and osteoarthritis, arthralgia, and osteoarthritis. Notably, TMD stands as the second-most common cause of orofacial pain, with a higher prevalence in females. The subclassification of TMD into distinct categories allows for a nuanced understanding of the diverse manifestations of this complex condition.

Epidemiological research has consistently highlighted the gender disparity in TMD, with women constituting the majority of TMD patients. This observation extends further, revealing a correlation between age and TMD, particularly in postmenopausal women. The intricate dance between the female reproductive system and TMD's etiology raises intriguing questions about the role of hormonal fluctuations in shaping the prevalence and presentation of TMD in different demographic groups.

As we embark on this journey of exploration, it is crucial to acknowledge the significance of understanding TMD in postmenopausal women not merely as a localized oral health concern but as a manifestation of broader hormonal dynamics. This comprehensive investigation aims to unravel the multifaceted interactions between hormonal changes, TMJ structure, and the development of TMD in postmenopausal women, shedding light on potential avenues for targeted interventions and holistic patient care.

## **II. Background**

### **a. Temporomandibular Joint Disorders (TMD):**

TMD represents a complex array of clinical conditions affecting the temporomandibular joint (TMJ) and the muscles responsible for jaw movement. The TMJ is a bilateral diarthrodial joint that facilitates essential oral functions, including chewing, speaking, and swallowing. TMD encompasses various subcategories, such as internal joint derangements, myofascial pain, and osteoarthritis, arthralgia, and osteoarthritis.

Internal joint derangements involve structural abnormalities within the TMJ, leading to symptoms like joint pain, clicking sounds, or limited jaw movement. Myofascial pain focuses on discomfort in the muscles involved in jaw movement, often presenting as localized pain or radiating discomfort. Osteoarthritis, arthralgia, and osteoarthritis expand the spectrum, involving broader musculoskeletal implications. TMD stands as the second-most common cause of orofacial pain, with a notable predilection for females.

### **b. Hormonal Dynamics in Postmenopausal Women:**

Menopause marks a significant life transition for women, signaling the end of reproductive years. This natural biological process entails a decline in ovarian function, resulting in decreased production of estrogen and progesterone. Estrogen, a key player in various physiological processes, influences bone density, cardiovascular health, and the integrity of connective tissues, including those in joints.

The postmenopausal phase is characterized by estrogen deficiency, leading to a range of systemic changes. These changes extend beyond the typical menopausal symptoms and can impact musculoskeletal health. Estrogen's role in maintaining bone density is well-established, but its influence on joints, particularly the TMJ, is an area of growing interest and research.

**c. Linking TMD and Hormonal Changes:**

The intersection of TMD and hormonal dynamics, especially in postmenopausal women, unveils a compelling narrative. Research suggests that estrogen deficiency contributes to degenerative changes in the TMJ, affecting the composition of the TMJ disc and synovial membrane. Estrogen's chondroprotective actions on articular chondrocytes further emphasize its role in preserving joint health.

The prevalence of TMD in women, coupled with the observation that postmenopausal women are particularly susceptible, highlights the potential connection between the female reproductive system and TMD's etiology. Understanding this intricate interplay requires a holistic approach that considers the systemic implications of hormonal changes, the structural integrity of the TMJ, and the multifaceted nature of TMD.

In essence, the background of TMD and hormonal dynamics in postmenopausal women sets the stage for a nuanced exploration. It prompts us to unravel the threads that weave together oral health, hormonal transitions, and musculoskeletal well-being, offering insights that extend beyond the confines of traditional medical specialties.

**d. Clinical Manifestations of TMD in Postmenopausal Women:**

The clinical manifestations of TMD in postmenopausal women add another layer to this intricate tapestry. Beyond the typical symptoms of jaw pain and dysfunction, the hormonal influence becomes palpable in the presentation of TMD. The degenerative changes induced by estrogen deficiency, such as cartilage thickening and osteophyte development, contribute to a unique set of challenges in diagnosis and management.

