FLEX CEUs

Temporomandibular Joint Disorders - Diagnostics and Treatment Considerations

Introduction

Around one-third of United States adults experience temporomandibular joint disorders (TMD) annually. Many factors contribute to the development of the common condition of TMD. TMD could be caused by a problem with the structure or function of the temporomandibular joint (TMJ), stress, tension, habits, trauma, and chronic pain. Physical therapists and physical therapist assistants should be knowledgeable in best evaluation and treatment practices to manage the disorder. This course will detail the structure and function of the TMJ, the prevalence of TMD, contributing factors to developing TMD, examination, diagnosis, treatment and timeframes, and expected outcomes.

Section 1: Overview and Background [1]

The temporomandibular joint (TMJ) is one of the most complicated joints in the human body due to its structure and function. The TMJ is classified as a compound joint, meaning it has more than one articulating surface to form the joint. Its motion includes rotation and translation with the help of an interarticular disc. It is surrounded by four crucial muscles and the trigeminal nerve that allow jaw movements. The anatomy of the joint along with its function creates scenarios for pain, stiffness, and dysfunction to occur. Dysfunction in the TMJ is called temporomandibular joint disorder/dysfunction (TMD). There is extensive history on the classification of TMD, the anatomy that contributes, several signs and symptoms, and factors that increase the risk of developing TMD.

What is TMD? [1–3]

The history of temporomandibular joint disorder is relatively short. In the 1930s, an otolaryngologist named James Costen first described the disorder as “Costen syndrome”. Costen syndrome was meant to describe a condition with symptoms

regarding the ear and TMJ. The term “temporomandibular joint dysfunction syndrome” was first introduced in 1959. The disorder was renamed “functional temporomandibular joint disturbances” shortly after that. It was not until the 1970s and 1980s that the term temporomandibular joint disorders became recognized as the condition it is today. At that time, the healthcare community recognized that TMD is not a simple problem. Rather, it is complex and associated with the cervical and thoracic spine, the TMJ itself, external factors like emotional or psychological stress, and daily activities that stress the joint.

Temporomandibular joint disorder is an umbrella term to represent a group of around thirty disorders that cause symptoms at the TMJ and surrounding anatomy. TMD can be broken up into two main causes including joint or disc disorders (interarticular) or disorders of the mastication muscles (extraarticular).

Interarticular TMD

Interarticular, or occurring within a joint, can explain many causes of TMD. Conditions like inflammation, synovitis, and retrodiscitis can lead to TMD. Synovitis is inflammation of the joint capsule and retrodiscitis is inflammation of the posterior aspect of the disc to the mandibular fossa. These issues cause severe pain with any jaw movement due to the inflammatory process within the joint. Internal derangement is another type of interarticular source of TMD. Internal derangement can be caused by trauma such as a fall, continued clenching or grinding of the teeth, periods of overactivity in the jaw such as heavy chewing, or other structural problems within the joint. The disc can displace and reduce, which causes audible or palpable clicking. If the disc displaces anteriorly, it will be pushed forward when the mouth opens. The disc can also displace and not reduce, meaning the disk is stuck outside the joint space and the jaw will completely lock up. Arthritis is another cause of problems in the TMJ. The condyle of the mandible can develop osteophytes or flattening, which can cause crepitus,

pain, and inflammation. In addition to this, rheumatoid arthritis, infectious arthritis, and gout can all cause problems at the TMJ. Another contributor of interarticular joint problems at the TMJ is conditions of hypermobility. Connective tissue disorders like Marfan syndrome and Ehlers-Danlos syndrome can cause the disc to lengthen and break down. This may cause open locking of the jaw and occurs because of an excess of anterior movement of the TMJ and the disc.

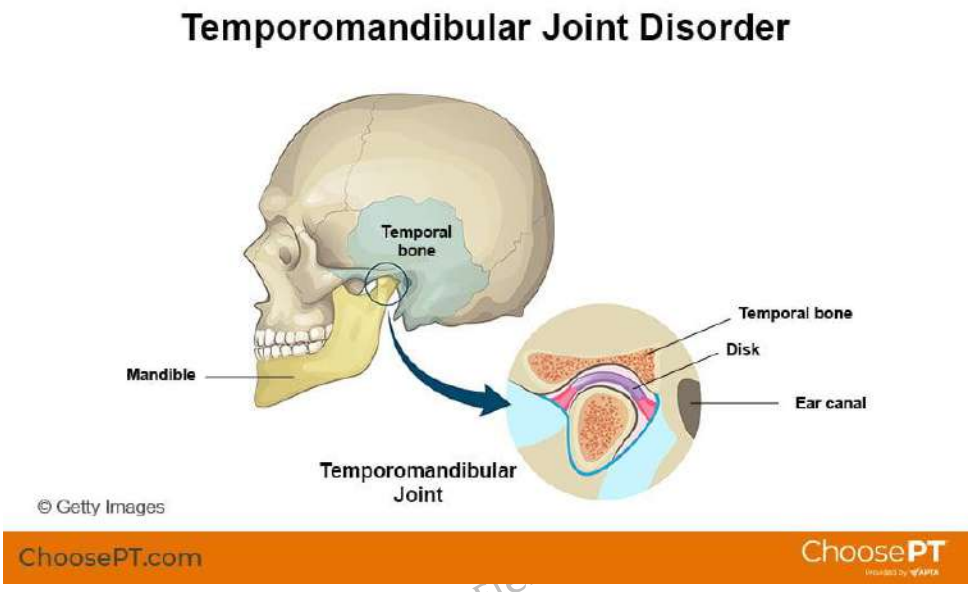
Extraarticular TMD

Extraarticular causes of TMD include muscle spasms, posture disorders, temporal tendinopathy, fractures, myalgia, and myofascial pain syndrome. Muscle spasms most commonly affect the masseter, temporalis, and pterygoid muscles due to tension and overuse. Posture disorders involve the cervical spine with continued protraction/forward head posture. This puts pressure on the mandible due to the digastric muscle attaching from the anterior mandible to the hyoid bone. Temporal tendinopathy happens due to prolonged temporalis muscle demand, most frequently from grinding teeth (bruxism). The tendinopathy of the temporalis tendon leads to pain and inflammation. The most common fracture site in the mandible is the condylar neck, which occurs due to trauma like a fall or car accident. Myalgia is a general term describing muscle pain. In this context, myalgia of the muscles of mastication occurs from overuse, strain, tension, or other causes. Myofascial pain and myalgia are examples of mastication muscle disorders. Myofascial pain syndrome can cause temporomandibular pain due to tension and fatigue of the muscles of mastication Regardless of the cause, it causes localized muscle pain at the TMJ.

Anatomy and Function of the Temporomandibular Joint [2,4]

As the name implies, the temporomandibular joints are the articulation between the temporal bone of the skull superiorly and the mandible inferiorly. This is a bilateral joint and both work in unison to allow movement of the mandible. The

TMJ is classified as a synovial, condylar, and hinge joint. It is also considered a ginglymoarthrodial joint because it rotates in the sagittal plane and translates on its own axis. Ginglymoarthrodial joints are defined as having both a hinge and a gliding motion. The motions at the TMJ are also controlled by a complex structure of ligaments and muscles that surround the TMJ. The joint contains a synovial cavity, articular cartilage, and a capsule that exists to allow smooth movement by reducing friction.



Motion and Normative Ranges of Motion

Mandibular Depression involves the lowering or inferior movement of the mandible as a result of rotational and gliding motion at the TMJ. The normal range of motion is 40 to 60 mm.

Mandibular Elevation is the raising or the superior movement of the mandible by rotation and gliding at the TMJ.

Mandibular Lateral Movement is voluntary side to side movement of the mandible. The normal range of motion for lateral movement is 8 to 12 mm.

Mandibular Protrusion is anterior translation of the mandible. The normal range of motion is 8 to 12 mm.

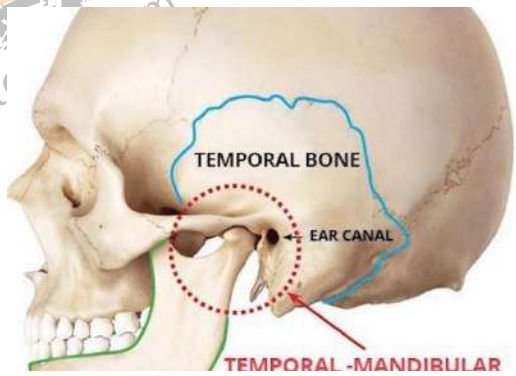
Mandibular Retrusion is posterior translation of the mandible.

Bones Surrounding the TMJ

The TMJ connects the mandible to the skull. The TMJ is composed of the temporal bone of the skull and the condylar process of the mandible.

The *Temporal Bone* forms a part of the lateral skull and is present bilaterally. It forms the inferior and lateral aspect of the skull. It contains structures such as the middle and inner ear, the mastoid process, and the styloid process. It has a concave aspect called the mandibular fossa, which forms the joint socket of the TMJ. The mandibular fossa is found on the inferior surface of the zygomatic process of the temporal bone.

The *Condylar Process* is the rounded ridge at the posterior aspect of the mandible. It comes together with the mandibular fossa of the temporal bone to form the TMJ. The condylar process is covered by a thin layer of cartilage and is held in place by the articular disc that sits between the condyle and the mandibular fossa.



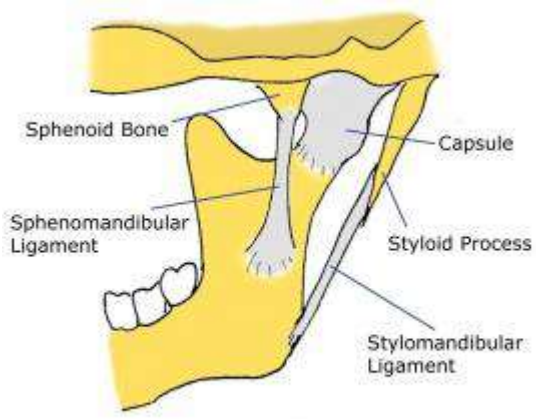
Ligaments of the TMJ [4]

The TMJ is supported by several ligaments, which play an important role in maintaining the stability and function of the joint. This section will describe the important ligaments of the TMJ and their role.

