TMJ Dysfunction & Pain

The temporomandibular joints (TMJs) are two of the most functionally important and frequently used joints in the body. It is with these joints that important processes such as chewing, kissing, speaking, sucking, yawning and facial expressions are carried out. Unfortunately, TMJ dysfunction is often a cause of numerous symptoms throughout the head and neck. It is through an understanding of the unique anatomy and biomechanics of these joints that a Physiotherapist can effectively assess and safely treat TMJ pathology.

Functional Anatomy

The TMJ is a synovial, ovoid, condylar and hinge type joint. It is unique for several reasons. The articulating surfaces of the mandibular condyle and the mandibular fossa of the temporal bone must act as a pair and perform coordinated movements together. Further, the teeth affect movement by occlusion on mandibular elevation. Along with the teeth, this joint is referred to as a "trijoint complex." There is a pronounced difference in shape between the articulating surfaces of this joint. Surprisingly, these surfaces are covered by avascular fibrocartilage as opposed to hyaline cartilage. Further, a fibrocartilaginous articulating disk (meniscus) divides each joint into an upper and lower joint cavity. This disc is innervated along its periphery but is aneural and avascular in its intermediate (force-bearing) zone. It is thicker posteriorly to "cover the thin bone at the bottom of the mandibular fossa". The disc's inferior surface is concave and covers the mandibular condyle, with medial and lateral attachments. Anteriorly, the disk is fused with the thin, loose and fibrous joint capsule and is directly attached to fibers of the upper head of the lateral pterygoid muscle. While posteriorly, the disc and capsule are attached to a pad of loose connective tissue, which allows for easier anterior movement. The deep layers of the disk run at right angles to the bone and are adapted to inferior pressure, whereas the superficial fibers run parallel and are adapted to gliding under pressure. The ligaments which contribute to the formation of the fibrous joint capsule and unite the articulating bones are the temporomandibular (a.k.a. lateral), sphenomandibular, and stylomandibular. The temporomandibular ligament restrains movement of the mandible and prevents compression of tissues behind the condyle. Some authors note that this collateral ligament is simply a thickening of the joint capsule. The sphenomandibular and stylomandibular ligaments keep the condyle, disk, and temporal bone firmly opposed. The latter is a specialized band of deep cerebral fascia with thickening of the parotid fascia. Innervation of the TMJ is accomplished by the auriculotemporal and masseteric branches of the mandibular nerve.

Arthrokinematics & Osteokinematics

Translation (or gliding) occurs in the upper compartment of the TMJ while rotation (hinge movement) occurs in the lower compartment.11 Movement of the TMJ is accomplished primarily by the masseter, temporalis, medial pterygoid and lateral pterygoid, and secondarily by the suprahyoid, digastric and infrahyoid.

As the *jaw opens* (mandible depression), the mandibular elevators (masseter, temporalis, and medial pterygoid muscles) relax and allow gravity to assist. When opening against gravity or resistance, the suprahyoid and digastric muscles contract. From jaw opening to midrange, rotation (simultaneous roll and glide in opposite directions (convex rule)) of the condyles occurs in the lower compartment. At midrange, further jaw opening is achieved by the lateral pterygoid. This muscle is divided into an upper and lower head. The upper head is responsible for a forward translation of the

disk and condyle along the articular eminence of the temporal bone while the lower head accomplishes protrusion and lateral deviation at the opposite TMJ.

Jaw closure (mandible elevation) is accomplished through contraction of the mandibular elevators and retraction of the disc by the elastic fibers of the posterior capsule. The flexible disk separates and cushions the articular surfaces, while filling in any bony irregularities between the condyles and the temporal bone. Both translation and rotation are essential for full opening and closing of the mouth.

Mandibular protrusion and retrusion also occurs at the TMJ. During protrusion, the two heads of the lateral pterygoid contract and cause the disks and condyles to slide anteriorly and inferiorly. This takes place in the upper compartment. Whereas during mandibular retrusion, these structures slide posteriorly and superiorly while still in the superior cavity. This is accomplished by the temporalis.