Postmenopausal women with TMD may experience not only the characteristic joint pain and muscle discomfort but also an increased propensity for structural abnormalities within the TMJ. These manifestations, often intertwined with hormonal fluctuations, demand a nuanced approach to treatment, considering both symptomatic relief and addressing the underlying hormonal factors.

**e. Diagnostic Challenges and Considerations:**

The intricate relationship between hormonal dynamics and TMD poses diagnostic challenges that necessitate a comprehensive understanding of the patient's medical history, hormonal status, and oral health. The traditional diagnostic criteria for TMD must be augmented with considerations for hormonal fluctuations, especially in postmenopausal women.

Advanced imaging techniques, such as magnetic resonance imaging (MRI) and computed tomography (CT), provide invaluable insights into the structural changes within the TMJ. These diagnostic tools, coupled with a thorough understanding of hormonal influences, empower healthcare professionals to tailor treatment plans that address both the symptoms and the underlying hormonal imbalances.

**f. Treatment Modalities and Hormone Replacement Therapy (HRT):**

The management of TMD in postmenopausal women necessitates a holistic approach that goes beyond mere symptom control. While traditional treatments, such as physical therapy, pain management, and occlusal splints, remain integral, the potential role of hormone replacement therapy (HRT) emerges as a promising avenue.

HRT, a well-established intervention for alleviating menopausal symptoms, could extend its therapeutic reach to TMD in postmenopausal women. By restoring hormonal balance, HRT may mitigate the degenerative changes within the TMJ, offering a targeted approach to address the root cause of TMD in this demographic.

However, the incorporation of HRT into TMD management requires careful consideration of individual factors, including the patient's overall health, risk profile, and preferences. Collaborative decision-making between

healthcare providers and patients becomes paramount, emphasizing the importance of personalized medicine in navigating the intersection of hormonal dynamics and TMD.

#### **g. Research Frontiers and Future Directions:**

The exploration of TMD in postmenopausal women stands at the forefront of research, beckoning further investigations into the intricate mechanisms that underlie this complex relationship. Future studies may unravel additional nuances, shedding light on the genetic, environmental, and lifestyle factors that modulate the interplay between hormones and TMD.

Moreover, the evolving landscape of medical and dental research holds the promise of innovative interventions, from targeted drug therapies to precision medicine approaches. Integrating the wealth of knowledge gained from molecular and genetic studies into clinical practice will pave the way for more effective, individualized treatments for postmenopausal women grappling with TMD.

In conclusion, the convergence of temporomandibular joint disorders and hormonal dynamics in postmenopausal women unfolds as a multifaceted narrative. From the clinical manifestations and diagnostic challenges to the evolving landscape of treatment modalities, this intersection invites a holistic understanding that transcends traditional medical boundaries. As we navigate this terrain, a collaborative and interdisciplinary approach emerges as the compass guiding future research and clinical practice, offering hope for enhanced patient care and improved quality of life for postmenopausal women affected by TMD.

### **III. Review of literature**

EsaKlemetti (1996) conducted an anamnestic study with 355 postmenopausal women, aged 48 to 56, to identify the symptoms of temporomandibular dysfunction associated with edentulousness and complete dentures. Elderly people with complete dentures frequently exhibit symptoms of temporomandibular disorder (TMD) than the patients with natural teeth.<sup>[25]</sup>

Jiang Wang et al in 2008 studied the possible role of estrogen in the incidence of temporomandibular disorders. The authors have looked at three factors in order to examine the possibility that oestrogen maybe involved in the pathophysiology of TMD. The first is epidemiological investigation of the connection between levels of oestrogen and TMD occurrence. The second is how oestrogen affects the temporomandibular joint's growth, restoration, metabolism, and related structures. The third is how oestrogen affects the pain-regulating mechanism. According to the study, estrogen may have an impact on development, restitution and metabolism of the TMJ and its supporting tissues, including the articular disc, bone. Estrogen may have a significant impact on the synovial membrane, articular disc, ligament, and masticatory muscles, in addition to its effects on bone and cartilage, other TMJ structures. The hypothesis that estrogen may play a significant role in the predisposing to TMJ disease, modulation of its development, or its therapeutic response is supported by studies that provide substantial evidence for these ideas.<sup>[13]</sup>

