

Note: When the TMJ Disc is dislocated anteriorly, the retrodiscal tissue and posterior ligament is pull up and over the condylar head. The cartilage of the condyle and fossa are now in contact with this tissue which adapts into an avascular fibrous tissue within a few weeks.

All Clicking joints are damaged

Not so dangerous Clicks:

- Unchanging click for 2 or more years
- Consistent, easy reduction of Disc
- Good range of motion with clicking
- Stable occlusion with clicking

Clicks that need further Evaluation- Order Scans

- Clicking that has stopped in past 2 years
- Clicking has changed in the past 2 years
- Wiggling jaw to open. Locking.
- Chronic Painful click
- Unstable Occlusion, Changing Occlusion

Questions to ask Patients with clicks

- Has the clicking changed in the past 2 years?
- Any pain with the clicking?
- Any difficulty opening your mouth?
- Any problems chewing food?

Limited Opening Needs Immediate Treatment

- Rule out masseteric space infection- Check molar area
- Rule out muscle spasm- Anterior deprogrammer, TENS
- Rule out TMJ pain avoidance- Auriculotemporal nerve block
- Tx mechanical joint obstruction- Arthrocentesis
- Post-op anterior repositioning orthotic

Two very important Question in diagnosing Pain around the TMJ:

Does the joint damage have anything to do with the discomfort or dysfunction that the patient is feeling?

It appears to be _____, but what else could it be?

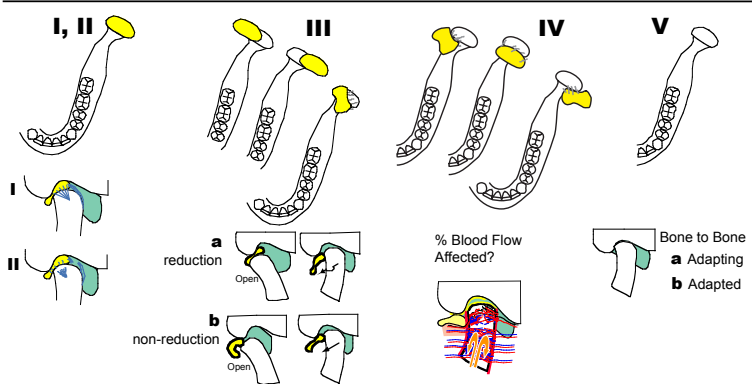
Specific Diagnosis of Damaged TMJs

- Ligaments- Stretched, Partial Tear, Complete tear
- Disc- Piper 1,2,3a,3b,4a,4b,5a,5b, Size, Location
- Cartilage Fibrillation, Wear, Necrosis, Tear
- Synovium Inflamed- Synovitis, Hyperplasia, Fibrotic, Adhesed
- Bone Osteolytic, Hypertrophy, Ossification, OsteoNecrosis
- Remodel/ Adaptation, HyperCalcification
- Marrow Inflamed, Necrotic

MRI Scan Information

- T1 shows more fat than water- TE 15, TR 400
- T2 shows more water than fat- TE 110, TR 3500
- PD (Proton Density) between a T1 and T2 and shows the disc- TE 15, TR 2500
- STIR (Short T1 Inversion Recovery) more sensitive for water- TE 15, TR 4000

Dr. Mark Piper's Classification



- 1 Normal Healthy Disc, Ligament and Cartilage
- 2 Normal Disc Position but damage: Ligaments damage, Cartilage Fibrillation, Disc Distortion Perforation of Disc, Disc unstable from contralateral TMJ
- 3ae Early Partial disc subluxation, with reduction
- 3a Partial disc subluxation, with reduction
- 3b Partial disc subluxation, non-reducing
- 4ae Early Complete disc dislocation, with reduction
- 4a Complete disc dislocation, with reduction
- 4 adh Adhesed disc to eminence
- 4b Complete disc dislocation, non-reducing- Risk AVN 1st year
- 4b/a Complete disc dislocation, non-reducing in function
- 5a No Disc, Bone to bone- Adapting- OA Active
- 5b No Disc, Bone to bone- Adapted- OA adapted