Lateral movement of the jaw requires that different movements occur concurrently in the TMJs. For example, through the contraction of the two heads of the left lateral pterygoid, lateral movement to the left occurs. This necessitates a rotation occurring in the left joint (the mandibular head rotates in relation to the disc in the inferior compartment) and an anterior gliding taking place in the right joint (the disc and mandibular head glide ventrally in the upper compartment). The resting position of the TMJ is with the mouth slightly open, the lips together and the teeth not in contact. When the teeth are clenched, the TMJs are in their closed packed position. The capsular pattern of the TMJ is limitation of mouth opening.

TMJ Symptoms & Pathology

As a consequence of the frequent and repetitive stresses which are placed on it, the TMJ is often predisposed to similar degenerative changes and pathologies seen in other synovial joints. TMJ dysfunction is typically characterized by local pain and stiffness. Further manifestations may include ear symptoms (ringing or earache), neck symptoms (pain or stiffness), or head symptoms (sinuses or dizziness) that may be referred to or from these areas. The causes of TMJ dysfunction can include dental problems (malocclusion or overbite), poor joint mechanics (inflammation, subluxation of the disk, joint contractures or joint asymmetry), muscle spasm, postural dysfunction, personal habits (grinding or clenching teeth, chewing gum, etc.) and trauma (whiplash or direct blow).

Of the numerous possible pathological conditions which may result in TMJ dysfunction, three relatively common groups of TMJ pathologies are chondromalacia and osteoarthritis (OA), disk dislocation with reduction and disc dislocation without reduction. First, *chondromalacia and OA* are characterized by erosion of retrodiscal tissue. This may be followed by erosion of the fibrocartilaginous surfaces of the condyle, fossa, and articular eminence. If new bone has not developed in the presence of these changes, the condition is known as chondromalacia. If bony changes have taken place, OA is diagnosed. Joint pain, stiffness, and crepitus can result from the articulation of irregular surfaces. Further degeneration in the presence of chronic inflammation can lead to flattening of the condylar head, fibrous adhesions, or bony ankylosis between the joint surfaces. Second, *disk dislocation with reduction* is present in a significant proportion of the asymptomatic population. It is characterized by an audible click upon opening or closing of the jaw. This click is a result of an anterior displacement of the disk in relation to the condyle. This can be caused by a change in disk morphology, lengthened

collateral ligaments, or over activity of the superior lateral pterygoid. The location of the click during the range of movement can provide information regarding the degree of anterior displacement, with a late opening click and an early closing click indicating greater displacement. In certain individuals, anterior disk displacement can cause pain and dysfunction, and may predispose the individual to the eventual development of degenerative changes within the TMJ. Finally, *disk dislocation without reduction* is commonly referred to as a "closed lock" dislocation. This condition results when the anterior disk dislocation progresses to the point where the condyle is unable to glide onto the disk during opening and the disk now interferes with anterior translation of the condyle during movement. The ranges of mandibular depression, protrusion, and contralateral lateral excursion are all reduced. The resultant compressive forces induces tissue inflammation, proliferation and remodeling. This can lead to a state of chronic inflammation, which can progress to deterioration and perforation of retrodiscal tissue.

With the above background knowledge, the evaluation and application of appropriate manual therapy techniques to the TMJ can now be considered.

