Big Sky Tanner 2

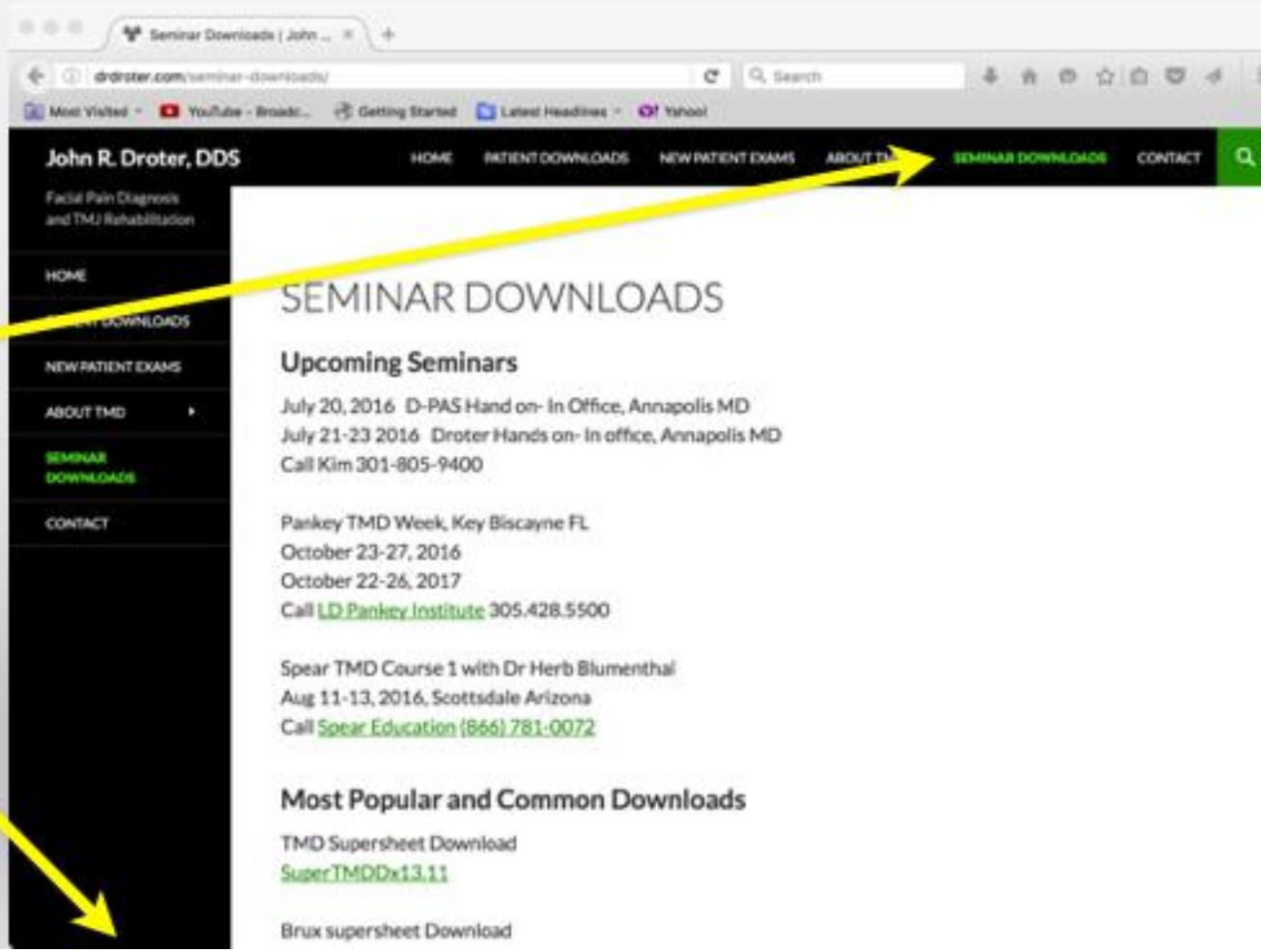
John R Droter DDS
Annapolis, Maryland

John R Droter, DDS

To get todays lecture slides:
go to www.jrdroter.com

Seminar Download

Big Sky 2