CT Scan- Normal

- Cortex intact- No cysts, no hypercalcification
- Trabecular bone has a good pattern
- Normal Size and shape of right and left condyle (70% condyle to fossa)
- Non congruent ovoid shape of condyle
- No flat areas
- CR Load Zone- Condyles load on superior medial condyle
- Closest bone distance superior medial surface
- Condyles are centered medial-laterally.
- The Mandible sits centered under the skull base
- Inferior border mandible Right/Left equidistant to the fossa
- Condyles centered in fossa in sagittal axial, and coronal views
- The joint space indicates adequate room for a disc
- No lesions or tumors in the TMJ and surrounding areas
- Sinuses clear
- Adequate airway nasal, adenoids, tonsil, tongue
- Teeth- no PAP
- Brain, muscle, parotid even tissue pattern

MRI- Normal

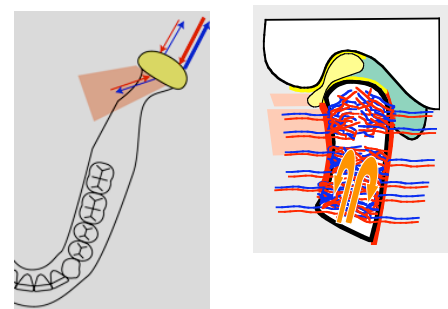
- Disc is in a proper position on both the medial and lateral pole
- If not; Off both medial and lateral?
- Where is it? Size of disc?
- Recaptures? Does Disc move in open view (Adhesed?)
- PseudoDisc formation (fibrosis)?
- Cortex intact- No cysts,
- No areas indicative of either sclerotic or necrotic bone
- Normal Size and shape of right and left condyle
- 70% condyle to fossa
- Non congruent ovoid shape of condyle
- No flat areas, No lipping
- Condyles are centered anterior-posteriorly in fossa
- No edema in the joint, synovial tissue or bone marrow
- T2 and STIR images.
- No lesions or tumors in the TMJ and surrounding areas

Normal TMJ Bone

- Bone Density
- Intact Cortex
- Even pattern Trabecular bone
- Normal Size/Shape Condyle/Fossa
- Ovoid Condylar Shape
- Non-Congruent Condyle/Fossa
- Condyle 70% Size Fossa
- Condyle Centered in Fossa
- Coronal and Sagittal
- Room for Disc
- Stable CR load Zone
- Condyle closest to fossa

Normal TMJ Condyle Blood Flow

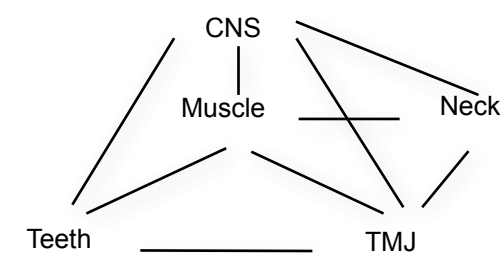
- Condylar head limited collateral circulation
- Marrow is fatty tissue with blood vessels
- Marrow contains the precursor for blood cells
- No Blood vessel inside joint