The *Temporomandibular Ligament (Lateral ligament)* is the main ligament of the temporomandibular joint. It prevents extra posterior mobility of the mandible. It attaches from the zygomatic process of the temporal bone to the neck of the mandible. It is connective tissue formed into a wide, flat band that courses from the zygomatic arch to the lateral surface of the condylar process of the mandible.

The *Sphenomandibular Ligament* runs from the spine of the sphenoid bone to the medial mandible. This ligament prevents extra anterior movement of the mandible.

The *Stylomandibular Ligament* courses from the styloid process of the temporal bone to the angle of the mandible. It prevents excess medial and lateral movement of the mandible.



The Temporomandibular Ligaments and Joint capsule (medial view)

As mentioned, the main function of the ligaments is to prevent excessive movement in all directions to keep the joint stable and secure.

The Articular Disc

The presence of the articular disc allows two distinct functions of the TMJ. The disc is comprised of fibrocartilaginous tissue and divides the joint into a superior and inferior compartment. The superior joint compartment consists of the temporal bone (more specifically the mandibular/glenoid fossa) and the articular

disc. This compartment allows lateral and anterior translation of the mandible. The inferior compartment is made up of the articular disc and the mandibular condyle. It allows interarticular rotation, or the hinge function and jaw opening and closing movements. The inferior joint compartment (articulation of the articular disc to the mandibular condyle allows for 20 millimeters of motion. The remainder of motion (jaw hinging/opening the mouth) is achieved by translation of the condyle and articular disc anteriorly as a fixed structure.

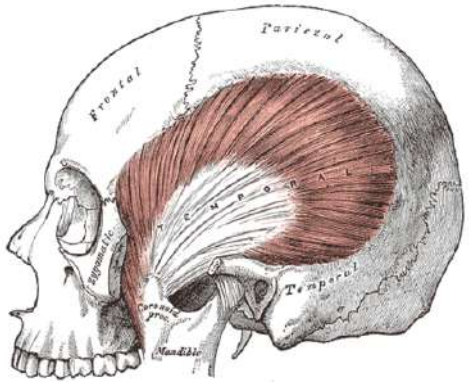
Muscle Surrounding the TMJ [5]

There are ten major muscles that produce motion at and around the temporomandibular joint. Each has a specific action to allow jaw motion and the functions of talking, eating, yawning and more. The origin, insertion, and function will be explored in this section.

The muscles of mastication include the temporalis, the masseter, the lateral pterygoid, and the medial pterygoid.

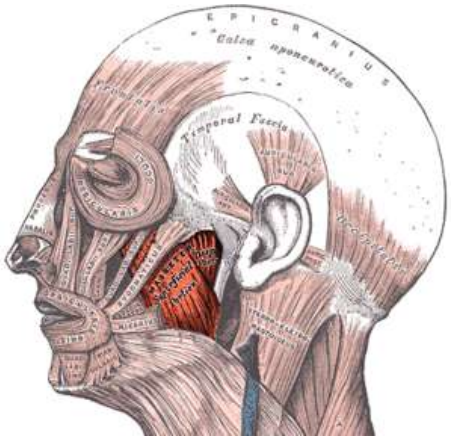
Temporalis

The temporalis attaches from its origin on the temporal fossa to the inferior temporal line of the skull. The temporalis tendon then is deep to the zygomatic arch and attaches to the coronoid process of the mandible. Its action is to elevate and retract the mandible. It is innervated by the deep temporal nerve (from the mandibular nerve). It gets circulation from the maxillary artery and superficial temporal artery.



Masseter

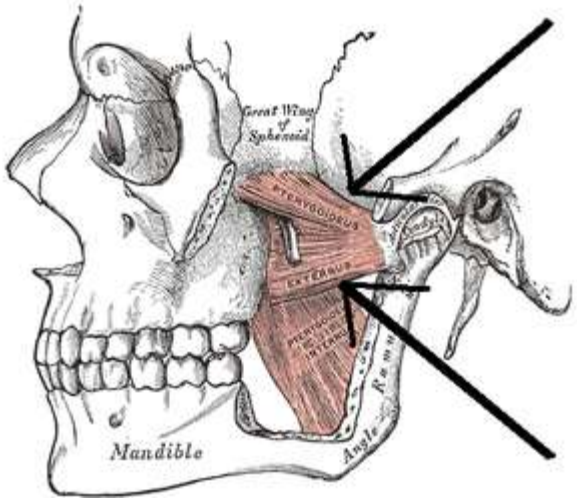
The masseter attaches from the zygomatic arch to the coronoid process of the mandible. Its function is to elevate the mandible. It also works to protrude the mandible. It is innervated by the mandibular division of the trigeminal nerve. It gets circulation from the masseteric artery (from the maxillary artery).



Lateral Pterygoid

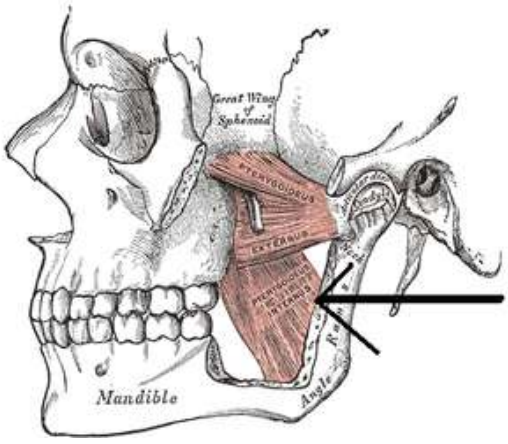
The lateral pterygoid has two different heads, the upper and lower head. The upper head originates from the infratemporal surface and the greater wing of the sphenoid bone. The lower head originates from the lateral surface of the sphenoid bone. The two heads come together and form a tendon that is inserted into the mandibular condyle and the joint capsule/disc. The function of the lateral pterygoid is to depress the mandible. It also plays a role in protrusion and lateral

movement of the mandible. The lateral pterygoid is innervated by the mandibular nerve and gets circulation from the maxillary artery.



Medial Pterygoid

The medial pterygoid attaches from the pterygoid process off of the sphenoid bone to the medial ramus of the mandible. Its function is mandibular elevation and protrusion. The medial pterygoid is innervated by the mandibular nerve and gets circulation from the maxillary artery.



The accessory muscles of mastication include the buccinator, digastric, stylohyoid, mylohyoid, geniohyoid, and platysma. The muscles above the hyoid bone (suprahyoid) all act to depress the mandible while the muscles below the hyoid bone (infrahyoid) stabilize or depress the hyoid bone. Suprahyoid muscles include the digastric, mylohyoid, and geniohyoid muscles. The infrahyoid group are the omohyoid, sternohyoid, and thyrohyoid.

The buccinator is responsible for facial expression and assists in chewing/ mastication. It originates at the maxilla and mandible and inserts with other muscles at the upper lip. It is innervated by cranial nerve seven (the facial nerve).

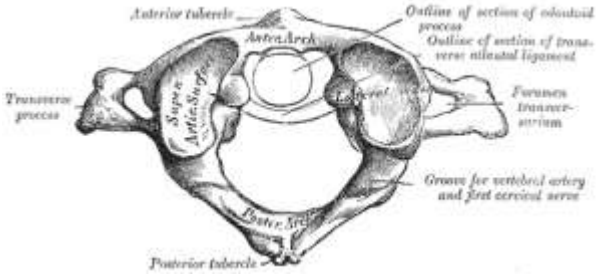
Anatomy of the Cervical Spine [6,7]

The cervical spine is close in proximity to the TMJ, shares muscle function, and problems in this area can create problems in the TMJ. This section will discuss the vertebrae, muscles, and innervation of the cervical spine as this area is crucial to healthy TMJ functioning.

Vertebrae

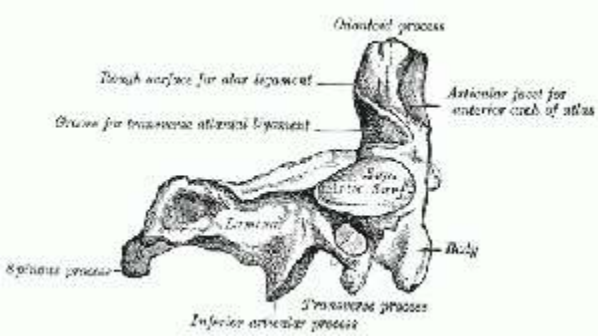
The vertebral bodies C1 to C7 all have slightly different functions, but their overall purpose is comprising the structure of the neck, protecting the spinal cord, and supporting the skull.

C1 is called the atlas, which articulates with the occiput of the skull superiorly and the axis or C2 inferiorly. This is the only cervical vertebrae with no vertebral body. Distinct features of the Atlas are a posterior arch having a groove for the vertebral artery and the C1 spinal nerve as well as the anterior arch containing a facet to articulate with the Dens of the axis below.

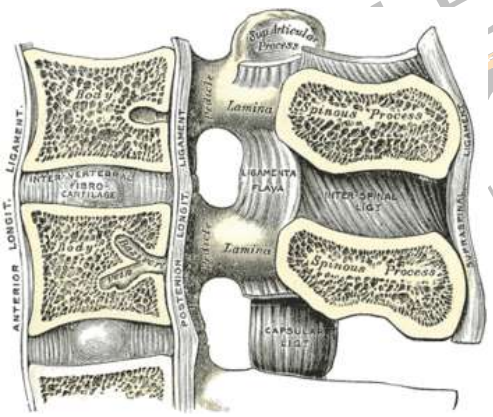


C2 is called the axis, which consists of a vertebral body, laminae, pedicles, and transverse processes where muscles attach. The axis and atlas articulation is responsible for around 90 degrees rotation (45 degrees in left and 45 degrees in

right rotation) of the neck. This joint is known as the atlanto-axial joint. The axis articulates with the atlas superiorly to allow this rotation and the C3 vertebral body inferiorly.



