

Examination & Treatment of TMJ Dysfunction (TMD)

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Lecture Objectives

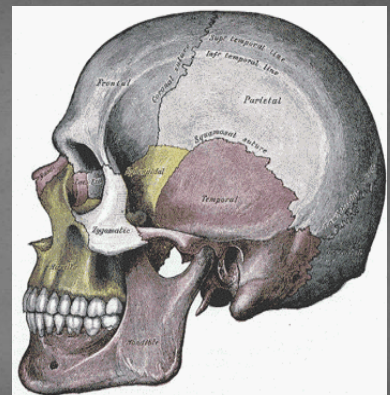
- Grow in understanding the jaw by learning
 - anatomy & kinematics of a healthy TMJ
- Increase our awareness of pathology related to TMJ disorders
- Review the process of a musculoskeletal examination and apply it to the jaw
- Discuss the evidence behind physical therapy examination of the jaw
- Explore PT treatment options and efficacy

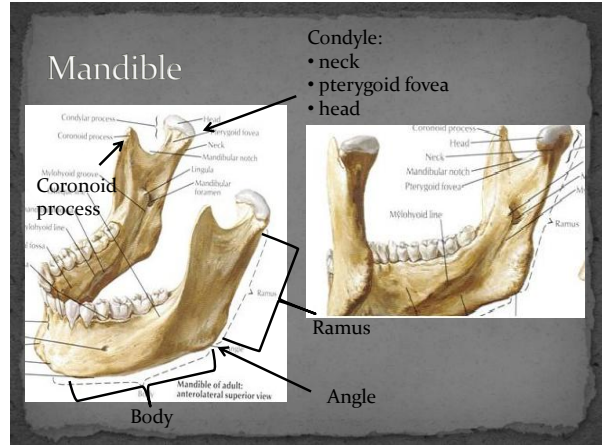
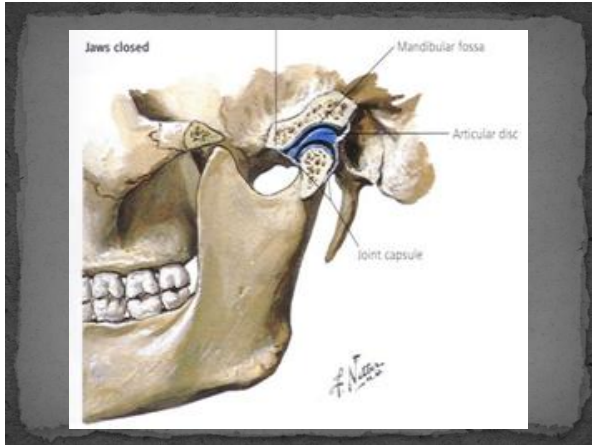
TMD stats

- Most common cause of facial pain.
- TMJ is one of the most frequently used joints in the body (~ 2000 repetitions/day).
- 10 – 35 million people in the United States of America suffer from TMJ disorders. Typically more female than male.
- Annual cost is ~\$4 billion

- (National Institute of Dental and Craniofacial Research / TMJ Association)

- Maxilla
- Zygomatic
- Sphenoid
- *Mandible
- *Temporal

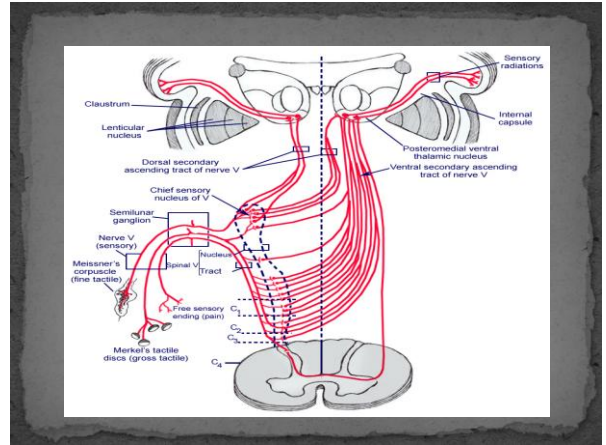
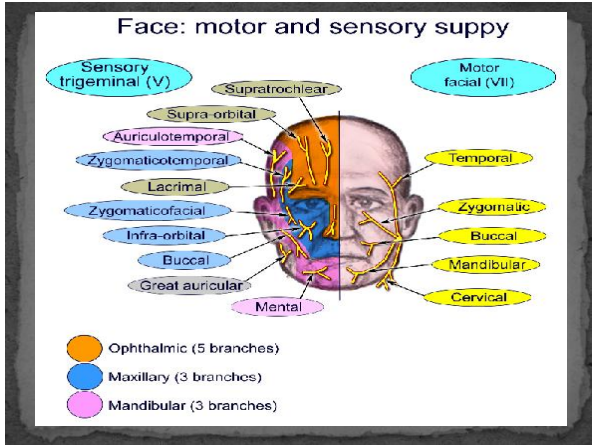