Detecting TMJ Health

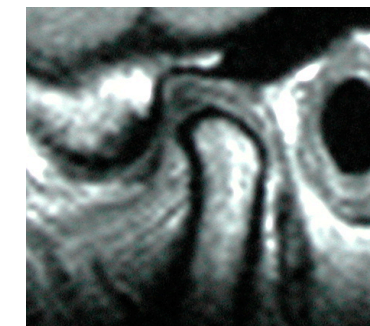
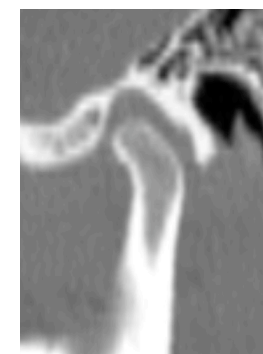
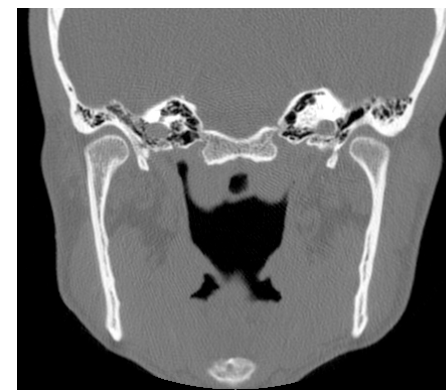
- Palpation and Load- No Pain
- anterior lateral pole, posterior lateral pole, indirect through ear
- Load in CR
- History- No: Click, Limited opening, pain, trauma
- Motion- Full, Smooth Range of Motion
- 40-55 mm, 300mm/sec velocity, straight path, consistent arc
- Sounds/Vibrations
- Stethoscope - No Sounds
- No abnormal subtle sounds- paper, sand, pebbles, rocks, crackle
- Doppler Auscultation- No joint vibrations
- Joint Vibration Analysis- No joint vibrations
- Mechanical Stability- Pass the DATPAS test 24/7 3-7 days
- Not occlusally hypersensitive
- Stable Occlusion- No changes over one year

Dynamic Orthopedic System



A change in any one area will affect the others

Healthy Joints



Normal MRI

- Normal Synovial Tissue
- Synovial Tissue lines inside periphery of joints
- Synovial Tissue makes Synovial Fluid
- Filters out Red Blood Cells from plasma
- Adds Hyaluronic Acid and Lubricin to the plasma
- Synovial fluid lubricates the joint
- Synovial fluid provides nutrition to cartilage cells

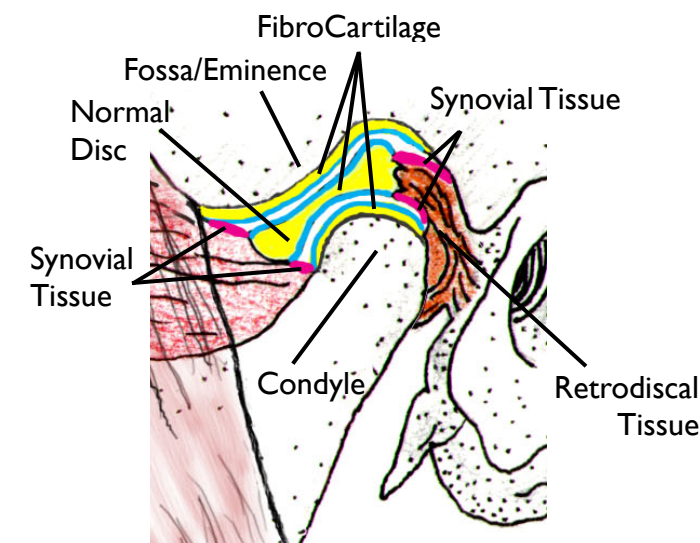
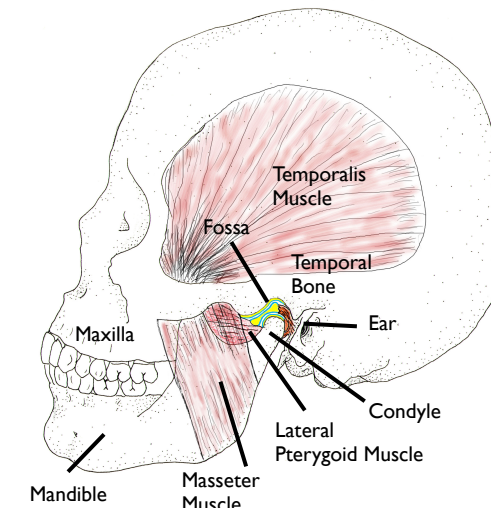
Healthy Cartilage

- Water layer in blue covers Fibrocartilage
- There are no blood vessel in joints
- Synovial Fluid brings in nutrition and O₂

Cartilage is 80% water. The surface of cartilage is fluid (surface active phospholipids). When cartilage slides against cartilage, the surfaces never touch- it is fluid sliding against fluid- very little friction, no wear.