C3-C7 are similar in structure, and they have structure that differentiate them from the thoracic and lumbar vertebrae. They have small vertebral bodies, transverse foramen for passing of the vertebral vessels and nerves, spinous processes with a bifurcation, and triangular vertebral foramen.



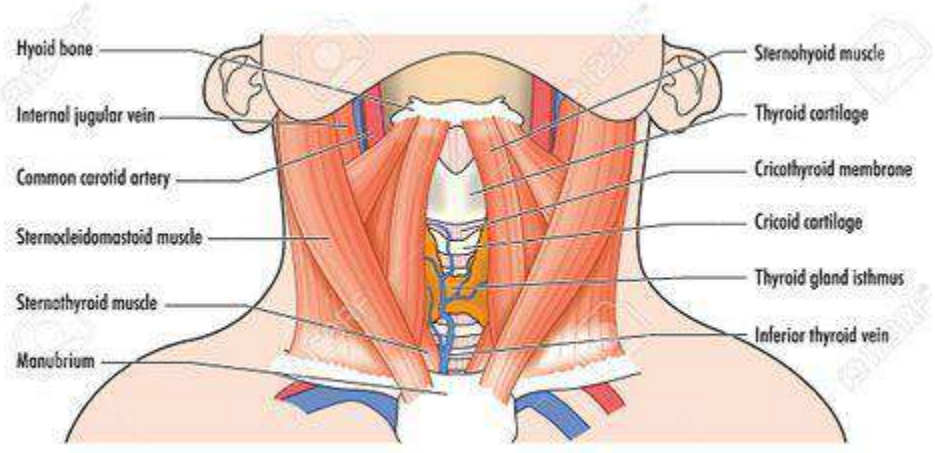
The presence of an intervertebral disc between each two vertebrae and ligaments that attach each vertebra to each other provide further reinforcement for the cervical spine.

Muscles of the Cervical Region

The muscles of the upper cervical region especially play a role in the function of the TMJ. This section will explore the cervical muscles from anterior, posterior, and lateral location.

Anterior Cervical Muscles

Superficial muscles include the platysma and sternocleidomastoid. The function of the platysma is facial expressions. The suprahyoids, digastric, mylohyoid, geniohyoid, stylohyoid, are pictured below and function was described in the TMJ anatomy section. The infrahyoids are the sternohyoid, sternothyroid, thyrohyoid, omohyoid. The deeper cervical muscles function to allow cervical spine movement. They are innervated mainly by the upper cervical spinal nerves, C1 and C2. The role of the rectus capitis anterior is flexion at the atlanto-axial joint. It attaches from C1 to the occipital bone. The role of the rectus capitis lateralis is to laterally flex the atlanto-occipital joint. It attaches from C1 to the occipital bone as well. The longus capitus attaches from C3-6 to the occipital bone and allows rotation and weak flexion of the cervical spine. The longus coli spans from C1 to T3 and flexes the neck.



Posterior Cervical Muscles

The superficial layer of the posterior cervical muscles includes the trapezius, splenius capitis and splenius cervicis. The upper trapezius attaches to the occipital protuberance and the clavicle. It allows lateral flexion and extension of the head/ neck. The splenius capitus attaches from C7-T3 to the mastoid process of the temporal bone. The splenius cervicis attaches from the spinous processes of T3-T6 to the transverse processes of C1-C3. The splenius muscles extend, laterally flex, and rotate the head. They are innervated by the middle and lower cervical spinal nerves.

The deep layer consists of the cervical transversospinalis muscles (semispinalis capitis, semispinalis cervicis, multifidus cervicis). These muscles attach posteriorly from the cervical to thoracic spinous and transverse processes. The function of this group of muscles is to extend, laterally flex and rotate the head. They are innervated by branches of the spinal nerves C2 and C3.

The deepest layer consists of the suboccipital muscles, interspinales cervicis and intertransversarii colli muscles. The suboccipital muscles are a group of four muscles that are innervated by the suboccipital nerve from C1. They play a large role in posture and are often shortened from forward head posture. They attach from the atlas to the axis and allow slight extension, lateral flexion, and rotation of the skull on the atlanto-axial joint. The interspinalis cervices are found between each spinus process of the vertebrae from C2-T1 and function to extend the neck. The intertransversarii colli are found between the transverse processes from C1-T1 and assist in lateral flexion of the skull.

Lateral Cervical Muscles

The scalenes (anterior, posterior, lateral) attach from lateral cervical spine to the upper two ribs. They allow ipsilateral flexion. The scalenes are innervated by the cervical nerves C3-8.

The main reason to overview cervical anatomy is that this region provides stability and foundation for the TMJ to function properly. A cervical spine examination may reveal stiffness, short muscles, weak muscles, and pain generators that relate to TMD.

Prevalence of TMD [8]

The epidemiology of TMD varies slightly in studies due to several different collection methods. The information in this section is derived from the best evidence from meta-analyses. TMD affects around 30 percent of adults and elderly and around 10 percent of adolescents and children. The most common type of TMD is disc displacement with reduction, which occurs at 26 percent in adults and the elderly and at seven percent in children and adolescents. TMD is up to two times more prevalent in women than men as well. The cause of this is relatively unclear but hypothesized to be from different hormone levels in the two sexes.

As for specific disorders, masticatory muscle pain occurs in thirteen percent of the population, disc derangement occurs in sixteen percent of the population, and TMJ pain disorder occurs in nine percent of the population. Most of the chronic and symptomatic TMD cases occur in patients who are 20-40 years old. Only up to seven percent of people experience enough symptoms to seek out treatment. Symptoms like joint clicking and disc displacement are often painless and do not progress. In fact, in a study screening for disc displacement in people without symptoms, 35 percent of the population has disc displacements. Some people

with disc displacement will have no pain, and some without disc displacement will have severe pain. This highlights the importance of inquiring about all symptoms and history to put together an accurate diagnosis and treatment plan.

Common Signs and Symptoms [2,9]

As alluded to, the TMJ is a complicated joint and TMD can create symptoms in the jaw, the face, neck, shoulder, and upper back. The most common signs and symptoms are highlighted in this section.

Jaw pain is the most common symptom of TMD. It can start gradually or suddenly depending on the cause of developing TMD. One may experience either mild or severe pain that is either unilateral or bilateral. It may worsen from jaw opening and closing as well.

Jaw clicking is another common symptom. This will either happen with mandibular depression or elevation, or both. Sometimes the clicking is audible to others and sometimes it is only audible to the person experiencing the symptom.

Trouble opening or closing the mouth is a symptom of disc displacement. This can lead to the jaw locking open or closed. Obviously, this symptom makes things like eating and talking difficult.

Headaches are common with TMD, especially in locations of the temples, forehead, or posterior to the eyes. Headaches may be dull or sharp and may be accompanied by other symptoms such as dizziness or nausea.

Ear pain or ringing in the ears is also a common complaint of TMD. Patients will report tinnitus, ear fullness, or pain around the ears.

Facial pain, especially around the cheeks, is a sign of TMD. This pain may be mistaken for a sinus infection but does not respond to treatment with antibiotics.

Bruxism, or grinding or clenching of the teeth is also a symptom of TMD. This can lead to damage to the teeth or jaw, and can worsen the symptoms of TMD. This may happen voluntarily during the day or involuntarily at night.

Cervical, thoracic, and shoulder pain are common with TMD as well. Neck pain is reported in around 70 percent of people with TMD. It is due to cervical muscle tension, either as a result of TMD or that contributed to the development of TMD. Due to regional interdependence (the concept of the cervical and thoracic spine, the shoulder, and jaw working together by sharing muscles and innervation), it is common to experience pain in any of these regions when one area is not functioning properly. Other symptoms are joint hypomobility, weakness, and muscle tension in the spine and muscles supporting it.

Contributing Factors of Developing TMD [2,10]

TMD is typically caused by a variety of factors, and often more than one factor at a time. It is often a comorbid condition with neck pain disorders, thoracic spine issues, and shoulder problems. The other top causes are outlined below.

A **jaw injury** from an accident like a fall can lead to TMD. Trauma to the jaw can damage the ligaments, the joint itself, and the muscles surrounding the TMJ.

Bruxism or the grinding and clenching of teeth can cause TMD. This is due to the extra tension and pressure that clenching puts on the TMJ throughout the day and night.

Arthritis in the TMJ can cause TMD due to inflammation and structural changes to the joint.

Poorly aligned teeth can create uneven pressure on the TMJ, and lead to unilateral TMD.

Stress can cause muscle tension in the face and jaw, which can contribute to TMD as the muscles of mastication and TMJ become overworked.

Poor posture, especially when sitting or standing for long periods, can lead to muscle shortening and weaknesses in the neck, shoulders, and face. Forward head posture and thoracic kyphotic posture is a common pattern seen in patients with TMD. Typically, this is associated with weak deep neck flexors, tense and short posterior cervical muscles and an imbalance of cervical muscle strength/length. This is the common posture seen in patients who sit too often with a poor ergonomic set up for work.

Female sex is a risk factor for developing TMD. Two times more women than men have TMD due to reasons not fully understood. There is emerging research testing the validity of estrogen hormone levels being responsible for cases of TMD. It is hypothesized that estrogen receptors within the fibrocartilage of the TMJ may affect cartilage regeneration and the health of the joint. More evidence-based studies will be available as research advances.

Prolonged jaw opening from dental surgery is also a risk factor for TMD. This puts prolonged stress on the TMJ and can cause issues with the joint and articular disc position.

Ages between 20 and 40 and 45 to 64 are associated with higher levels of TMD. These age groups are most likely to seek treatment for TMD symptoms. Although incidence is high in the elderly population (three to five percent), this population seeks treatment for TMD less often than their younger counterparts. This is due to symptoms being mild, non-progressive, and self-managed.

These factors represent the most correlated reasons someone would develop TMD. This list is non exhaustive as other comorbidities affecting the joints and muscles, such as connective tissue disorders, may also lead to TMD. People

experiencing painful chewing, more painful sites, frequent similar headache, and more comorbidities (such as irritable bowel syndrome, fibromyalgia, and chronic pain) will rate their TMD as more severe than those who do not report these symptoms.