Assessment

As in any orthopedic joint evaluation, a thorough *history* must be performed. In assessing patients with TMJ dysfunction this requires both a medical and a dental history. The history should include detailed questioning relating to the individual's pain. This includes onset, severity, duration, progression, aggravating and easing factors, and location. Details about painful movements, pain on opening or closing the mouth (indicating extra or intrarticular problems), and pain on eating bilaterally or unilaterally (malocclusion) should be obtained. Symptoms such as crepitus (crepitation can occur in both pathological (a.k.a. hard crepitus, which is indicative of degenerative problems such as osteoarthritis and disk perforations) and nonpathological states (soft crepitus)), clicking (the timing of clicking is important as clicking on opening indicates a protrusive pathology whereas on closing indicates a retrusive pathology), locking, or muscle tenderness need to be addressed. It should be noted that joint noises can be examined by auscultation over the TMJ. The examiner must also inquire about the presence of any head (headache, dizziness or vertigo), neck (pain or stiffness), laryngeal (voice changes) or ear (hearing loss, tinnitus, earache) symptoms. Breathing mechanics (mouth breathing may indicate developmental problems or a forward head posture), grinding or clinching teeth (may arise from psychological problems), applicable personal habits (including pipe smoking, chewing tobacco, chewing gum or nail biting), occupational stresses (violin player, singer, prolonged talking or leaning with jaw on hand), and dental history (missing teeth or recent dental work) needs to be fully discussed with the client. Past trauma to the face or jaw as well as any previous cervical spine pathology should be noted. Finally, the examiner must discuss any functional limitations or personal concerns that the individual may have. Throughout the history, the natural movements of the jaw, personal habits, and posture should be assessed. The use of x-rays has shown to be of little benefit when evaluating the TMJ or planning treatment. However, they should be taken to rule out a suspected fracture or involvement of another joint.

Observations should include the TMJs, the cervical spine, and the head. During the observation, posture should be checked in detail. The TMJ musculature should be examined for symmetry, spasm, over development, or paralysis. The examiner should check the bite for malocclusion, overbite and crossbite (lower teeth lie in front of upper); check the tongue for normal function and position; check the face for symmetry; and check the teeth for any obvious abnormalities. In addition, the examiner should note any

orthodontic devices or dentures, and if present, any sores associated with these. Active range of motion should be checked for all cervical spine movements (flexion, extension, side flexion and rotation) with concurrent observation of the position of the mandible. With respect to the TMJ, active TMJ elevation, depression, protrusion, retrusion and lateral excursion should be assessed and measured. If present, pain, restriction, deviation, and joint noise should be noted during these movements. Hypomobility or hypermobility of TMJ depression can be detected by the patient attempting to insert two to three of their flexed P.I.P.s between their teeth (the norm). Hypomobility may be caused by a tight capsule, disc derangement, trauma, connective tissue disease or osteoarthritis among others. Deviations during opening are noted using the upper midline of the incisors as a reference point. A 'C' shaped deviation indicates hypomobility (a restricted joint capsule) to the side of the deviation whereas an 'S' shaped curve indicates a muscular problem. A late deviation can be indicative of a posterior capsulitis, whereas an early deviation can be caused by a spasm of the opposite muscle. Next, protrusion is checked with the measurement of overjet ("buck teeth") from resting position to the protruded position. This is followed by a retrusion check measured from resting to full retrusion. Lateral deviation is actively performed, measuring bilaterally from the posterior aspect of the TMJ to the notch of the chin. The right and left sides should then be compared. A finding of limited range is indicative of a contralateral problem. These problems could include muscle dysfunction, joint capsule problems, disk displacement or coronoid process impingement.

For the above movements, *passive range of motion* is employed to assess end feels and to check for ligament damage. A temporomandibular ligament sprain is indicated by pain on the side opposite to the direction of movement or by excessive range. Joint play is evaluated to determine if the TMJ's are unrestricted. These movements are independent of voluntary muscle action and are most marked in condylar distraction. Further, if these non voluntary movements are limited, it follows that the voluntary joint movement will be impaired. The evaluation requires the therapist to use one hand (opposite to the affected side) to move the mandible, and the other arm and chest to stabilize the head. Unilateral downward movement involves a strong downward thumb pressure on the last lower molar and an upward chin pressure. The therapist’s forefinger is extended to the mandibular angle and aids in mandibular advancement. Lateral joint play can be checked by placing the examiner's mobilizing hand on the lingual side of the posterior molar and exerting a lateral pressure while maintaining a counter force with the remainder of the hand on the anterior mandible. Both sides may be checked in this manner. If bilateral downward movement is desired an assistant is required to stabilize the head. These should be performed gently during the assessment stage especially in cases where swelling or pain are present.