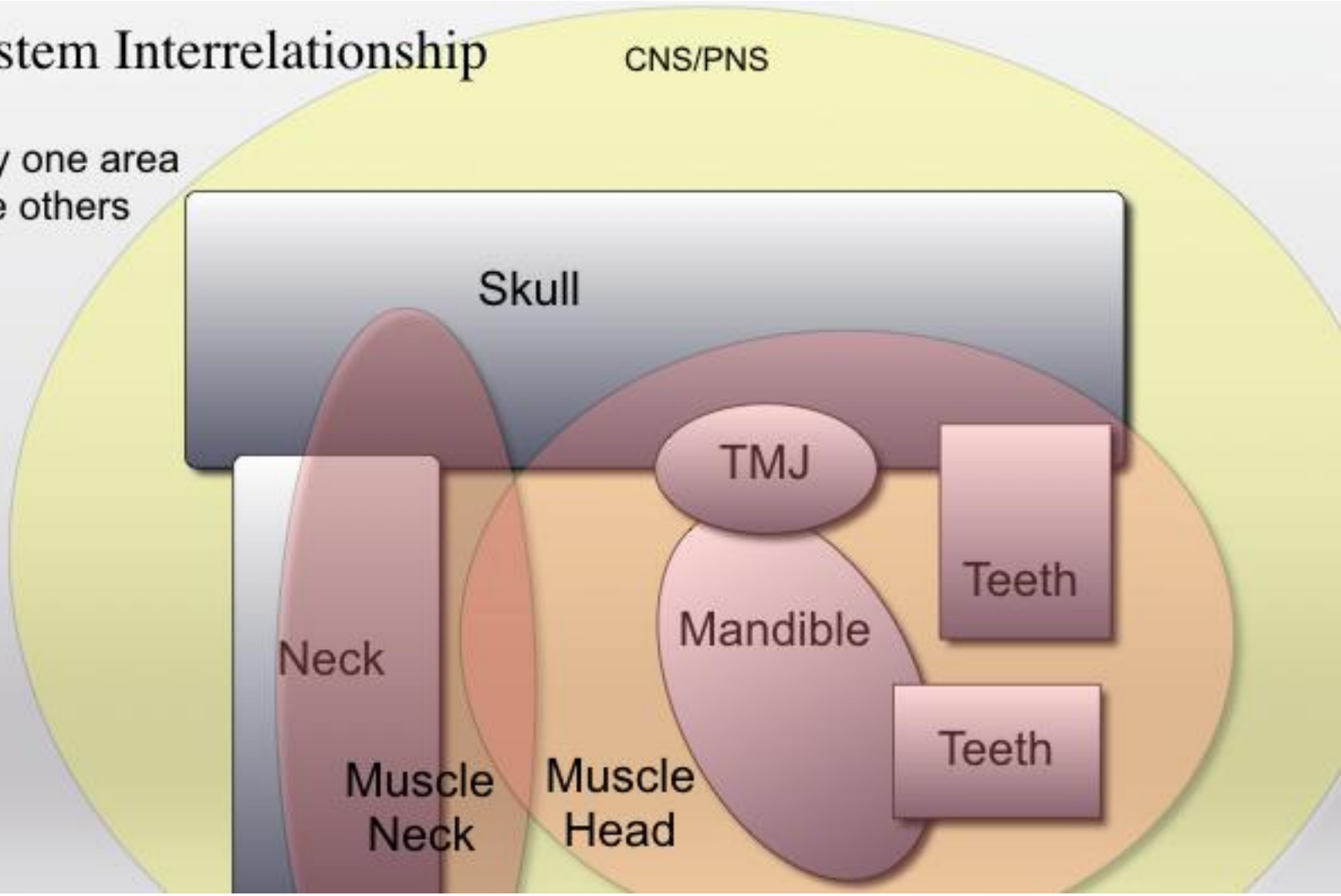


Stomatognathic System Interrelationship

A change in any one area will affect the others

"Adaptation"

This is a **dynamic** orthopedic System



venn diagram

What is a Click?