Pertinence to Physical Therapy [11]

Physical therapists and assistants should know how to examine (physical therapists only) and treat temporomandibular joint disorder. It is a common disorder that often either causes or is a result of cervical, thoracic, or shoulder conditions. Although specialties and further education are available for certification, every therapist should know the symptoms and at least the basics of how to successfully manage patients with TMD.

Physical therapists may pursue a specialty certification by the Physical Therapy Board of Craniofacial & Cervical Therapeutics (PTBCCT) to specialize in TMD treatment. The Orthopedic Clinical Specialist (OCS) board certification also advances knowledge in TMD evaluation and treatment. Physical therapists and assistants may always refer to a specialist in TMD but should be able to treat most cases with evidence-based methods of evaluation and treatment learned in this course.

Section 1 Key Words

Interarticular TMD – causes of temporomandibular joint disorder related to inside the joint, such as disc derangement.

Extraarticular TMD – causes of temporomandibular joint disorder related to outside the TMJ, such as cervical muscle tension

Bruxism – jaw and teeth clenching which contributes to TMJ problems

Section 1 Summary

The temporomandibular joint (TMJ) is highly complex due to its structure and function. Temporomandibular joint dysfunction is an umbrella term for pain, popping, stiffness, and hypermobility at the TMJ. TMD is also associated with cervical, thoracic, and shoulder problems due to the complexity of muscles and nerves interacting in this area. It is crucial to understand the anatomy of the TMJ itself, the muscles and ligaments that support it, and the role of the upper spine in TMJ function. Physical therapists and assistants should have an in-depth understanding of the structure and function of the TMJ to effectively examine and treat patients with any type of TMD.

Section 2: Temporomandibular Joint Dysfunction Examination

The first step to managing a patient with TMD or suspected TMD is a diagnosis and examination. An assessment for a patient with suspected or already diagnosed TMD includes a thorough subjective history, posture, palpation, range of motion, muscle tension, TMJ mobility, and observing for signs of bruxism. This section will overview components of a comprehensive examination, evaluation, and differential diagnosis for TMD.

Diagnosis

There is no standard test or method of diagnosis for TMD. Diagnosis is made from a detailed subjective history of symptoms, clinical evidence of symptoms, and assisted with imaging studies. It is also supported by ruling out other conditions by differential diagnosis.

There are helpful outcome measures to help with the diagnosis of TMD. These can be assessed at evaluation, progress visits, and discharge to document

improvements. Two examples of these tools are the TMD Pain Screener and the 3Q/TMD.

TMD Pain Screener [10]

1. In the last 30 days, on average, how long did you have any pain in your jaw or temple area on either side last?
    a. No Pain
    b. From very brief to more than a week, but it does stop
    c. Continuous
2. In the last 30 days, have you had pain or stiffness in your jaw on awakening?
    a. No
    b. Yes
3. In the last 30 days, did the following activities change any pain (that is, make it better or make it worse) in your jaw or temple area on either side?
    a. Chewing hard or tough food
        a. No
        b. Yes

Scoring: ‘a’ responses = 0 points; ‘b’ responses=1 point; ‘c’ response=2 point.

Interpretation: A total sum of ≥2 points suggests need of further TMD evaluation

3Q/TMD [10]

1. Do you have pain in your temple, face, jaw or jaw joint once a week or more?

a. No

b. Yes

2. Do you have pain once a week or more when you open your mouth or chew?

    a. No

    b. Yes

3. Does your jaw lock or become stuck once a week or more?

    a. No

    b. Yes

Scoring: Any affirmative answer yields a '3Q-positive' result.

Interpretation: 3Q-positive score suggests need of further TMD evaluation.

The most common diagnoses of TMD are either painful or non-painful TMD and present with the listed symptoms below. One patient may have one or multiple of the disorders below when they are evaluated for TMD.

Painful TMD [10]

Painful TMD is one of the categories of diagnosis for patients with TMJ issues. To receive one of the diagnoses below, provocation tests must be positive. A physical therapist should be able to reproduce pain in the following areas during a clinical examination.

Myalgia is pain in the masticatory muscles. It can be divided into the following subtypes:

- *Local myalgia* is pain in the muscles of mastication that is only felt in one area of palpation.

- *Myofascial pain* is more general than local myalgia in that it is felt in more than one area of a muscle but doesn't spread beyond that muscle.
- *Myofascial pain with referral* is pain that is felt at the muscle the examiner is palpating and refers beyond the affected muscle.
- *Arthralgia* is a term for joint pain in the TMJ.
- *Headache attributed to TMD* is TMJ related headaches present at the temple.

Non-painful TMD

TMD that is not painful represents disorders of clicking and popping or joint degradation.

Disc displacement with reduction occurs when the articular disc translates anteriorly with mouth opening. The disc also sits anteriorly when the mouth is closed. The disc moves posteriorly when the mouth is closed and produces a click/ pop.

Disc displacement with reduction and intermittent locking occurs when the anteriorly positioned articular disc does not reduce posteriorly with mouth opening. This can prevent movement and is intermittent.

Disc displacement without reduction occurs when the anteriorly positioned articular disc does not reduce posteriorly with mouth opening. This prevents jaw movement and is persistent.

Degenerative joint disease can occur in any joint in the body. In the TMJ, it represents degradation of the articular disc and cartilage and changes in the mandibular condyle. The clinical examination may reveal joint creaking (crepitus) that is not disc displacement.

Subluxation occurs when the condyle and disc are positioned anteriorly to the fossa. This prevents the joint from articulating and therefore the mouth cannot close. This is common in conditions of hypermobility, such as Ehlers-Danlos syndrome.

The gold standard for diagnosis of disc displacement is with magnetic resonance imaging (MRI) to visualize the disc movement and position. Degenerative joint disease can be confirmed with computed tomography (CT) scans. Imaging should be used sparingly and is most beneficial when ruling out red flags like infection and cancer. This is because most TMD can be diagnosed based on a history of symptoms and a clinical examination.

Subjective History

Physical therapists should gather a thorough subjective history to guide their examination. Questions and pertinent information are similar to inquiring about any ailment in a physical therapy evaluation. The following are categories of information to gather, the purpose behind it, and what it may signify.

History of Symptoms

Physical therapists should ask for a qualitative description of the symptoms their patient is experiencing. Depending on how much the patient shares, guiding questions should gather a clear picture of the quantity and quality of symptoms. Providers should use open-ended questions so the patient has to share descriptive details. Close-ended questions, where the patient is welcome to simply answer “yes” or “no” will not elicit the proper detail in a subjective history. The following are guiding questions for the subjective history portion.

Can you describe the symptoms you are experiencing?

This question should derive the patient’s perception of what their symptoms are, why they are seeking treatment, and how it affects their life. They may describe

when the symptoms started, how frequently they have symptoms, and what the symptoms feel like. PTs should ask for TMD like symptoms of jaw clicking and locking, headaches, facial pain, and if the patient has to change their diet to be able to eat.

When and how did your symptoms start?

PTs should gather information on a timeline of symptoms to determine the acuity or chronicity of the symptoms. They should also inquire if the symptoms started from an injury or gradually and if there is a pattern to what makes the symptoms the worst. The mechanism of injury is important in diagnosis, ruling out differential diagnosis, and determining red flags. For example, if a patient had severe jaw trauma within a week ago and self-managed, they could have a fracture. This would warrant an emergent referral to urgent care or the emergency department to prevent complications. If symptoms came on gradually, are accompanied by night pain, unintentional weight loss, and fatigue, these are red flags for cancer screening.

What makes your symptoms better and worse?

Discovering aggravating and relieving factors is crucial to detect how a patient's symptoms respond to certain strategies, like rest, ice, and activity modification. It will give perspective on the patient's ability to self-manage and their coping mechanisms around their symptoms as well.

How have your symptoms influenced your daily routine?

It is important to get a grasp on how symptoms have affected the lives of patients. For TMD disorders, it's possible that symptoms have affected the ability to eat solid foods, to speak, or talk without pain. This will impact a patient's quality of life socially, professionally, and personally. This information will provide insight into what motivates a patient in the goals they set for treatment as well.

Do you have headaches or other pains?

TMD rarely creates pain and tension just at the TMJ. It can create problems in the cervical spine, thoracic spine, shoulder girdle, and produce all sorts of symptoms. The most common additional symptoms are headaches and pain/stiffness in the upper cervical spine, the thoracic spine, and sometimes the shoulders as well. A follow up question should be whether there are any past cervical spine injuries, like whiplash from a car accident. Also, it is pertinent to know about any dental problems or procedures as these can also contribute to TMD.

These questions represent a basic knowledge of the history of one's symptoms at PT evaluation. Of course, conversation with a patient may always deliver more or less information depending on how much they share and how comfortable they feel with the patient-therapist rapport. It is the clinician's responsibility to derive information pertinent to a TMD diagnosis, spinal or shoulder involvement, and differential diagnosis.

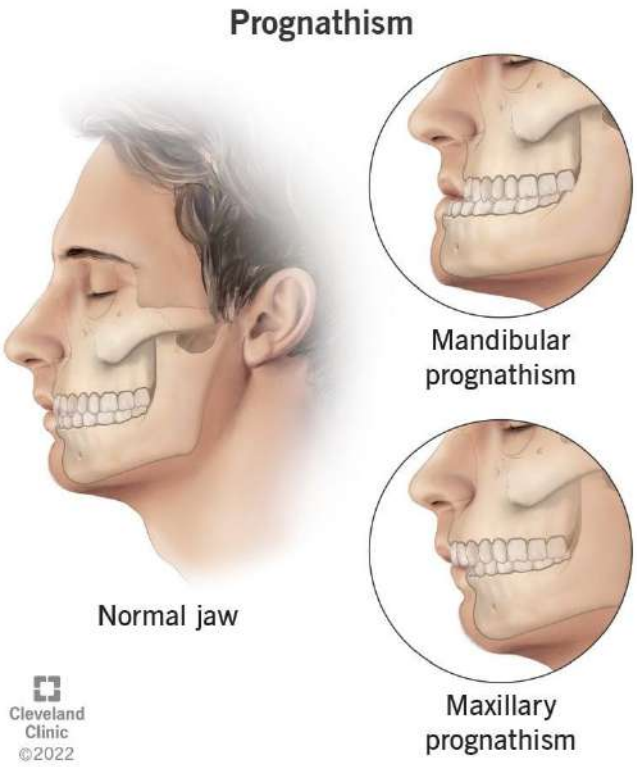
Posture and Facial Symmetry [12]

Posture is key to observe and document during an evaluation for TMD. PTs should examine posture of the mandible, cervical spine, thoracic spine, lumbar spine, and scapular/shoulder position.