Anatomy: The Joint

- Complex, synovial joint
 - Closed pack position is full occlusion/closing
 - Resting position is slight opening
- Capsular pattern: opening
- Healthy joints end feel:
 - Opening: Firm (contractile and/or inert tissue tensile load)
 - Closing: Hard (bone to bone)
- Blood supply from temporal and maxillary a. (branches of external carotid)
- CN V - Trigeminal nerve supplies motor function & major part of sensory input

Component	Associated Nucleus	Function
Branchial Motor	Motor nucleus of CN V	Motor innervation to mastication ms, mylohyoid, digastric as well as tensor tympani & tensor veli palatini
General Sensory	Mesencephalic	Proprioceptive info. From the ms of mastication, teeth and TMJ
General Sensory	Principal nucleus of CN V	Tactile sensation from the face, oral structures, eye & associated structures, nasal cavity, frontal sinuses, side of the head & scalp
General Sensory	Spinal nucleus of CN V	Pain & temperature sensation from face, oral structures, eye & assoc. structures, nasal cavity, frontal sinuses, side of the head & scalp

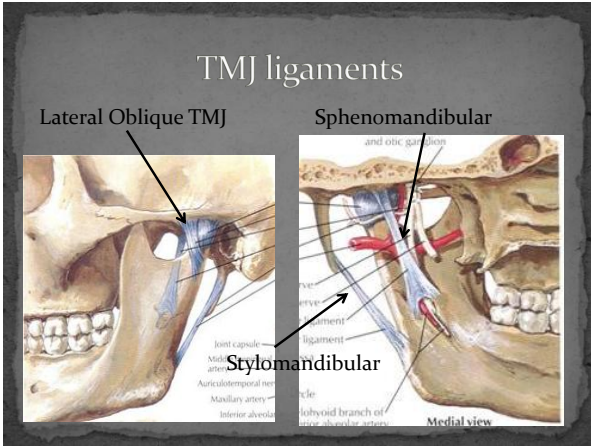


“my ear feels full, but ENT says it’s clear”

- Tensor veli palatini tenses the soft palate, which assists in the opening of the auditory tube to equalize air (between the tympanic cavity and outside air) pressure during swallowing and yawning. This homeostasis protects the tympanic membrane and hearing acuity.

Trigeminal neuralgia

Feature	Trigeminal neuralgia
Prevalence	Rare
Main location	Trigeminal area
Pain duration	Seconds – two minutes
Character	Stabbing, electric feeling
Pain intensity	Severe
Provoking factors	Light touch, washing, shaving, eating, talking
Associated symptoms	none



- ### TMJ ligaments
- Lateral Oblique TMJ ligament
 - Origin – zygomatic arch
 - Insertion – neck of the mandible
 - Function – limits opening and posterior motion of disc
 - Stylomandibular ligament
 - Origin – styloid process
 - Insertion – angle of the mandible
 - Function – becomes taut w/ protrusion, controls anterior motion.
 - Sphenomandibular ligament
 - Origin – sphenoid bone
 - Insertion – mandible
 - Function – controls anterior glide

Muscles

- Mastication:
 - Temporalis
 - Masseter
 - Lateral Pterygoid
 - Medial Pterygoid
- Swallowing/speaking:
 - Supra & Infrahyoids