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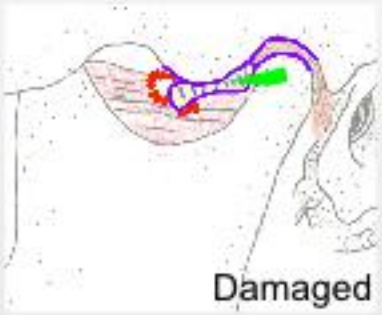
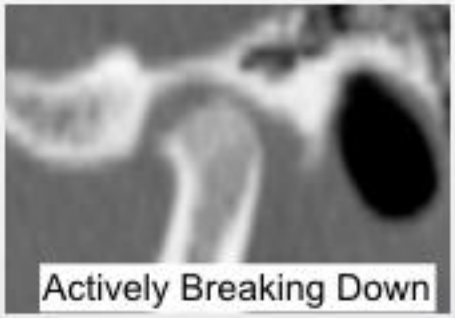
Basic Orthopedics

Joints are either
- Healthy or
- Damaged

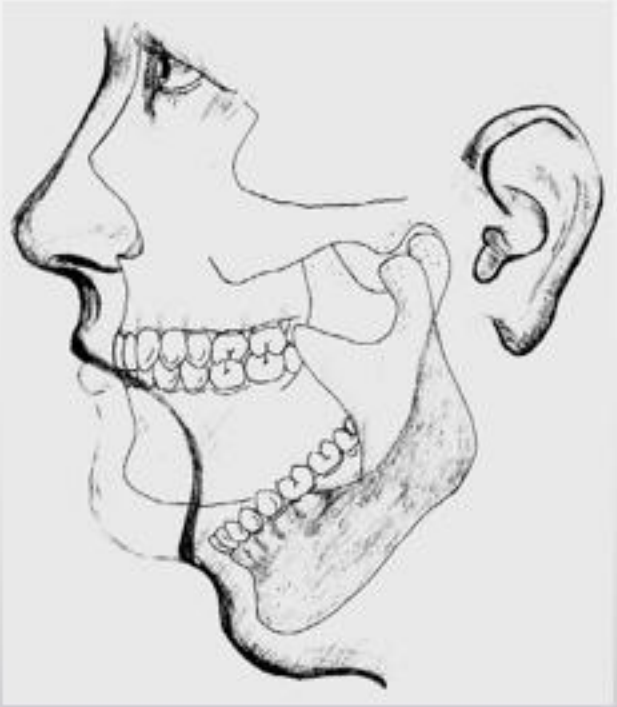

Healthy


Damaged


Actively Breaking Down

If damaged, joints will be either:
- Actively Breaking Down
- Adapting
- Adapted Favorably Structurally and Mechanically
- Adapted Unfavorably

Rotate
Slide
Pivot

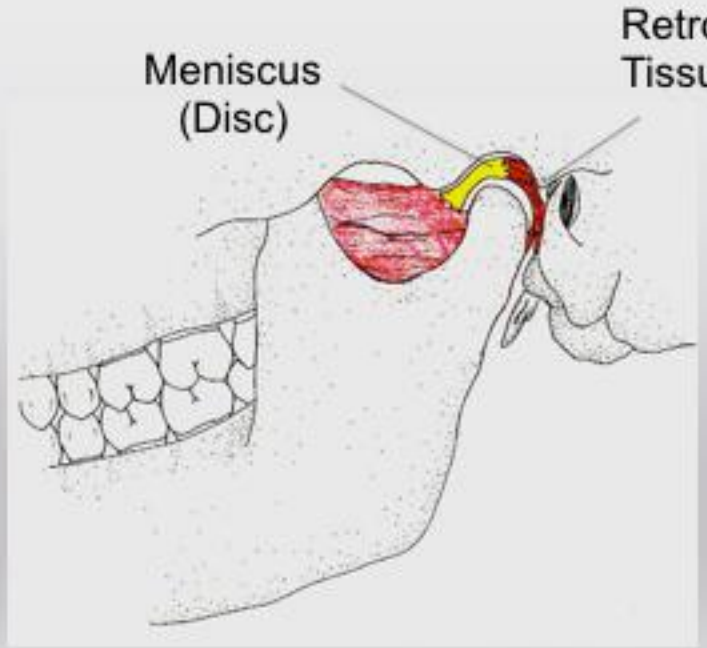


Solid end point closing
Ligamentous end point opening

A joint joins two bones that allows movement between the two bones

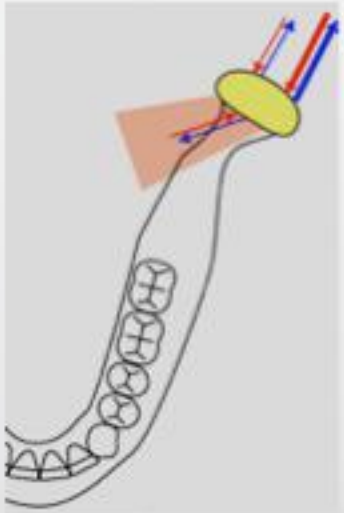
TMJ has 2 Joint Compartments:

Upper- Translation
Lower- Rotation



Oblique Sagittal View

Axial View



Normal TMJ Blood Flow, Marrow

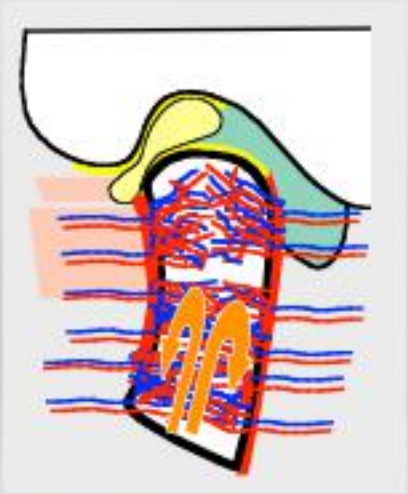
Condylar head limited collateral circulation

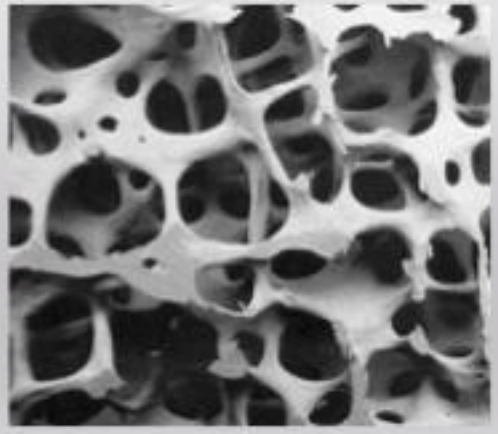
Epiphyseal growth center

Marrow is fatty tissue with blood vessels, containing the precursor for blood cells