Mandibular Position/Facial Symmetry

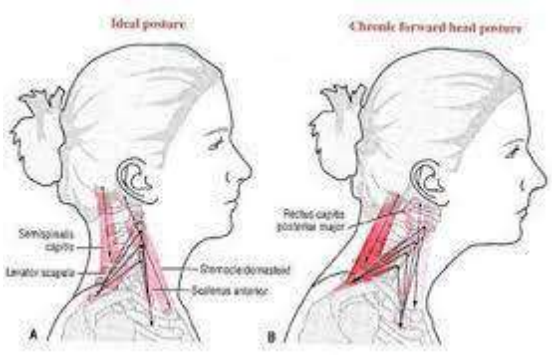
Observation using key landmarks of the face can reveal specific problems either in the upper cervical spine or the TMJ. Using the eye and angle of the mouth with no facial expression are helpful. If the eye and angle of the mouth are elevated ipsilaterally, there is likely an upper cervical issue. If the eye and the contralateral angle of the mouth are elevated, it is likely a TMJ issue. From a lateral view, examination of resting protrusion of the mandible is called mandibular prognathism. The patient's mandible and chin will protrude further anteriorly

than their maxilla. On the contrary, maxillary prognathism is when the maxilla is anterior to the mandible. These are both abnormal and can either be symptomatic or asymptomatic.



Cervical Spine Posture

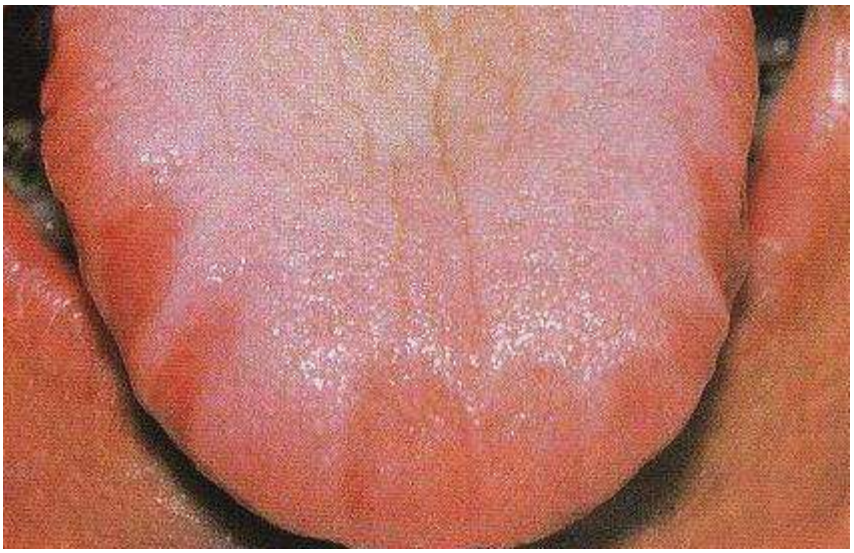
Optimal cervical spine posture should represent balance from the upper to the lower cervical spine. This is best observed from a lateral view where the mastoid process should be directly superior to the acromion of the shoulder (unless there are abnormalities at the shoulder as well). Forward/anterior head posture is a sign of weak anterior and tight/overactive posterior cervical muscles and is common in patients with neck pain and TMD.



Thoracic and Lumbar Posture

Observe and note the position of spine, whether there is lordosis or kyphosis present and any hinged parts of the spine especially at the cervicothoracic or thoracolumbar junction. Observe and note the scapula position and level bilaterally. The center of the scapula should be directly inferior to the mastoid processes bilaterally. This maintains balance between the shoulder girdle and the cervical musculature from anterior to posterior. This is important as the shoulder girdle describes the connection of the spine, the scapulae, clavicle and glenohumeral joint.

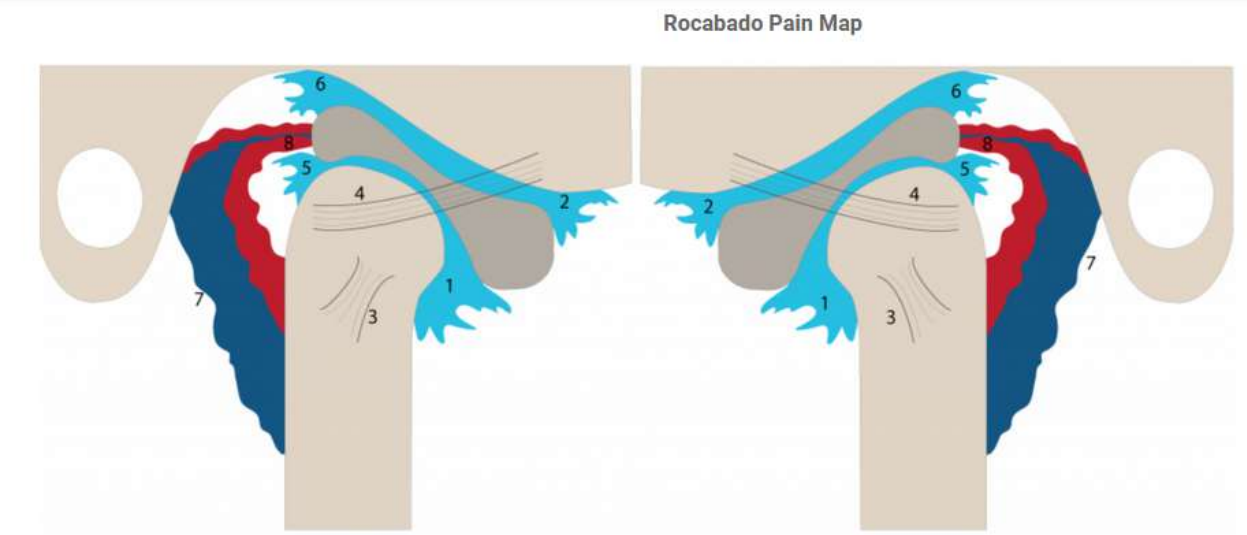
Other observations that are important to make are examining the tongue for scalloping and the teeth for extra wear. These are signs of bruxism.



Palpation [13]

Palpation is an important step in the examination to gain insight on muscle tension, muscle shortness, and sensitivity to touch. The examiner should palpate the facial muscles including the masseter, temporalis, and medial pterygoid. They should also palpate the upper cervical suboccipitals, the upper trapezius, and scalenes. The examiner should note where the patient has tenderness to palpation and where they can feel palpable trigger points.

A helpful tool for diagnosis of TMD is the Rocabado Pain Map. Using this map in practice allows identification of structures that are leading to TMD symptoms. Pain from palpating area 1 and 2 are indicative of excess anterior translation of the mandible which causes pain and inflammation. Pain from palpating area 3 and 4 are indicative of hypermobility due to a ligament sprain or laxity. Pain from palpating area 5 and 6 is due to excess posterior position of the mandible and condyle. Pain in area 7 and 8 indicates a posterior ligament sprain, compression, and disc displacement.



Imaging

Some patients may have been seen by either a physician or a dentist and have images available to view. This may provide insight into the TMJ position and upper cervical spine position to help inform your examination. It is not required for a diagnosis and patients should only be referred for imaging if there is evidence of red flags like cancer or infection.

Range of Motion and Quality of Motion [14]

Temporomandibular joint normal active range of motion are as follows:

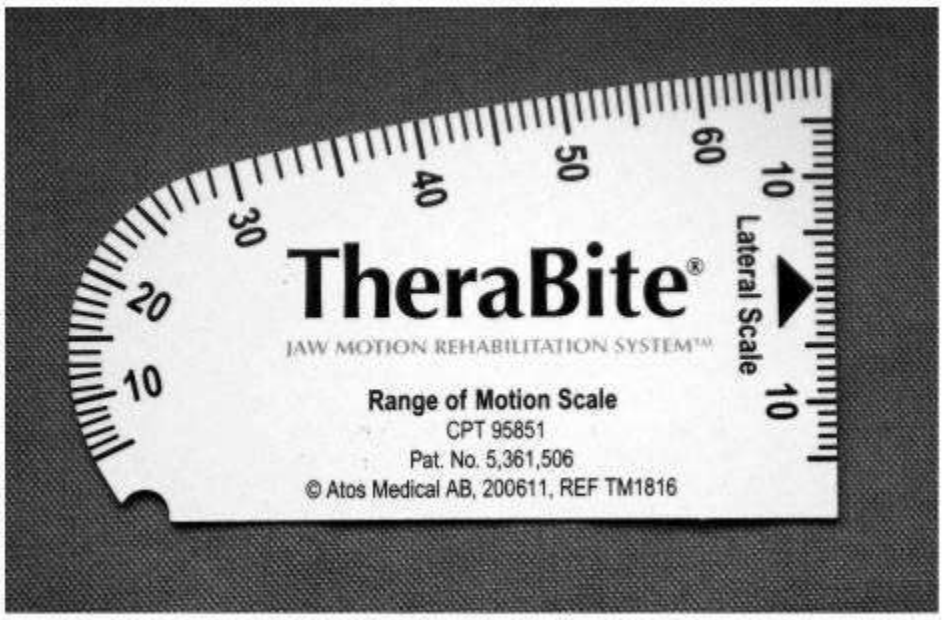
Mandibular Depression: 40 to 60 mm

Mandibular Lateral Movement: 8 to 12 mm

Mandibular Protrusion: 8 to 12 mm

Observation is key with these motions as this is where the examiner may feel or see clicking and popping. Examination for lateral deviation is also crucial during mandibular depression. Deviation during depression indicates hypomobility ipsilaterally and hypermobility contralaterally.