Temporalis muscle

Origin: fossa of temporal bone

Insertion: coronoid process and anterior border of ramus of mandible

Innervation: CN V, 3rd branch (mandibular n.) via deep temporal branches

How do we test it? Resist closing, Palpate it

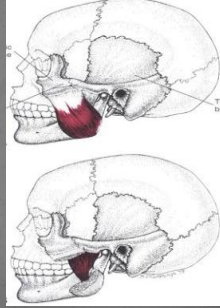
Masseter muscle

Origin: inferior & medial aspect of zygomatic arch

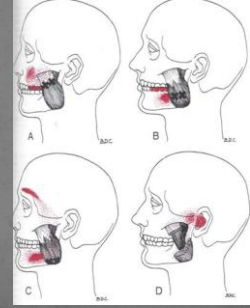
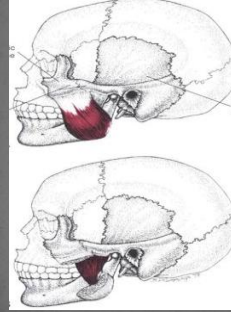
Insertion: lateral surfaces of ramus of mandible and coronoid process

Innervation: CN V, 3rd branch (mandibular) via masseteric n.

How do we test it? Resist closing motion, Palpate it



Masseter & referral patterns



Lateral Pterygoid muscle

Origin:

- (a) superior head = greater wing of sphenoid bone
- (b) inferior head = lateral pterygoid plate

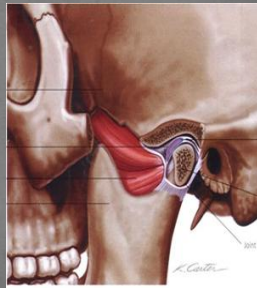
Insertion:

- (a) superior = disc and capsule
- (b) inferior = neck of mandible

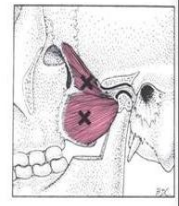
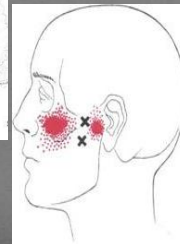
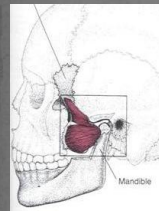
Innervation: CN V, 3rd branch (mandibular n.) via lateral pterygoid n.

How do we test it?

- (a) Unilaterally - Resist contra-lateral lateral deviation
- (b) Bilaterally - Resist protrusion
- (c) Palpate it



Lateral pterygoid & Referral pattern



Medial Pterygoid muscle

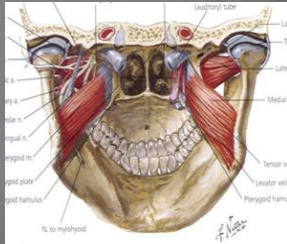
Origin: medial surface of lateral pterygoid plate, palatine bone, tuberosity of maxilla

Insertion: medial surface of ramus of mandible

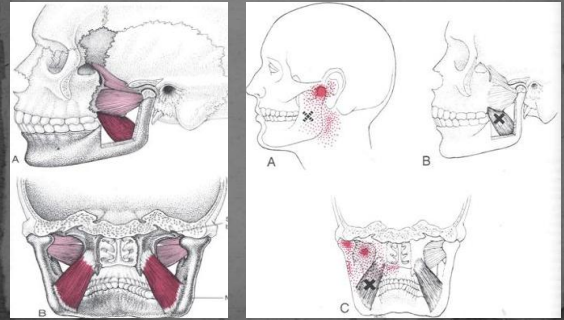
Innervation: CNV, 3rd branch (mandibular n.) via medial pterygoid n.

How do we test it?