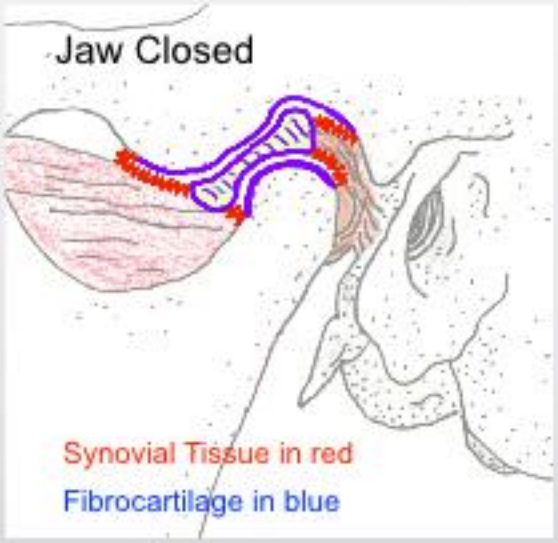
No Blood vessel inside joint

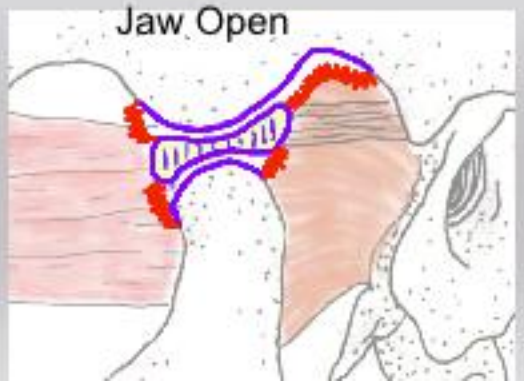
Closed Sagittal





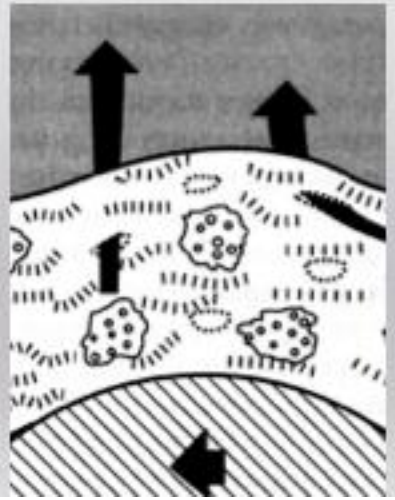
Normal TMJ- Synovium, Cartilage



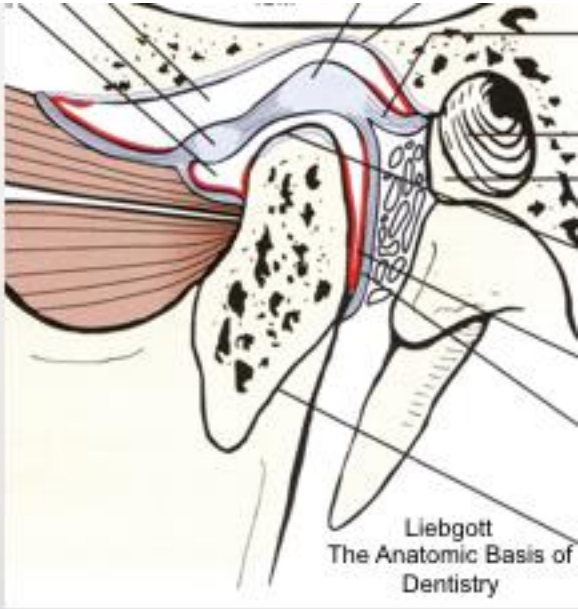


Fibrocartilage-
- Slope of Eminence
- Disc
- Top of Condyle

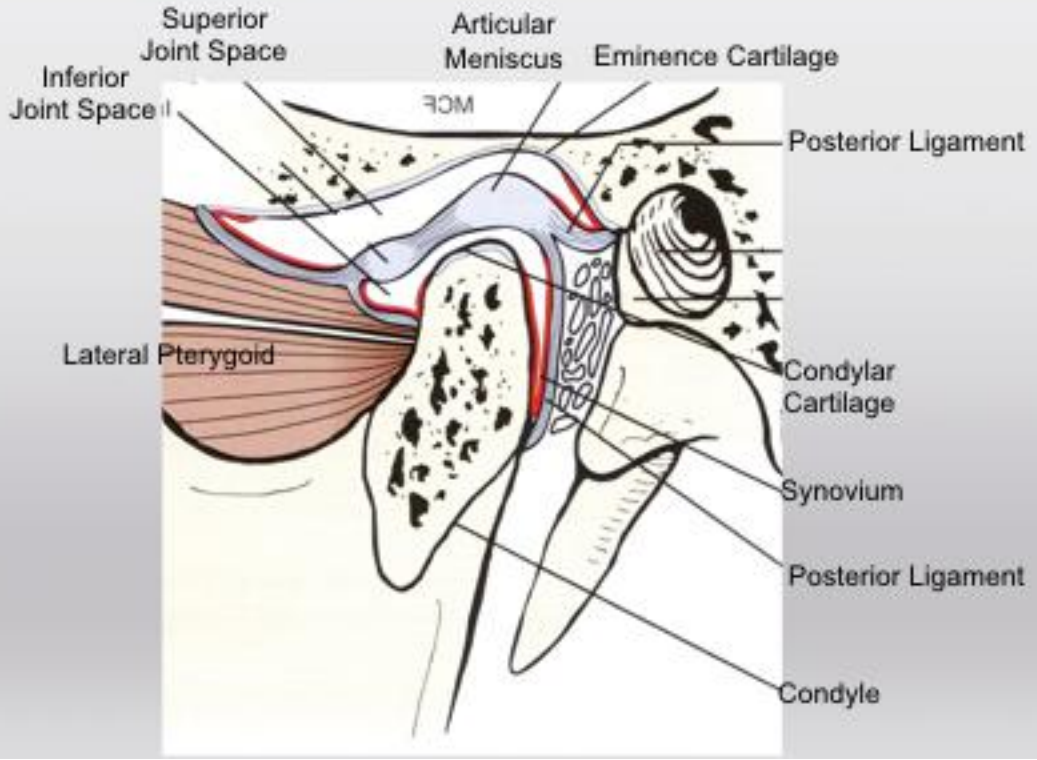
Synovial Tissue makes Synovial Fluid
- No blood vessels in a health joint
- Nutrition to the cartilage cells
- Lubrication- Hyaluronic Acid and Lubricin