TMJ evaluation also includes resisted isometric *muscle testing*. The lateral pterygoids are tested during mouth opening; the masseter, temporalis, and medial pterygoid are tested for mouth closing; and the contralateral lateral pterygoid is tested for unilateral lateral excursion. Pain or weakness may be elicited in the presence of muscle problems. The TMJ is palpated, by placing a finger in the external auditory meatus, to determine if capsular inflammation is present. Information regarding position and symmetry of movement of the condyle during opening and closing of the mandible as well as pain or tenderness is obtained in this manner. The examiner then palpates the muscles of the TMJ and neck, as well as the cervical spine, mandible, hyoid bone, and thyroid cartilage noting pain, swelling, temperature and any points of tenderness.

Finally, *neurological function* should also be evaluated. The dermatomes of the head and neck should be assessed. The integrity of cranial nerve V (trigeminal) and VII (facial) should be evaluated by using the jaw reflex and the Chvostek test respectively.

The Use of Manual Therapy as a Treatment Technique

Mobilizations are indicated when the assessment has illuminated any of the following: pain, progressive limitations of functional mobility, post arthroscopic TMJ surgery, reversible joint hypomobility, or muscle guarding or spasm. TMJ mobilization is performed to tear joint capsule adhesions and to realign collagen fibers. The following manual treatment techniques can also be used as an evaluative tool.

During a ventral glide of the mandibular head the therapist holds the ramus of the mandible with his fingers gripping the posterior aspect of the mandibular angle. With the patient's head stabilized with his other hand, the mandible is then mobilized ventrally. This technique is indicated in the presence of severely restricted movement such as decreased opening of the mouth.

The hypomobile TMJ is usually caused by a restricted joint capsule or by an anterior displaced disk without reduction (closed lock). Inferior traction of the TMJ is indicated. The therapist stabilizes the patient's head with one hand and with the other places his thumb over the posterior, lower molars with his fingers gripping the mandible. The mandible is moved caudally thus producing traction at the TMJ.

A medial or lateral glide of the TMJ requires the therapist to stabilize the supine patient's head against his chest. With his thenar eminence over the patient's mandible (just caudal to the TMJ), a medially directed force is applied. If the force is applied from the patient's right mandible medially, the right TMJ is medially moved while the left TMJ is laterally moved, and vice versa. This technique is indicated for restricted jaw movements.

Other Treatment Techniques Available

(adapted form G.E. Tata's course notes, with permission)

1. Postural alignment, cervical spine techniques
2. Muscle techniques: relaxation, strengthening, stretching, treatment of trigger points, proprioception.
3. Local joint treatment: passive movements, physiological/accessory, active movements/coordination
4. Electrophysical agents

Synovitis

• rest, soft diet, anti-inflammatory medication, electrophysical modalities and positioning/posture

Disc derangement

• self resistive exercises for opening and protrusion, orthodontic splint, repositioning appliance (to maintain opening, allow relocation of disc and retraction of posterior ligament)

Occlusomuscular dysfunction
• orthodontic management and symptomatic treatment of myofascial pain & local joint signs with:
i) TENS: over ride proprioceptive impulses from tense muscles, pain relief
ii) Ultrasound
iii) Resistive exercises/relaxation/proprioception/coordination of mandibular movement with use of mirror

Hypomobility
• Joint mobilization (as above), accessory and physiological movements, stretching
• Caudal and PA movements, downward traction with anterior translation/protrusion
• Use of tongue depressors to maintain opening and stretch, in combination with PA movements at limits of available ROM
• Active home exercises and stretching
• US to heat prior to stretch

Hypermobility
• Neuromuscular reeducation
• Opening with tongue against roof of mouth to limit range and control opening without deviation
• Resisted opening at mid range to increase proprioceptive awareness
• Mirror work

Dislocation
• Manipulation to reduce
• May require pain medication, anesthesia
• Maintain depression (splint) to avoid spasmodic closure

Conclusion
Pathology of TMJ accounts for a significant proportion of individuals with head and neck symptoms. It is through a clear understanding of the TMJ's anatomy and biomechanics that a responsible Physiotherapist or Chiropractor can effectively assess and treat dysfunction at this joint.

(References are available upon request)