- Unilaterally - resist contra-lateral deviation
- Bilaterally - resist closing
- Palpate it

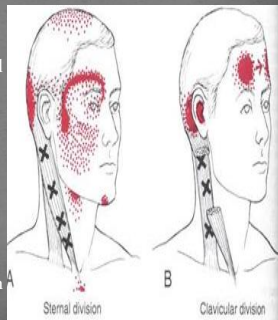


Medial Pterygoid & Referral pattern



Sternocleidomastoid muscle

- **Origin:** mastoid process and superior nuchal line
- **Insertion:** manubrium, medial surface of clavicle
- **Innervation:**
 - Motor: CN XI,
 - Sensory for pain and proprioception: C2/C3
- **How do we test it?**
 - Resist neck flexion & contra-lateral rotation
 - Lengthen it with neck ipsi-lateral rotation and extension
 - Palpate it (*one side at a time*)

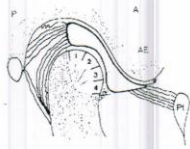


The TMJ disc / meniscus

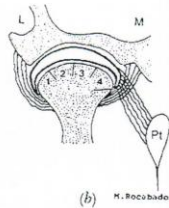
- The disc is biconcave (concave on the top and bottom) intra-articular structure.
- Described as dividing the joint into a lower and upper area.
- Composed of fibrocartilage & primarily avascular
- Anteriorly it is continuous with the capsule and superior aspect of the lateral pterygoid muscle.
- Posterior to the disc is vascular, innervated & contains the posterior elastic ligament.
- **Function of the disc itself:**
 - load bearing cushion
 - Facilitates ROM

TMJ: normal disc (Rocabado)

Sagittal view



Coronal view



(b) M. Rocabado

Jaw Opening

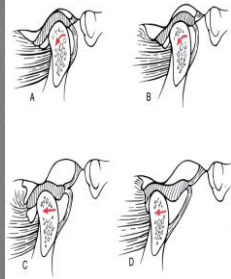
From a closed position, initial movement (until ~10 mm. of opening) occurs at the 'lower joint' as both mandible condyles move on the inferior concave aspect of the intra-articular disc. This is your ROTATION.

The remaining motion occurs at the upper aspect within the joint as the superior aspect of the concave disc translates inferiorly, anteriorly and laterally on the articular eminences of the temporal bone. This is your TRANSLATION.

* The lateral glide component bilaterally is because the temporal bone is more narrow here than the mandible.

• Protrusion is the same joint motion, but differs regarding muscular & ligamentous lengthening.

• Closing is the opposite and retrusion is the same joint motion as closing.



Jaw lateral deviation

From the resting position of the jaw translate the jaw left or right.

The same joint motions apply as in opening and closing relative to the disc and upper/lower aspect within the joint, just unilaterally.

Example: During lateral deviation to the left:

- The right joint motion is anterior, inferior and lateral (i.e. opening)
- The left joint motion is posterior, superior and medial (i.e. Closing)

Causes of TMJ disorders



Forward head posture w/ compression



Emotions are like a dashboard light in a car
& can alert you to a problem



- Sadness, Fear, Anger and Guilt are common
- What's our role?
 - Stop
 - Listen
 - Let compassion build
 - Coach to G.R.O.W.?
 - Goal?
 - Reality?
 - Options?
 - Willingness to change?
 - "What will you do?"
- Refer when appropriate

Myofascial Pain Dysfunction

What is it?

- Pain arising from muscle and/or its surrounding tissues
 - Develops from chronic stress... physical, social, emotional or pathological source
- Pain → muscle spasm → pain
 - Chronic muscle spasm may lead to decreased extensibility of musculotendinous unit, which means decreased ROM

What's it look like?

- Often Unilateral
- Described as Dull or achy pain that is poorly localized
- Moderate to severe limitation of mouth opening
- No local TMJ tenderness
- Muscle tenderness
 - (Jaw & Neck)
- No Radiographic TMJ changes

Arthritic Conditions

- Osteoarthritis (OA) – the most common type for this joint
 - Often originates from abnormal shear forces on the joint surfaces.
 - Alters force bearing surfaces of the TMJ
 - Osteophytes or bone spurs – can perforate the disc
 - Cracks in joint surface
 - Pain lowest in morning, increases as day progresses and patient moves the joints and they become mechanically irritated
- Rheumatoid Arthritis
 - Often 1st joint involved in juvenile RA
 - Pain & stiffness upon arising in the morning

Capsulitis

- Trauma to the joint capsule
- Pain? Tightness? or both?
 - If just inflamed, then end range position is painful (early stage of healing)
 - If the inflammation has resolved, but the joint hasn't been moved through its ROM the capsule may develop adhesions. In this case, loss of motion but with or without pain (remodeling phase of healing)
 - If tightness of capsule & a unilateral problem then the jaw will deflect to the same side of the tightness near its end range position

Intra-articular

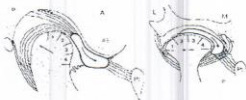
A disc derangement cascade...