TMD Diagnosis Supersheet

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Information from Important Slides

Occlusal Muscle Disorder Diagnostic Flow sheet for a General Dentists

1. Exam/Differential Diagnosis:

What is sore- Is it joint, muscle or neck?

Take History, Palpate TM Joints, Palpate TM muscles, Palpate Neck
Rule out dental causes. What are the choices?

2. Diagnostic Tests:

D-PAS Orthotic for 1 week PM wear only- Test for clenching

D-PAS Orthotic for 2 days, 24 hr wear except to eat. Test for OMD

Rules out other....

or Full Coverage Centric Relation Orthotic 3-6 weeks, 24/7 wear

Test for OMD. Testing benefit of a fully functioning occlusion

3. Repeat Step 1. If all the pain has gone away then step 4.

4. Occlusal Analysis. Alter Occlusion- See LD Pankey 3 Rules of Occlusion

Two days before adjust occlusion, use D-PAS 24/7 to verify joint stability.

At any point if pain increases, or if the pain has not fully resolved after 6 weeks of therapy, a full facial pain diagnostic work up is needed including TMJ imaging.

Joint are either Healthy or Damaged

If Damaged they will be either:

Actively Breaking Down

Adapting

Adapted Favorably

Adapted Unfavorably

85% of damaged joints adapt favorably w/out therapy

Increased Risk of unfavorable adaptation:

Large Disc anteriorly dislocated nonreducing

Distalized condyle

Bone Marrow edema on T2/STIR of MRI

Limited opening

Unfavorable adaptation of TMJ Damage

Structurally unstable: Active Bone loss

Mechanically unstable:

Joint subluxates under load (wobbly joint)

Wiggle jaw to recapture disc and open

Unable to open

If Adapted Unfavorably:

Mechanically unstable on moving

Mechanically unstable on loading

Painful muscles and/or joints

Occlusal Muscle Disorder

LD Pankey's 3 Rules of Occlusion

1. With the condyles fully seated in the fossa, all the posterior teeth touch simultaneously and even, with the anterior teeth lightly touching.

2. When you squeeze, neither a tooth nor the mandible moves (in a lateral direction).

3. When you move the mandible in any excursion, no back tooth hits before, harder than, or after a front tooth.

Evaluate every TM joint for:

1. Comfort

2. Movement

3. Mechanical stability.- does the joint wobble on loading

4. Structural stability- will the joint lose bone with a resulting occlusal shift.

Comfort- The TMJ should not be painful. If the TMJ is painful, I order imaging, both MRI and CT. See CT/MR Rx on my website.

Movement- The TMJ should have a full range of motion. If no full ROM, more diagnostic info is needed. Is it muscle or joint? If muscle, usually progress can be made with datpas or an anterior deprogrammer. If the joint is the problem, get imaging, need MRI.

Mechanical stability- I use a datpas orthotic for 24/7 for 3-7 days. If pain does not increase, the joints are mechanically stable.

Structural stability- There are two ways to determine

1. Monitor occlusion.

2. Monitor bone on CT or CBCT.

If you can determine that the occlusion and condylar bone have not changed over a one year period, the joints are stable. In patients that I suspect may not be stable, I use a mounted set of models in CR and take a bite record every 1-2 months over a year and compare the various bite records with a vericheck. Structural condylar bone loss will manifest as a change in occlusion. ANY CHANGE IN OCCLUSION needs a CBCT and MRI. If you do not want to monitor over a year, a CT scan will give you a good indication of joint stability. Any break in the condylar cortex is an indication of joint structural instability. The most sure way to verify structural stability, two CBCTs one year apart showing no changes in bone. Orthodontics makes it hard to detect a change in occlusion from condylar bone loss since all the teeth are moving from the orthodontics. For orthodontic cases I like to have a start CT or CBCT so if the case is not going as planned (taking longer than expected), we can get a follow up CBCT and compare the two scans. Patients heading to ortho are given the option of getting a CBCT and explained risk/ benefit. A CBCT will identify many unstable joints before orthodontics is started, minimizing the risk of a less than desirable outcome.