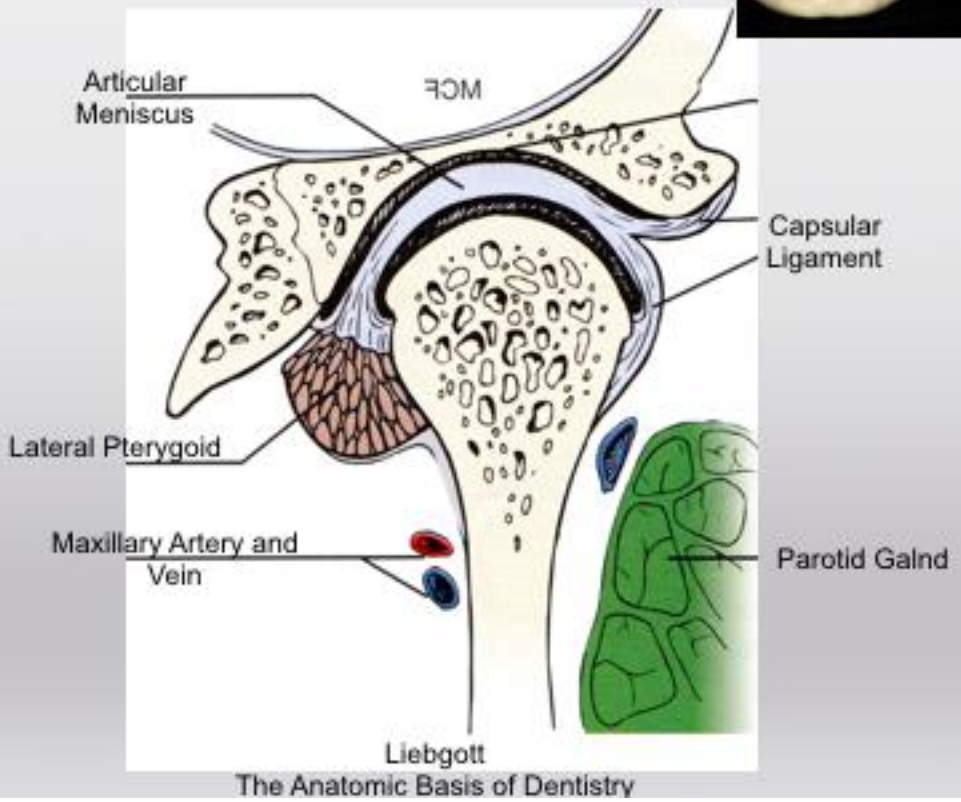
Fibrocartilage surface covered in fluid
- Cartilage is hydrophilic
- Proteoglycan negative charge
- Surface Active Phospholipids
- Fluid slides against fluid
- 5x slipperier than ice



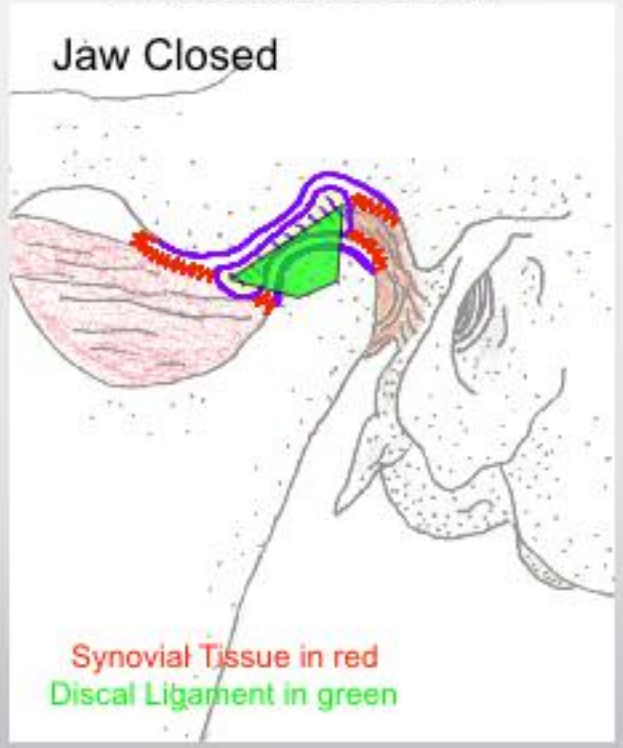
Left TMJ Sagittal View



Left TMJ Coronal View



Normal TMJ



Discal Ligaments attach Disc to Condyle

Synovial Tissue
- Covers Front , Back and Sides
- Collapsed due to negative joint pressure