- **Stage 1** – *Pain-free or mild pain* is the common report. Disc is positioned slightly anterior & medial. A *click* may occur *inconsistently*, but is not always present. If a click occurs it's often early during the opening phase.
- **Stage 2** – *Pain* is common and often intense. Disc is positioned *even more anterior & medial*. A *reciprocal click* is present & more consistent. The click occurs early during opening & late during closing.
- **Stage 3** – *Intense pain*. Reciprocal click. A click occurs late during opening and early during closing.
- **Stage 4** – Anterior displacement of the disc without reduction. Sometimes pain-free and *rarely a click* because the disc is never recaptured (i.e. the disc is not being loaded). ROM is limited "closed locked"

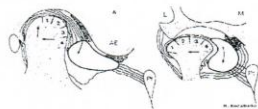
The basic progression of intra-articular derangement is the disc moves anterior and medial, lengthening the posterior ligament.

TMJ: abnormal disc (Rocabado)

Phase II derangement



Phase IV derangement



Joint hypermobility / instability

- Condylar Subluxation
 - Mandible condyle translates past articular eminence – can over stretch and irritate the retrodiscal tissues
- Condylar Dislocation or "Open lock"
 - Mandible condyle can't return and is locked anterior to the articular eminence– usually requires ER visit



Subjective Exam

“Interrogate with empathy” – Geoff Maitland

- Onset of chief complaint:
 - Mechanism of injury?
 - Duration of symptoms?
- Behavior of the symptoms:
 - Description & Location of the pain and function?
 - “Can you put a finger right on the area of your pain?”
 - Aggravating / Relieving activities or postures;
 - Pain in a.m. w/ waking? (Bruxism at night)
 - Pain with activity? (chewing, yawning, posture stress, etc.?)
 - Signs would include clicking or locking of the jaw?
 - Other areas of symptoms: headaches, dizziness, neck pain, etc.?
- PMH:
 - Vascular: temporal arteritis, MI
 - Visceral: CA
 - Neurogenic: Trigeminal neuralgia, Bell's palsy, etc.
 - Musculoskeletal: osseous, soft tissue or systemic (RA, AS, etc.)
 - Dental hx: tooth infections, oral surgery, splint, etc.

Observation:

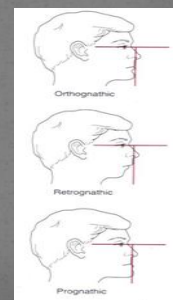
Why is Forward head posture bad for TMD?

- Direct impact - It places the mandible in the retrusion position
 - *For the joint:* Statically, this is a prolonged closed packed position, which means compression duration increases (cartilage impact). Dynamically, the axis of motion is changed and perhaps ROM
 - *For the intra-articular disc:* it's placed in an anterior position relative to the mandible condyle; more load on posterior aspect of disc inferiorly, more tension on retrodiscal tissue (remember this is the vascular & innervated area)
 - *For the muscles:* they are placed in a less than optimal position
- Indirect impact – the upper cervical spine (occiput to C2/3) is extended, shortening the SCM, anterior scalenes, suboccipital muscles.
- A quick test to help patients kinesthetically understand the importance of your “sit up tall” advice: Have them slump and open their jaw and compare it with sitting tall and opening their jaw.

Your structure is only as good as the foundation it is built on



Observation

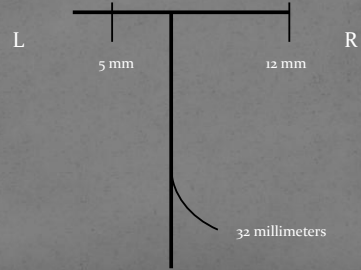


ROM

- Opening:
 - Normal ranges are 35 – 50 millimeters
 - Below 35 mm is limited opening
 - Measure the distance in mm from the upper to lower central incisors during opening.
 - Reliability: Interrater ICC= .98 - .99 & Intrarater = .77 - .94
- Lateral deviation:
 - Normal ranges are 8 – 12 millimeters
 - Measure the distance between the upper and lower central incisors as the patient (from a resting position of the jaw) moves the jaw laterally.
 - Reliability: Interrater= .90 - .96 & Intrarater = .70 - .92
- Retrusion (normal is 3-4 mm) & Protrusion (normal is 5 mm)
 - Measure the horizontal distance between lower & upper incisors
 - Reliability with a plastic ruler (Walker et al)
- Distinguish between the pain-free ROM and maximum ROM