7 Basic Rules for Diagnosing Pain

1. Listen to the patient

- Get both written and oral History

2. Patients can have more than one disease.

3. Develop a differential diagnosis

- Ask: It appears to be, but what else could it be?

4. Run tests that will increase or decrease the pain

- Palpate, Diagnostic blocks, Diagnostic Orthotics

- Verify in more than one way if possible

- Radiographs, Doppler, Joint Vibration Analysis

5. Develop a working diagnosis

6. Diagnosis confirmed after Tx

- Confirm that the patient got better

7. Don't chase a diagnosis too long before ruling out cancer. Cancer is rare but can mimic other diseases.

Suspect Cancer if:

Sudden onset headache in 50+ year old

Numbness

Past history of cancer elsewhere in the body

Pain description not quite the same as other TMD patients.

Pain does not resolve with TMD therapy.

TMJ Damage and Pathology

Adhesions and ankylosis

Avascular Necrosis Mandibular Condyle (AVN)

Bifid Condyle

Cartilage Fibrillation

Closed Lock, Jaw Cartilage, Acute

Closed Lock, Jaw Cartilage, Chronic

Closed Lock, Jaw Cartilage, Intermittent

Crush Injury Mandibular Condyle

Crystal arthropathy, TMJ

Dislocation jaw cartilage with reduction

Dislocation jaw cartilage without reduction

Effusion, TMJ

Fibrosis Retrodiscal Tissue

Fracture of subcondylar process of mandible

Gout, TMJ

Growth Disturbance, TMJ damage prepuberty

Hemarthrosis TMJ, Traumatic

Hydroxyapatite deposition disease

Hyperplasia Mandibular Condyle

Hypoplasia Mandibular Condyle

Hypoxia Reperfusion Injury

Hypoxic Progressive Condylar Resorption

Impingement Retrodiscal Tissue

Inflammatory Tissue Bone Resorption

Malignant neoplasm of bones

Open Lock TMJ, Recurring

Osteoarthritis (OA)

Osteoarthritis (OA)

Osteochondritis Dissecans TMJ

Osteolysis Mandibular Condyle

Osteomyelitis Jaw

Perforation Meniscus, TMJ

Perforation Pseudodisc, TMJ

Pseudo Gout

Psoriatic Arthritis TMJ

Rheumatoid Arthritis (RhA)

Sprain Discal Ligament

Sprain of TMJ, Recurring

Subluxation on Loading, TMJ

Subluxation on Movement, TMJ

Synovial Cyst (Ganglion Cyst)

Synovial Hyperplasia

Synovitis

Villonodular synovitis (pigmented)

TMJ Muscle Hyperactivity Choices

Occlusal Muscle Disharmony (OMD)

Posterior Interferences

Disharmonious Anterior Guidance

Parafunctional Clenching

Parafunctional Grinding

Pain avoidance- TMJ Pain

Joint Stabilization- CR Subluxation

Translatory Slippage

Neck Stabilization

Dystonia

Condylar Bone Loss Choices

Slow- Progressive (Occlusion Adapts)

Osteoarthritis / Osteoarthritis- Lose 0.2mm/yr or less.

Not Slow- Single Event (Anterior Open-Bite Develops)

Avascular Necrosis (AVN)

Not Slow- Progressive (Anterior Open-Bite Develops)

AVN followed by Inflammatory Tissue Bone Resorption (ITBR)

Hypoxic Progressive Condylar Resorption (HiPCR)

Rheumatoid Arthritis

Severe Osteoarthritis

Infection- Lyme Disease, Syphilis

Others- Crystalline Deposition, Cancer, Psoriatic Arthritis

Note: Adaptation after rapid bone loss stops may close open-bite over time.