The device below is the most appropriate measurement tool for depression and lateral movement of the TMJ.[13]



Aberrant movement patterns should guide further examination as well. Two examples of such movement patterns are the C-Curve and S-Curve.

C-Curve

This pattern of movement involves deviation of the mandible laterally when the mandible is depressed actively. This happens from hypomobility of the TMJ ipsilaterally to the deviation. The mandible will halfway through mouth opening and return to center at the final stage of opening.

S-Curve

This movement pattern involves deviation of the mandible bilaterally as the patient opens their mouth. This occurs from joint laxity and a lack of control of the muscles of mastication. The problem may be due to the masseter, temporalis, ligament laxity, or the articular disc.

The cervical spine moves in flexion, extension, lateral flexion, and rotation. These motions may be measured using an inclinometer. Normative values for these movements are listed below.

https://www.netterimages.com/positioning-of-inclinometer-to-measure-flexion-and-extension-unlabeled-orthopaedics-10951.html

Cervical flexion is around 80 – 90 degrees and this movement comes from the C1 and occiput articulation and small movements anteriorly and posteriorly on the remaining cervical vertebrae.

Cervical extension is around 70 degrees, and this movement comes from the C1 and occiput articulation and small movements anteriorly and posteriorly on remaining cervical vertebrae.

Cervical lateral flexion is around 20 – 45 degrees and this movement comes from rotation unilaterally as a combination of flexion and rotation throughout the cervical spine.

Cervical rotation is around 90 degrees and this movement occurs from C1 rotating on C2 to provide around 50 degrees of motion. The remaining rotation comes from the rest of the cervical spine.

Movements in the thoracic spine include flexion, extension, lateral flexion, and rotation.

Flexion is around 75 degrees, extension is around 20 – 25 degrees, lateral flexion is around 10 – 12 degrees per segment, and rotation is around 30 – 35 degrees.

The shoulder flexes, abducts, extends, externally rotates, internally rotates, and adducts. The normative values of motion for flexion is 180 degrees, abduction 180 degrees, extension is 50 degrees, external rotation is 90 degrees, internal rotation is 70 degrees, and adduction is 45 degrees.

Deviations from these normative values could be related to TMD or could have even contributed to the development of TMD. The spine, shoulders, and TMJ are very closely interrelated due to common musculature and innervation.

Cervical and Upper Extremity Muscle Strength [16]

Cervical muscle testing is important to gauge the function and stability of the regions that provide the foundation for the TMJ. In addition to that, myotome assessment of the cervical nerve roots that supply the upper extremities are also indicated in a complete examination.

Cervical flexion, extension, and lateral flexion strength can be examined by either handheld dynamometry or manual muscle testing. Handheld dynamometry is the most reliable, valid tool for measuring strength in the cervical muscles. Dynamometry tests should be completed as make tests, meaning isometric holds for three seconds. The examiner should record the highest grade the patient did not break form. The patient should be positioned seated for these tests.

Manual muscle testing of the cervical spine is also done seated with break tests on a grading scale of 0 to 5. This method is less consistent between different examiners than handheld dynamometry. It is still a good option to determine strength of the cervical flexors, extensors, rotators, and lateral flexors, especially for clinics that do not have hand held dynamometers.

Cervical Deep Neck Flexor Test

The deep neck flexors, or the anterior cervical muscles are a key measure to record in patients with suspected TMD. They may be weak for several reasons, including posture, tension in the suboccipital group, and movement patterns.

For this test, the patient should lay supine or hook lying without a pillow to support the spine. The examiner should guide the patient into cervical flexion (chin tuck) and lift their head off the table while maintaining the same flexion. The normative value for holding this position is 30 seconds. The examiner needs to stop the test if they see compensation from the sternocleidomastoid muscle.

Upper Extremity Testing

Myotome testing represents strength of motor innervation of corresponding muscles from spinal nerves. It is important to assess for strength deficits in a myotome pattern as ventral nerve roots from the cervical spine directly innervate muscles from the shoulder down to the fingers. The following is a list of which spinal segments correspond with strength deficits that can be detected during a physical examination. Spinal nerves in the cervical spine from C1 to C7 leave the spinal cord in the space above the bony vertebrae that corresponds to that level while C8 nerve leaves the spinal cord between C7 and T1 bony vertebrae. Testing the myotomes in this table will give an idea of the integrity of the nerve pathway from the spinal cord to the corresponding muscle. If there are specific weaknesses from myotome testing, manual muscle testing of specific groups is indicated.

Nerve Root	Myotomes – Action, Strength Test	Applicable Muscles for Testing
C1+C2	Cervical flexion	Rectus lateralis, longus colli, cervices and capitis, sternocleidomastoid
C3	Cervical lateral flexion	Trapezius, scalene, longus capitis
C4	Shoulder elevation	Trapezius, levator scapula, scalene, diaphragm
C5	Shoulder abduction	Deltoid, biceps
C6	Elbow flexion, wrist extension	Brachioradialis, wrist extensors, serratus anterior, latissimus dorsi
C7	Elbow extension, wrist flexion	Triceps, wrist flexors

C8	Thumb extension, ulnar deviation	Extensor pollicus longus/brevis, flexor carpi ulnaris
T1	Finger abduction	Lumbricals, interossei muscles

Joint Mobility and Accessory Movements

In a comprehensive examination for suspected TMD, joint mobility in the following areas should be assessed: TMJ, cervical spine, and thoracic spine. The shoulder may also need assessment, depending on the subjective history. Accessory movements are the arthrokinematics that occur directly at the joint surface, such as gliding and rolling.

TMJ Joint Mobility

The patient should be positioned in supine on a treatment table. An examiner should put sterile gloves on because they will be assessing the TMJ with an open mouth from the inside and outside of the joint. The hand on the outside of the mouth should stabilize the joint and the head while the hand inside the mouth should grip the mandibular condyle from the inside and outside of the joint. This testing can be quite provocative of pain and symptoms related to articular problems in the TMJ.

Lateral mobility should be assessed by moving the mandibular condyle laterally and then by 30 degrees dorsally. This transverse sliding normally should be smooth and painless. However, in patients who have ear pain, the lateral pterygoid muscle may be involved. Patients may also have mandibular nerve sensitivity if this is a provocative test.

Anterior, medial, and posterior mobility are important to assess as well. If the patient has pain in any of these movements, they may have a disc issue, muscle

tension, or hypermobility. This joint accessory motion will guide to a specific structure that is causing TMD symptoms and is part of a larger diagnostic picture.

Cervical Mobility

Upper and lower cervical mobility is imperative to test in a comprehensive TMD evaluation. The upper cervical spine is the foundation for the occiput, and therefore the TMJ.

Occipital-Atlas Joint Testing

The OA joint is responsible for 25 degrees of flexion and minimal rotation normally. To test the OA joint mobility, the patient should be in supine and the therapist should stand at the head of the patient. To test the motion of the right OA joint, the therapist should rotate the patient's head 20 to 30 degrees to the right side to orient the right facet into the sagittal plane. From there, the therapist

should translate the occiput anteriorly on the superior facet of C1 to assess for a possible OA extension restriction. Then, they should translate the occiput posteriorly to assess for a possible OA flexion restriction. This same process should be repeated with rotation to the left.

Atlanto-Axial Joint Mobility Testing

The AA joint is responsible for 40 degrees of rotation of the cervical spine. To test rotation, the examiner should have the patient lay supine and cradle the head with both hands. They should flex the cervical spine while placing fingertips at C1. At that point, the examiner should rotate the neck to the left and right while maintaining the C1 pressure with flexion.

C3-T12 Accessory Joint Testing

The clinician should instruct the patient to lay in supine to test cervical spine accessory motion and prone to detect thoracic spine mobility. The general idea is to move spinal segments in respective directions to detect decreased mobility or stiffness bilaterally and to reproduce pain in a spinal segment. As the clinician moves by segment and assesses with overpressure laterally on each spinal segment, they should determine whether a patient has pain or stiffness and document these findings. Restrictions in the lower cervical spine and upper thoracic are consistent with TMD, as the area is interdependent on a delicate balance of muscles.

Bruxism [3]

Bruxism, as briefly explained earlier in this course, is a condition where one grinds and clenches teeth together. Two different types, awake bruxism and sleep bruxism, explain when the problem occurs. Some people have both awake and sleep bruxism. Bruxism is most common in people with high levels of stress and

tension. It affects those with nervousness, aggression, and competitive patterns more than others. It is possible to discover signs of bruxism in an examination. Patients are often told by their partner or roommates that they grind their teeth. In addition to that, in examining the tongue and mouth, there may be rough edges from biting the lateral edge of the tongue and the side of the cheek. Symptoms of bruxism from the patient's subjective report include waking with jaw muscle soreness, tension, and clenched teeth after sleeping.

What do the Findings Indicate? [17,18]

It is imperative to know not only how to perform an examination for TMD, but also what the findings mean. It is expected to find a certain group of results from clinical tests and history for the joint disorders (atherogenic) TMD versus muscle related TMD disorders. The evaluation should determine if the upper cervical spine is involved and which classification of TMD the patient is experiencing.

Atherogenic TMD Findings

The joint disorder group of TMD is accompanied by several key findings. First of all, patients with these disorders will have reduced active range of motion. This will be most evident in lateral excursion and protrusion. Range of motion testing may occur with or without pain. Patients may also have a C curve when depressing the mandible due to one hypomobile TMJ. There are typically joint sounds like popping and clicking. In addition, it is painful to palpate the joint capsule and the bony prominences around the TMJ.

Muscle Disorder TMD Findings

The muscle disorder group will have several distinct symptoms and a lack of others to indicate it is indeed a muscle and not a joint TMD. First of all, the muscles of mastication and upper cervical muscles will be tender to palpation. The most common muscle in muscle disorder TMD cases is the lateral pterygoid. These

patients will have a full active range of motion due to the lack of joint involvement and restriction. In addition, they will likely have an S-curve mandible deviation with depression and elevation. They will have pain with ipsilateral biting, and there will be no joint sounds.