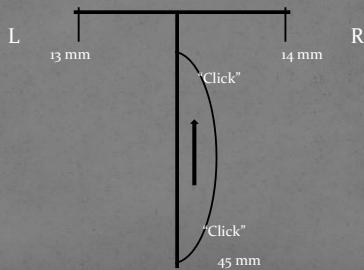
ROM documentation

Example: Hypomobile capsule at R TMJ?

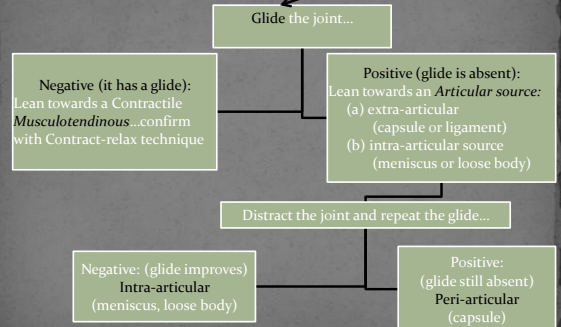


ROM documentation

Example: R TMJ Anterior disc displacement with reduction?



Decreased Joint AROM & PROM



TMJ Accessory motion

- **Opening:** Stand on opposite side you're testing. Example: If testing L joint, L arm secures head and palpates joint, while R thumb is placed on patient L lower molars and grasping mandible. Pt. opens to end range then examiner performs an inferior, anterior and lateral motion by supinating the forearm and adducting the shoulder.
 - This tests the quantity (grade zero to six: hypo to hypermobile)
 - Appreciate the quality of the end feel (should be firm)
 - Note that although this is the specific direction for the arthrokinematics of the TMJ, you can look at other components of joint play: distraction (caudal), compression, anterior, posterior, medial and lateral to assess for restrictions compared to non-involved side.
- **Closing:** to test end range joint position – same stance and hand position, but pt. performs lateral deflection to the side being tested & examiner performs a superior, posterior and medial motion by pronating the forearm and abducting the shoulder

Ligament stress (tensile load) tests

If L side being tested...

- **Lateral oblique ligament**
 - Stand on opposite side you're testing. L arm secures head and palpates joint, while R thumb on pt. L lower molar and grasping mandible.
 - Ask pt. to fully open and contralaterally deviate (this takes up full opening motion at L joint)
 - Examiner applies a caudal distraction force towards the manubrium
- **Stylomandibular and Sphenomandibular ligaments**
 - As above & add an Anterior force at end range
- **Intrinsic (anterior) ligaments**
 - Close left joint until contact with your thumb
 - Ask pt. to ipsilaterally deviate (to the L)
 - Apply a posterior force

Muscle function

In the jaw resting position, is there a symptom change when resistance is applied in any direction?

- If "No" & AROM against gravity hasn't changed the chief complaint, THEN add resistance against the muscle when it's in it's lengthened position.
- If still no effect on chief complaint, THEN add resistance against the muscle throughout the ROM concentrically and eccentrically.



Muscle: Direct or Indirect?

- A tear in the musculotendinous structure:
 - AROM against gravity may be painful.
 - Adding more resistance produces pain (unless perhaps a complete tear)
 - full lengthening of that structure may be painful
 - Hypertonic ms or myofascial trigger point
 - When the muscle is in a rested state, the patient reports "that's my pain" when you palpate / apply pressure to the muscle that feels 'taut, increased turgor, etc."
- Example:**
- The left lateral pterygoid muscle is in a spasm (contracting even when it should be resting).
 - The lateral pterygoid itself does not produce pain when you test it for its' ability to contract against resistance.
 - BUT, because of the spasms, the disc is in a position of anterior displacement. The disc itself is the structure at fault for the chief complaint.