Martina Schmid-Schwap et al. (2013) conducted the study to evaluate potential differences in patient variables that might explain for sex-specific disparities in TMD involving a total of 502 patients (404 females and 98 males) presenting with TMD. According to a clinical evaluation, females have significantly less mouth opening than males. The female patients had considerably higher tenderness on palpation of the TMJ and masticatory muscles, clicking, crepitation, and bruxism than the men.<sup>[26]</sup>

In a 2014 study conducted by Chalkoo et al, 195 female participants with temporomandibular problems were investigated and separated into the following groups to see whether estrogen might play a role in their condition. Women of reproductive age (20–40 years) Postmenopausal women under the age of 60. Subjects with and without temporomandibular disorder indications and symptoms. The serum levels of estrogen (also known as estradiol) were compared in TMD positive (TMD + ve) and TMD negative (TMD -ve) patients, as well as between TMD +ve women of reproductive age (20–40 years) and postmenopausal women. The reproductive age

group (20–40years) had a greater proportion of TMD +ve participants, and there productive age group's serum estrogen levels were significantly higher than those of the TMD+ve subjects who were postmenopausal.<sup>[27]</sup>

#### IV. Taxonomic Classification for Temporomandibular Disorders

Level	Category	Description
<b>I. General Type</b>	<b>A. Musculoskeletal Disorders</b>	Disorders primarily affecting the muscles involved in mastication and jaw movement.
	- Myofascial Pain Syndrome	Characterized by localized or widespread pain in the muscles and fascial tissues, often associated with trigger points.
	- Muscle Disorders (Non-inflammatory)	Involves non-inflammatory conditions affecting the muscles, leading to pain, stiffness, or limited range of motion.
	<b>B. Joint Disorders</b>	
	<b>1. Internal Joint Derangements</b>	Structural abnormalities within the temporomandibular joint (TMJ), affecting its normal functioning.
	- Disc Displacement	Displacement of the TMJ disc, leading to clicking, popping, or locking of the jaw.
	- Condylar Hyperplasia	Excessive growth of the condyle, impacting the structural balance of the TMJ.
	<b>2. Osteoarthritis and Arthralgia</b>	Conditions involving degenerative changes in the TMJ, leading to joint pain, inflammation, and possible osteoarthritis.
	- Osteoarthritis	Characterized by progressive degradation of the joint cartilage, accompanied by pain and limited joint movement.
<b>II. Etiological Basis</b>	- Arthralgia	Joint pain without significant structural changes, often associated with inflammation or dysfunction.
	<b>A. Traumatic TMD</b>	TMD resulting from physical trauma or injury to the jaw joint or surrounding structures.
	- Post-traumatic TMD	TMD arising as a consequence of a previous injury, such as whiplash or direct impact to the jaw.
	<b>B. Non-Traumatic TMD</b>	TMD with no apparent history of physical trauma, often associated with other factors like stress or parafunctional habits.
	- Stress-Related TMD	TMD influenced by psychological stress, leading to muscle tension, bruxism, or other stress-induced oral habits.
	- Idiopathic TMD	TMD with an unknown or unclear cause, potentially involving a combination of genetic, hormonal, and environmental factors.

**Table 1. Taxonomic Classification for Temporomandibular Disorders**

##### a. Signs and symptoms of TMDs

Sounds, restricted mouth opening, deviation while opening and closing of mouth, headache, jaw locking, TMJ pain, muscles of mastication tenderness.