Disc Disorder TMD Findings

Disc displacement is difficult to diagnose in its specific form but is relatively easy to identify. The joint should audibly click, and the examiner may be able to palpate a click. If a patient has pain with resisted mandibular depression, they may have a non-reducing disc.

Hypermobility Disorders

With hypermobility leading to TMD, the articular disc may sublux either posteriorly, laterally, or medially. As the disc moves anteriorly, the condyle moves posteriorly, and this pattern will often repeat while lacking proper stability.

Differential Diagnosis [3]

While many symptoms are directly associated with TMD, many conditions mimic this disorder. Trigeminal neuralgia, Bell's Palsy, Complex Regional Pain Syndrome, referred pain, migraines, cluster headaches, tumors, vestibular dysfunction, and sinus pain are some of these conditions.

Trigeminal Neuralgia is caused by impingement of the trigeminal nerve (cranial nerve five) and is typically unilateral. It is most commonly caused by vascular compression by the superior cerebellar artery. It can also be caused by trauma to the face or a dental procedure and subsequent inflammation compressing the trigeminal nerve. The most common symptom of trigeminal neuralgia is severe pain in the face that comes on suddenly. Many describe it as a sharp "electric" shock that lasts up to a few minutes and then dissipates completely.

Bell's Palsy is the unilateral paralysis of facial muscles caused by disruption in the function of the facial nerve (cranial nerve seven). It is unclear the exact cause of Bell's Palsy. A few probable causes are damage to the facial nerve, Guillain-Barre syndrome, Lyme disease, Myasthenia gravis, Multiple sclerosis, viral infection, diabetes, injury, and hypertension. It is typically painless besides headaches. Bell's Palsy will also cause tearing, drooling, loss of taste, sound hypersensitivity, poor movement sequences for facial expressions, loss of feeling in the face, and the inability to close an eye. It is important to rule out mimicking conditions of Bell's Palsy like a cardiovascular attack or a tumor that could cause these same symptoms. Bell's Palsy typically improves and completely resolves in one and a half to two months. Early steroid treatment and physical therapy to stimulate the facial nerve results in the quickest recovery.

Complex Regional Pain Syndrome (CRPS) describes a broad disorder with the presence of continual pain and inflammation that exists at greater intensity than expected relative to an injury. Acute and chronic CRPS are differentiated by bouts that are short term and long term (greater than six months). CRPS symptoms are excess pain with gentle touch, skin color changes, temperature changes, and swelling. This commonly occurs in the leg or arm but also impacts the face after injury.

Referred pain is a common differential diagnosis instead of TMD. Pain signals from the trigeminal nerve, C1, C2, and C3 all go through the trigeminocervical nucleus in the brain stem. This means that pain can refer from the upper cervical nerves or trigeminal nerve to any part of the head or neck. This explains the importance of not only using pain to guide an examination, but also the other guiding symptoms of TMD and other disorders to make an accurate diagnosis.

Migraines often cause cervical tension along with nausea, vomiting, and sensitivity to light or loud sounds. Migraines are a severe headache that can cause

throbbing at any part of the head, including the side of the face to mimic TMD. Migraines often have a cervical origin (plus other factors like stress, tension, psychological state, etc.) and respond well to physical therapy addressing cervical mobility and strength.

Cluster Headaches typically are unilateral and attacks last around thirty minutes and can occur multiple times per day. Sometimes patients will respond well to physical therapy if they have symptoms in their cervical spine or TMJ secondary to their cluster headaches. The etiology of cluster headaches can be attributed to factors, but the exact mechanism is unclear. One suspected cause is the sudden release of histamine or serotonin close to the trigeminal nerve. This causes a sharp pain near the eye, temple, and face.

Benign or malignant tumors can mimic some symptoms of TMD with pain, tension, facial numbness, loss of function, and secondary cervical symptoms. Tumors are rare within the TMJ itself but may occur anywhere near the trigeminal nerve and compression can cause symptoms. Tumors are ruled out completely with imaging.

Vestibular Dysfunction may lead to headaches and jaw pain along the same lines as TMD. However, these symptoms are secondary to dizziness, vertigo, nausea, neck pain, and balance problems that occur with dysfunction of the inner ear.

Sinus Pain resulting from a sinus infection can mimic TMD. It causes facial pain, headaches, and a sensation of fullness. This can actually cause TMJ pain and cervical pain as a result of the inflammatory process and muscle guarding. Sinus pain typically follows a period of a cold or sinus infection, and it is important to ask about recent colds/viruses in the subjective history.

These differential diagnoses are key to understand in treating the TMD population. An accurate examination includes not only ruling in symptoms and the

clinical picture of TMD, but also considering each possible differential diagnosis scenario. Referrals should be placed for cases needing imaging, like ruling out tumors, infection, and cardiovascular problems.

Section 2 Key Words

Rocabado Pain Map – a TMD evaluation tool with specific pain points for palpation that indicate either a muscle, joint, or disc problem in the TMJ

S-Curve – pattern of mandibular depression and elevation caused by poor control of the muscles of mastication

C-Curve – pattern of mandibular depression and elevation caused by hypomobility in one TMJ

Trigeminal Neuralgia – the presence of intense facial caused by trigeminal nerve impingement that is intermittent

Section 2 Summary

The examination and evaluation of TMD is complex but broken down in this section. It is important to gather information pertinent to symptoms in the subjective history, conduct an examination of the cervical spine and surrounding muscles, and understand the TMJ to reproduce symptoms with provocative tests. Honing a clinical evaluation for TMD does take practice and repetition to understand what impairments produce which symptoms. Once a PT evaluates and diagnoses a patient with TMD, they can begin a treatment plan. This will look different for each patient based on the results of the evaluation.

Section 3: Treatment

Physical therapy for TMD is among the best treatment options to resolve symptoms. Surgery and medical management are needed for specific cases, but

without trauma, most cases can be resolved by physical therapy. The main treatment approach to TMD involves restoring normal mobility in the TMJ, cervical spine, and thoracic spine and improving movement patterns. Along the way, modalities to reduce pain, postural education, exercises, and activity modification will all be components of a well-rounded TMD treatment plan.

Surgical Cases [19]

Surgery is rarely needed for gradual onset TMD. Of course, stabilization surgery of some sort or extended bracing if one has mandible or temporal bone fracture. Surgery is used for those with structural problems that do not resolve with other treatment such as abnormalities in the disc or mandibular condyle. Surgery methods include arthrocentesis, arthroscopy, and open joint surgery.

Arthrocentesis is flushing the joint space with the use of small needles to clear it of inflammation and insert medication.

Arthroscopy is the insertion of a scope into the TMJ with the intent to diagnose and treat with instruments.

Open joint surgery is a last-resort option that is only used for patients with extra tissue that doesn't allow the joint to function, fusion of the joint, when arthroscopy fails, or when the articular disc is mispositioned or damaged extensively.

Surgery should be followed up with physical therapy for the best results in restoring motion and strength. Physical therapists should ask for a protocol for safe movements from surgeons before evaluating patients post-operatively from TMD surgery.

Modalities and Passive Treatment [11]

Helpful modalities for TMD are similar to other conditions. Heat therapy to the muscles of mastication and upper cervical muscles can help to relax the overactivity and tension. Acupuncture has been proven to help in some TMD cases with muscle tension and stress. Fitted mouth guards that are moldable are helpful to use if patients have bruxism. This can alleviate tension during the day and night when their jaw is clenched. Electrical stimulation, like TENS therapy, therapy can be used at pain reducing frequencies. Ultrasound can also be used to heat the tissues to prepare for manual treatment or exercise.

Manual Therapy [17,20]

Manual therapy for TMD treatment includes soft tissue mobilization, trigger point dry needling, joint mobilizations, joint manipulations, and more. TMD symptoms respond well to manual therapy, but therapists should use it sparingly to not create a reliance on it within their patients. Sessions should include manual therapy but focus on active strategies and education to reduce symptoms as well.

Soft Tissue Mobilization (STM) [21]

Massage of specially the upper cervical and muscles of mastication are helpful in alleviating trigger points and tension. The following muscles should be targeted (confirmed by the examination): upper trapezius, suboccipitals, levator scapulae, scalenes, masseter, and temporalis. STM for the upper cervical muscles can include techniques like strain-counter strain, directed massage for palpable trigger points, effleurage (to prepare the tissue with light pressure), petrissage (kneading motion), and other techniques to loosen taut tissue.

Massage for the muscles of mastication should be completed in the clinic first and directed for self-massage at home once the tissue response is known. Directing fingers over the masseter and temporalis, the clinician should use a circular

motion to gently massage any palpable trigger points or tense areas. The clinician should teach the patient self-massage once per day for a few minutes over tense areas of the masseter and temporalis. Myofascial release treatment is a technique to target specific trigger points with strategies like strain-counterstrain, pin and release and pairing treatment with active mandible movement.

Trigger Point Dry Needling

With the appropriate training per state guidelines, physical therapists can help their patients with TMD alleviate pain and tension in the muscles of mastication and the upper cervical area. Dry needling the masseter for one treatment session has been proven to increase the range of motion of mandibular depression and reduce pain significantly. Other muscles to consider are upper trapezius, the levator scapulae, scalenes, and the lateral pterygoid. Typically, dry needling is most effective once per week in the same muscle group, and around three sessions total.

Joint Mobilization

The joint disorder and disc displacement group will respond best to joint mobilization specifically at the TMJ. All types of TMD will respond well to cervical and thoracic mobilizations in an effort to restore normal biomechanics and muscle balance in this region.

Cervical and Thoracic Mobilization

The purpose of passive accessory intervertebral mobilizations is to mobilize stiff joints in the direction that alleviates this restriction. Patients with TMD may benefit from cervical segmental mobilization in supine or prone to improve pain and range of motion. Mobilizations are Graded 1 to 4 and manipulations are Grade 5 (small thrust at end range). Thoracic mobilizations should be done in

prone or supine as well and often the mid-range and upper thoracic spine will benefit most from mobilization and manipulation.