Palpation

- ◉ Note the tension you feel under your hands & the patients' response to your touch.
- ◉ DO NOT just go with "oh, that's tender." Keep working your hypothesis; "is that the same pain that brings you here for therapy?"
- Dworkin et al:
 - Kappa .90-.91 inter-rater reliability with 64 volunteers
 - pain with palpation to temporalis & masseter ms
- Cacchiotti et al:
 - .76 Sen, .90 Spec, +LR of 7.6
 - to discern which patients had TMD as evidence of pain with palpation of the muscles of mastication and which did not among 81 people
- Manfredini:
 - Kappa .48 - .53 intra-rater reliability
 - 61 patients w/ TMJ pain
 - to detect pain with palpating (a) TMJ through the external auditory meatus (b) anterior to the ear, over the TMJ to actual joint effusion found with MRI.

Case 1 scenario

Subjective:
Establish your initial hypothesis

25 y.o female pt. with no history of trauma says "my left jaw crunches and makes noises when I open and close to chew and it hurts."

What could fit?

- 1) Internal disc derangement?
 - 1) Anterior disc displacement with or without reduction?
- 3) Myofascial dysfunction?

Disc derangement (stage 2?)

Narrow it down...

Objective findings:

- 1) Muscle resisted tests are strong & pain-free
- 2) Palpation reveals only tenderness locally at the L TMJ
- 3) Observing the ROM reveals a left mid range deviation that returns to midline at near end range
- 4) ROM: Opening 40 mm with L jaw early opening click and late closing click. Lateral deviation is 10 mm to left with a click near end range and 8 mm to the right with a click near end range

Case 2 scenario

Subjective:

Establish your initial hypothesis

32 y.o. single mom who works in a call center for credit card collections reports "my left jaw occasionally clicks & it hurts. I can't open wide enough to eat a Big Mac anymore."

What could fit?

1. Myofascial dysfunction?
2. Capsulitis?
3. Internal derangement?

Myofascial 'dysfunction' as source, perhaps leading towards an intra-articular lesion

Narrow it down...

Objective findings:

- 1. ROM <35 mm opening and at end range the jaw deflects to the left and she reports pain. Left and Right deviation are equal at 12 mm.
- 2. Left joint glide is symmetrical to the right jaw joint glide.
- 3. Muscle resisted tests are strong but mild pain provoked with closing.
- 4. Palpation to the jaw joint is sore, but palpation over the left masseter muscle causes the patient to respond with "ouch...that's my pain!"

Case 3 scenario

Subjective:

Establish your initial hypothesis

45 y.o. male karate instructor, "my L jaw hurts and I can't open my mouth very wide since my last competition."

What could fit?

- Traumatic OA?
- Joint Capsulitis?
- Anterior disc displacement without reduction?
- Muscle tear and or spasm of masseter, temporalis?

Anterior disc displacement without reduction

Narrow it down...

Objective findings:

- 1. ROM: opening 25 mm with left deflection at end range. L deviation is 10 mm, R deviation is 3 mm
- 2. Muscle tests are strong, pain-free and palpation to the muscles is pain-free with normal tissue turgor
- 3. Joint glide is absent on left
- 4. Adding traction and repeating the glide reveals improvement of the glide.

Work your hypothesis, but respect the evidence

- AROM
 - Is it a TMJ disorder or not? Restriction of maximal opening >6 mm & report of pain; Specificity .97 & +LR 8.67 (Cacchiotti et al).
- Overpressure into full PROM
 - Manfredini et al. 61 pt's with TMD performed overpressure at full opening looking at the correlation between confirmed joint effusion on MRI with the overpressure test producing pain. They found Sensitivity of .93 and -LR of 4.38 (poor Specificity and +LR)
- Accessory glide/motion testing:
 - Two studies show inter-rater reliability Kappa values from -.03 to .20 when looking at 79 randomly selected patients with jaw pain. (Lobbezoo-S. & de Wijer)
- Muscle testing:
 - Reliability: Three studies show isometric and dynamic test reliability ranging from .15-.30 for detecting pain during resistance (Lobbezoo-S, Manfredini & de Wijer)
 - Validity: One study shows that when attempting to identify patients with TMD, Resisted tests (static and dynamic) alone have Sen .63, Spec .93, +LR .90 & -LR .40 (Vissscher et al.)