Disc viewed from above

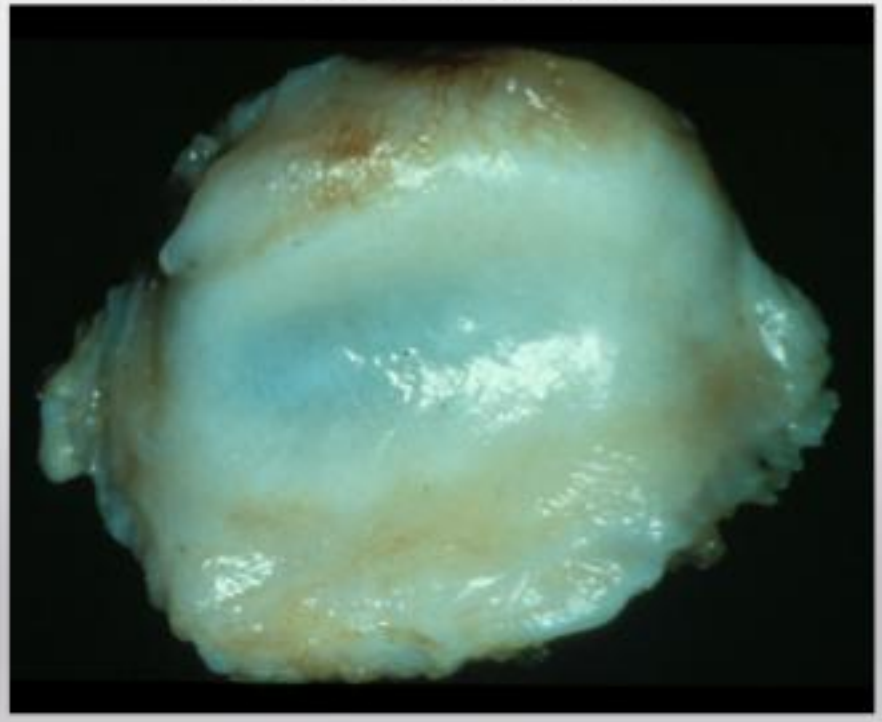
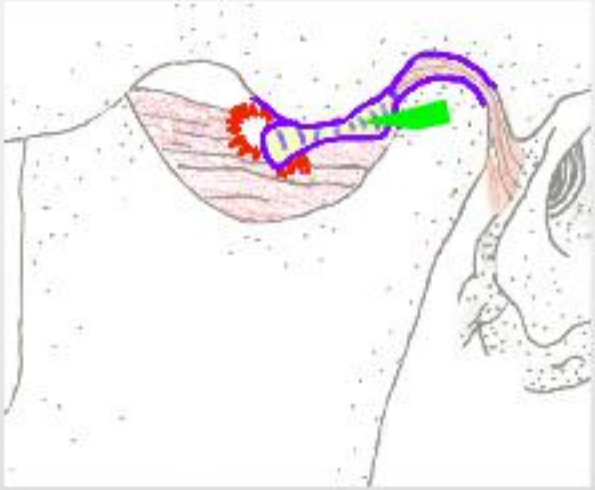