##### b. Imaging of TMD

Conventional radiographic Images like orthopantomogram, reverse townes view, are used to diagnose TMJ abnormalities. MRI, computed tomography (CT), cone beam CT, ultrasonography are imaging modalities used to diagnose problems of the temporomandibular joint. There are 3 specific views for imaging of TMJ namely transcranial, transorbital and transpharyngeal. Nowadays, there is less need for conventional radiography, because this joint requires three dimensional imaging views, the use of flat plane films for TMJ pathology is insufficient. CT and cone beam CT, osseous alterations can be seen more clearly. With a small radiation dosage and without superimposing the bony structures, cone beam CT enables high-resolution multiplanar reconstruction of the TMJ. The gold standard for imaging the soft tissue parts of the TMJ is MRI, a noninvasive

technology. The articular disc's position and shape are assessed using MRI. Additionally, the early TMD indicators and the development of joint effusion can be identified. The diagnosis of TMJ disc displacements can be aided by high-resolution ultrasonography, a noninvasive, dynamic, and affordable imaging tool.<sup>[17]</sup>

Research Diagnostic Criteria for Temporomandibular Disorders (RDC/ TMD) introduced in 2014 is used for diagnosing different conditions.<sup>[18]</sup>

### **c. Relation between Menopause and TMD**

Menopause, which is caused by an estrogen deficit and lasts for 12 months, is the permanent stop of menstruation that is unrelated to any ailment. Menopause typically occurs at age 51.

Osteoclastic activity increases after menopause due to estrogen deprivation, which causes an imbalance between osteoclastic and osteoblastic activity. More bone is reabsorbed as a result, leading to overall bone loss. The temporomandibular joint, among other joints, develops degenerative alterations as a result of this imbalance in hormone levels.<sup>[19]</sup>

Postmenopausal women lose bone mass due to estrogen insufficiency. Lack of estrogen triggers the release of many cytokines, including RANKK ligand (RANKL), a key player in the osteoclastogenesis cascade.<sup>[1]</sup> In 2 participants with TMD, Gruber and Gregg discussed the potential effects of osteoporosis.<sup>[20]</sup> TMD may be brought on by the decreased estrogen levels found in postmenopausal women with osteoporosis.<sup>[21]</sup> Osteoporosis in postmenopausal women is mostly attributed to the absence of estrogen's osteoprotective properties. Both TMJ elements and pain modulation can be affected by low estrogen levels.<sup>[22,1]</sup>

It has been noted that variations in estrogen levels during the reproductive years might exacerbate facial pain, and that decreases in estrogen during menopause may hasten the degeneration of the TMJ. <sup>[1]</sup> Additionally, it has been proposed that estrogen controls nociceptive responses and TMJ inflammation through peripheral and central neural systems.<sup>[23,13]</sup> As a result, osteoporosis in older women may be associated with low estrogen levels, and in these patients, low estrogen levels can cause TMD by causing TMJ degradation and heightened pain responses.<sup>[24]</sup>

## **V. Conclusion**

In conclusion, the taxonomic classification for temporomandibular disorders (TMD) provides a structured framework to categorize and understand the diverse array of conditions affecting the temporomandibular joint (TMJ) and associated structures. This classification, based on general types, etiological basis, and anatomical involvement, offers a systematic approach for clinicians and researchers navigating the complexities of TMD. The musculoskeletal disorders category encompasses conditions primarily affecting the muscles involved in mastication and jaw movement, including myofascial pain syndrome and non-inflammatory muscle disorders. The joint disorders category further delineates internal joint derangements, such as disc displacement and condylar hyperplasia, as well as osteoarthritis and arthralgia, each characterized by distinct structural and functional changes within the TMJ. Considering the etiological basis, traumatic TMD reflects disorders resulting from physical injury, while non-traumatic TMD encompasses conditions influenced by factors such as stress or idiopathic causes. Stress-related TMD highlights the impact of psychological stress on oral health, leading to muscle tension and parafunctional habits. Idiopathic TMD underscores the complexity of these disorders, acknowledging the involvement of genetic, hormonal, and environmental factors that may contribute to their development. This taxonomic classification serves as a valuable tool for diagnosis, treatment planning, and research in the field of TMD. It not only aids clinicians in identifying specific TMD subtypes but also guides researchers in exploring the underlying mechanisms and developing targeted interventions. As the understanding of TMD continues to evolve, this classification provides a foundation for future refinements and additions based on emerging research findings. By embracing a comprehensive and structured approach, the taxonomy facilitates a more nuanced understanding of temporomandibular disorders, ultimately contributing to improved patient care and outcomes.

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