Anterior Disc Displacement

- Detecting ADD with reduction: (Orsini et al.)
 - clicking: Sen .51, Spec .83, +LR 3.0, -LR .59
 - Overpressure producing pain: Sen .55, Spec .91, +LR 6.11, -LR .49
 - Deviation of the mandible w/ opening: Sen .32, Spec .87, +LR 2.46, -LR .78
- Detecting ADD without reduction: (Emshoff et al)
 - ROM, pain, clicking: Sen .75, Spec .83, +LR 4.41, -LR .3
 - PT treatment efficacy:
 - Pain frequency/intensity, function and ROM improvement shown with manual therapy, ther ex and posture re-ed (Cleland, J, and Palmer, J, JOSPT 2004; 34; 535-548)

PT Treatment options

- Manual Therapy
 - Restore joint mobility
 - Abolish abnormal muscle turgor and/or restrictions
- Therapeutic Exercise
 - TMJ ROM, stretching & motor control exercise
 - Posture muscle endurance
 - Mariano Rocabado
- Rest & Relaxation
 - Jaw rest position: "Anna"
 - Avoiding overuse; chewing gum, yawning wide, etc.
 - Actively dealing with underlying stress in a healthy way
 - Diaphragmatic breathing
- Modalities (US, TENS, laser and shortwave diathermy)

Mouth guard / splint

- Stabilization or flat plane splint:
 - This splint covers all the upper teeth, and its flat surface is intended to help reduce tooth grinding and relax jaw muscles.
- NTI-tss (Nociceptive Trigeminal Inhibition Tension Suppression System):
 - The NTI appliance fits on the upper front teeth and is designed to prevent tooth clenching and grinding. It fits on only a few teeth.
- Repositioning splint:
 - This splint is used to move the lower jaw either forward or backward. It is intended to put the jaw into a new position.
- A 2009 Cochrane Systematic Review:
 - "There is insufficient evidence either for or against the use of splint therapy for the treatment of TMD...need for further, well conducted RCTs"
- A 2010 Systematic review and meta-analysis of RCT evaluating intraoral orthopedic appliances for TMD:
 - "good evidence of modest efficacy in the treatment of TMD pain compared to non-occluding appliances and no treatment...in reducing TMD pain."

PT efficacy on TMD

Treatment

Outcome

- Ther Ex
 - Active and passive exercise with postural ms exercise are effective at reducing pain (McNeely et al)
- Modalities
 - Laser therapy shows best result
 - No pain relief, but better ROM (Kulekcioglu et al)
 - TENS – no change
 - US – little benefit for ms dx (van der Windt et al)
- Manual Therapy
 - Manual Therapy & ROM
 - Carmeli et al 36 people over 4 weeks joint glides and active exercise vs. splint.
 - Reduced pain and improved opening function
 - OA HV/LAT or ST mob to suboccipitals
 - Oliveira et al J Orth Sports Phys Ther 2007;40(3):310-317
 - RCT w/ 122 subjects. Immediate increase in pressure pain thresholds over latent TrPs in the masseter and temporalis muscles and an increase in maximum active mouth opening.

PT efficacy cont...

- Posture re-ed
 - Wright et al took 60 people for 4 weeks and compared *self-management* (NSAID, heat or cold, avoid overuse, rest masticatory ms) to *posture training* (2 sessions with a PT and exercises for posture)
 - Result: statistically significant reduction in pain and pain-free opening in the posture training group over the self management group.
- Muscle Awareness Relaxation Therapy & Biofeedback
 - Carlson et al took 44 people for 3 weeks and compared a splint and pt education to proprioceptive re-ed, breathing & relaxation techniques
 - Result: Less pain and greater opening ROM
- Komiya et al in '99 took 60 people for 1 session over 12 months and compared Cognitive Behavior (CB) to CB with Posture training sessions and to a control group.
 - Result: Both intervention groups better at 6 & 9 months regarding Pain & perception of daily life disturbance but Posture group statistically better in oral opening

Questions?



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