TMJ Mobilization

Just like the examination, with gloved hands and gripping the mandibular condyle by wrapping the hand around it from the inside and outside, it is possible to mobilize the TMJ. Clinicians should begin with joint distraction to determine sensitivity and response. Distraction mobilizations should be repeated at Grade 1-4 depending on response to the motion. This will effectively increase the joint space in the TMJ and reduce pain by eliminating inflammatory markers from the joint. Other directions to mobilize the TMJ should be conducted in the direction of restriction. Grades 1 and 2 should be used for patients in moderate to severe pain and grades 3-4 should be used for patients in mild or no pain. Clinicians should repeat the mobilization for around 30 repetitions for 3 sets in a session.

TMJ Manipulation

Manipulation of the TMJ is effective in a specific group of TMD, those with a mouth opening restriction of less than 35 millimeters. The **open locking TMJ manipulation** is helpful for an open restriction and is performed in supine with a quick thrust inferiorly on the molars of the mandible while stabilizing the contralateral inferior border of the mandible.

Exercises [22]

TMD Specific Exercises

Jaw Relaxation is a key exercise in managing the muscular group of TMD. To perform it, the patient should place their tongue gently behind their top row of teeth while slowly opening and closing the mouth. This can be repeated around 15 times for three rounds per day. Its purpose is to train relaxation as the movement pattern rather than over contraction of the muscles of mastication.

The *Goldfish Exercise* involves pushing gently on the mandible and gently on the affected TMJ while opening and closing the mouth with the tongue at the roof of the mouth at the soft palate. This will work to control mandibular elevation and depression by working the pterygoids, masseter, and temporalis a smooth pattern. This may be completed around 10 repetitions, for five to six sets per day.

Resisted Mouth Opening is performed by opening the mouth against self-resistance from a thumb on the inferior mandible. The patient should open their mouth partially against resistance, hold for three seconds, then slowly close. This can be repeated around 10 times and three sets per day for strengthening of the muscles used for mandibular depression.

Resisted Mouth Closing is performed by grasping the chin with the thumbs and index fingers of both hands and applying inferior resistance while closing the mouth. This is to strengthen the masseter, temporalis and other muscles of mastication. It should be performed for 10 repetitions and three sets for the best effect.

Slow Mouth Opening and Closing is performed with the tongue just touching the roof of the mouth. It can be repeated in bouts of 10 repetitions several times throughout the day to train slow coordinated movement of the muscles of mastication.

Lateral Deviation and Protrusion are performed with an object like a popsicle stick in the mouth and moving the mandible laterally in both directions and anteriorly without pain or clicking. This may be repeated 10 times and a few times throughout the day.

Cervical and Scapular Strength and Control Exercises

For strengthening, it is important to target the deep neck flexors, and the scapular stabilizers. Focus for deactivation of muscles or stretching should be on the scalenes, the suboccipitals, sternocleidomastoid, levator scapulae, and the upper trapezius. Of course, this is only the typical clinical picture and should be guided by the examination. In reality, a PT should treat all muscular imbalances with a cervical and shoulder girdle program based on the deficits present. This will indirectly help TMD symptoms because the cervical spine provides the foundation for the TMJ to function.

Deep Neck Flexor Exercise

The first step for strengthening the longus colli, longus capitus, rectus capitus and longus cervices, or deep neck flexors, begins in the test position for the deep neck flexor endurance test, in supine with no pillow. The therapist should instruct the patient into slight craniocervical flexion and cue to prevent compensations such as sternocleidomastoid or scalene activation. From here, the patient should either start with chin tucks without compensation, or chin tucks and elevating the head. They should be challenged on the most difficult progression they can make without compensation until they are able to maintain slight cervical flexion with elevating the head for 30 seconds.

Scapular Strengthening

Strengthening the scapular muscles that retract and depress the scapula are important with TMD to achieve muscle balance from the cervical spine to the

shoulder girdle. An example of an exercise to begin this are I's, Y's, and T's. This sequence strengthens the lower and middle trapezius and the rhomboids to maintain balance from tense or overactive anterior scapular muscles from forward head posture.

Stretching

Stretches should be used sparingly in the favor of strengthening weak postural muscles like the scapular stabilizers and the anterior cervical group. If instructing stretches, the levator scapulae, upper trapezius, and scalenes may be possible muscles to target.

Posture [19]

Posture modification is crucial to treating TMD. Patients should be cued out of thoracic kyphotic and cervical lordotic posture. Forward/anterior head posture is associated with weak anterior cervical and tense posterior cervical muscles. It is crucial to create mindfulness around improving posture. Helpful strategies are cuing patients to check in with posture once per hour at first by setting a reminder on their phone and using a mirror or having a friend or family member take a picture of their posture to have a visual cue. Diaphragmatic breathing during posture modifications is an excellent way to create motor control of the new positions as well.

Education [23]

At the very first visit and every subsequent treatment session, physical therapists and assistants should educate their patients on activities to avoid and activities to start to help their TMD. A helpful strategy is to instruct patients to identify, monitor and avoid habits called oral parafunctions. These include clenching the jaw, excessively chewing gum, and biting nails. In addition to this, it's helpful to identify and manage stress through improving sleep habits, relaxation techniques like meditation, and cutting down on caffeine. It's also helpful to recommend that patients temporarily change their diet if chewing hard or chewy foods begins to exacerbate their symptoms. It may be necessary to switch to soft foods for a week or so to allow the TMJ the rest that it needs to reduce the inflammation and pain in the area. Poor food for TMD includes tough meat, apples, pears, hard nuts, gum, and sticky candy like caramels.

Treatment Timeframe and Prognosis [18]

The length of a treatment bout and number of treatments per week varies, just like any other problem physical therapists see. Prognosis depends on adherence to recommendations, chronicity, type of TMD, and coexisting musculoskeletal problems like neck and shoulder pain. Most cases of TMD start with the craniovertebral spine which is the foundation for the TMJ. Resolving impairments at the occiput to C3 is crucial in managing TMD. In most cases, patients will need one to two months of physical therapy with a frequency of around two visits per

week before discharge. At this point, patients will still need to complete home exercises and have the potential for activity modification recommendations as well.

The joint disorder group generally responds most quickly to PT after resolution of the TMJ that is hypomobile, followed by stability training. Muscle disorder TMD can take around eight weeks to resolve, potentially more quickly, depending on adherence to the home exercise plan that restores correct movement patterns. With proper treatment, nearly all TMD cases will resolve completely or cause minimal problems in the span of eight weeks of physical therapy.

Expected Outcomes of Physical Therapy Treatment

The goals of TMD physical therapy treatment are to eliminate symptoms and prevent them from returning. This will be achieved by correcting all of the impairments found in an evaluation. It is imperative to restore correct biomechanics in the cervical and thoracic spine so the TMJ has a solid foundation to function. In addition, pain relief and inflammation management is crucial to address in PT treatment. Outcomes should include minimizing TMD related headaches, facial pain, and neck pain. In patients with joint and disc disorders, expected outcomes are to reduce painful joint sounds to minimal or none at all. Strength should be restored to 5/5 for all cervical muscles and muscle tension/ trigger points should be minimal in the cervical muscles and muscles of mastication.

Functionally, patients should be able to eat, talk, yawn, and make facial expressions without pain or mechanical locking in their TMJ by the end of treatment.

Section 3 Key Words

Arthrocentesis – a procedure to flush the joint to remove inflammatory markers and inject medication to facilitate healing

Open Locking TMJ Manipulation – Manipulation conducted to the TMJ when mandibular depression is less than 35 mm to increase joint space

Section 3 Summary

Treatment approaches for TMD should include manual therapy, exercise, education, and activity modifications. A bout of treatment should last around one to two months depending on how adherent the patient is to recommendations and how quickly they are able to progress through treatment. Successful treatment is marked by a reduction in joint clicking, headaches, pain, self-reported muscle tension, and improved objective measures like posture, strength, and mobility.

Case Study

Tanya is a 36-year-old female presenting to a physical therapy evaluation with a history of a motor vehicle accident two months ago. She reports developing neck pain a few days after the accident and it has gotten progressively worse despite rest, ice, and heating pads. She also reports it is difficult to chew tough food because her jaw muscles get tired and it produces a headache. She is finding it difficult to eat her normal diet and is losing weight as well.

Reflection Questions

1. What additional information would be pertinent to know from Tanya's subjective history?

2. What examination items should the physical therapist conduct to gain an accurate clinical picture?
3. Based on Tanya's symptoms, what type of TMD may she have?
4. What are the most important strategies for treatment for Tanya?
5. How long may Tanya's bout of physical therapy last?

Responses

1. The physical therapist should inquire about the following: how long has Tanya had symptoms at her TMJ, whether there is clicking or locking, what makes these symptoms better and worse, which food she cannot eat, where her headaches are located, how severe is her pain and headaches, and how else her symptoms in her neck and TMJ affect her life.
2. The PT should conduct a cervical and thoracic examination and TMJ assessment. It is important to understand strength, range of motion, and what tests provoke pain or symptoms for Tanya.
3. Tanya likely has a muscle related TMD, like myalgia, because she has no reportable locking or clicking in her TMJ.
4. Tanya's treatment plan should first address the cervical spine to restore normal mobility, strength, and stability after her car accident. This may include mobilization, exercises, postural education, and activity modification. From there, addressing the TMJ itself will be important. Tanya would likely benefit from muscle control exercises, like the goldfish exercise and others, as well as self-massage to the muscles for mastication.
5. It is likely that Tanya will need physical therapy for 6-8 weeks and be on an independent program from there. This is assuming Tanya adheres to recommendations and the plan of care.

Conclusion

About one third of United States adults experience temporomandibular joint disorder. TMD symptoms include jaw and neck pain, joint noises, a locking jaw, and dysfunctional use of the jaw for daily activities. Whether a patient's TMD is a problem with the muscles, joint, or trauma, most symptoms should be resolved by eight weeks of physical therapy. Physical therapists and assistants should be familiar with the evaluation and treatment techniques found in this course as part of a comprehensive approach to the management of patients with TMD. TMD is quite common and as more patients seek physical therapy for it, clinicians should be well versed in the best treatment strategies for each type of TMD.

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