Anterior Open Bite Choices

Pre-Puberty

Genetic

Damage to TMJ growth center

Habit- Thumb, Finger, Pacifier, Tongue

Airway/ Mouth breather

Post-Puberty

TMJ has changed

TMJ Bone Loss (See bone loss choices)

Recent Large Disc Displacement

Condylar Fracture

Teeth have moved

Tongue- used as occlusal cushion

Tongue used to stabilize neck or TMJ

iatrogenic- Orthotics, Retainers

Mandibular Asymmetry Choices

Pre-Puberty

Damage to TMJ growth center

Birth Trauma

Post-Puberty

Class2 = Condylar bone loss

Class 3 = Condylar Hyperplasia

Posterior Open Bite Choices

TMJ has changed

Condylar Hyperplasia

Synovial Hyperplasia

Acute Sprain joint effusion

Teeth have moved

Tongue- Used as cushion.

iatrogenic- Orthotics, Retainer

Differential Diagnosis- What are the choices?

Symptom

Nonpainful click

Painful Click

Limited opening**

TMJ tenderness

Sore Masseter

Sore Lateral Pterygoid

Sore Deep Temporalis

Pain on loading TMJ

No Pain on TMJ Load

Pain above the eyes

Migraine headache

Sudden Onset Headache:

Acute Pain Left jaw

Disharmonious Movement

Severe Chronic Pain

Differential Dx

Piper 4a well adapted

Piper 4a poorly adapted

Piper 3a well adapted

Piper 3a poorly adapted

Adhesed disc- Piper 4a

Adhesion click, Piper 4b

Sticky disc click

Eminence thud

Piper 4a poorly adapted

Piper 3a poorly adapted

Acute sprain

Retrodiscal impingement

Synovitis

Eminence thud/ sprain

Pain Avoidance

Arthralgia- sore joint

Myalgia- sore muscle

Muscle Spasm

Acute Nonreducing Disc- 4b,3b

Masseteric space infection- Molars

Joint Adhesions

Muscle Fibrosis

Metal Screw into Medial Pterygoid

**Permanent damage to joint and muscles after 6 weeks

Synovitis

Cystic degeneration- OA

AVN, HiPCR, ITBR

Acute sprain

Ear infection

Splinting/Clenching-TMJ Subluxation

Splinting/ Clenching- Neck Stabilize

Splinting/ Pain avoidance- OMD

Splinting/ Pain avoidance- TMJ pain

Splinting/ Pain avoidance- OMD

Splinting/ Pain avoidance- TMJ pain

Anterior Posturing severe Class 2

Splinting- TMJ Subluxation w/ load

Retrodiscal impingement

Cystic bone degeneration

Lateral Pterygoid splinting

May or may not be healthy/stable

Referred pain from neck

Sinus

C1 - C2 - Skull misalignment (90%)

10% something else

Muscle spasm, Brain Tumor, other

Heart Attack, other

Mechanical- disc is in the way

Pain avoidance

Joint stabilization of subluxation

Neck stabilization

CNS: Dystonia, Brain Cancer, CVA

RSD/CRPS

Central Sensitization

Psychological- secondary gain

CR orthotic not working

Verify CR orthotic well executed:

No rocking- orthotic hard, solid fit

No Nonworking or working interferences

No Anterior Arc of Closure Interferences

Painful CR

Disharmonious Anterior Guidance- Condylar Guidance has changed

Joint Subluxation - CR joint subluxation on load

Joint Subluxation- Translatory disc slippage

Neck

Other- Not an Occlusal Problem

D-PAS Interpretation

Pain improvement from PM only DATPAS wear

Pt clenches at night. Continue to use DATPAS as night guard.

Additional Pain improvement from 24/7 DATPAS wear

Occlusal Muscle Disorder

Verify Dx with 3-6w CR Orthotic 24/7

Tx- Occlusal Adjustment

Pain is Worse- Differential Dx:

Pain in CR Load Zone, tissue or bone.

Joint subluxation under load