Photo Courtesy of Dr Henry Gremillion

Damaged TMJ- Anteriorly Dislocated Disc



Torn or stretched Meniscal ligaments

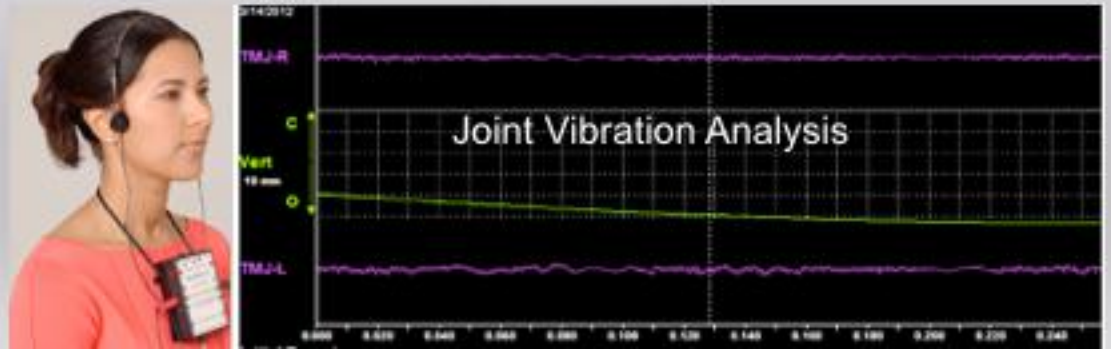
Anterior Dislocated Disc

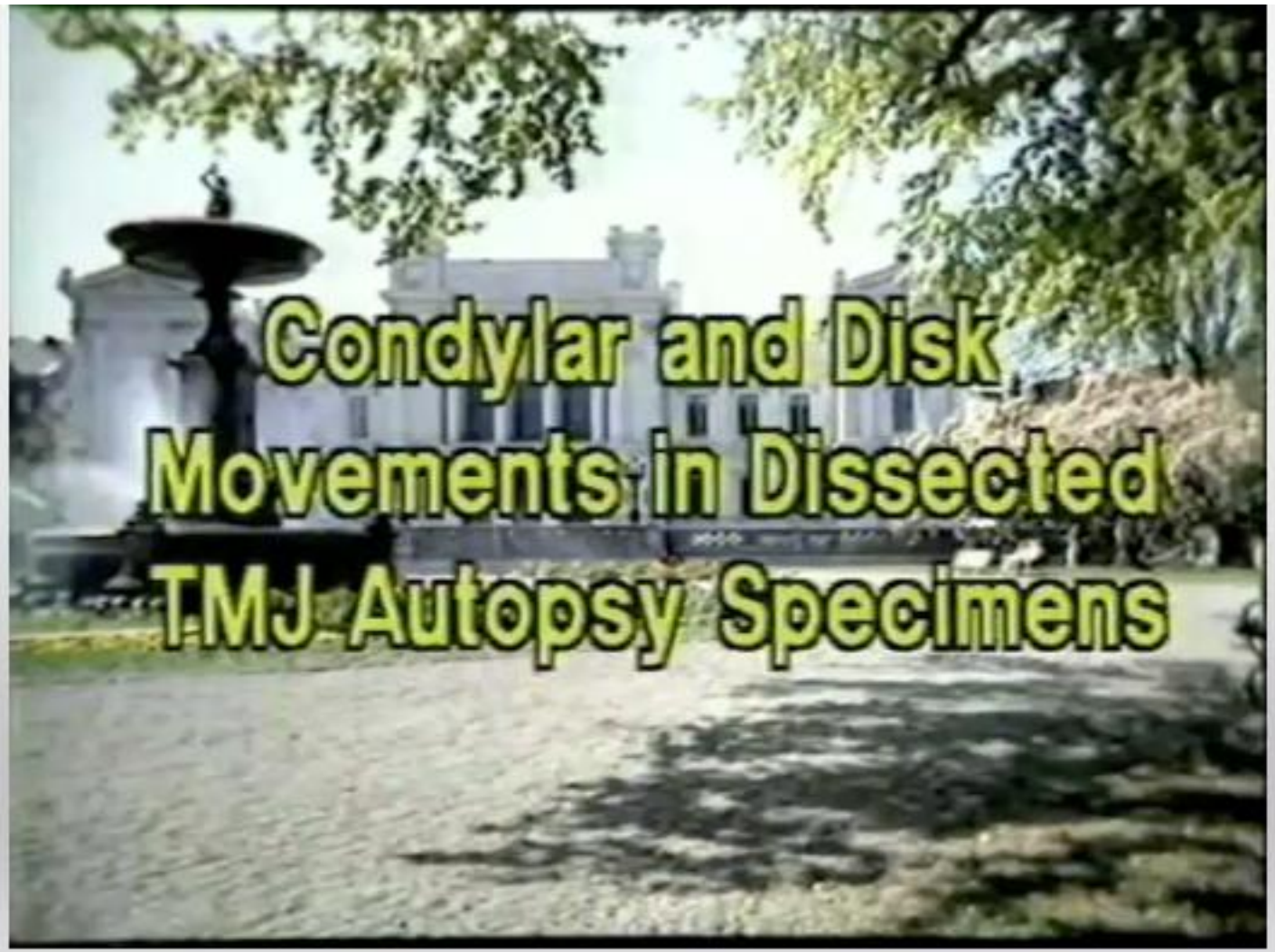
Damaged Synovium

Retrodiscal Tissue pulled up and over the condyle
- Retrodiscal tissue in direct contact with fibrocartilage
- Major Increase in friction
- Retrodiscal tissue adapts into fibrous “pseudodisc”

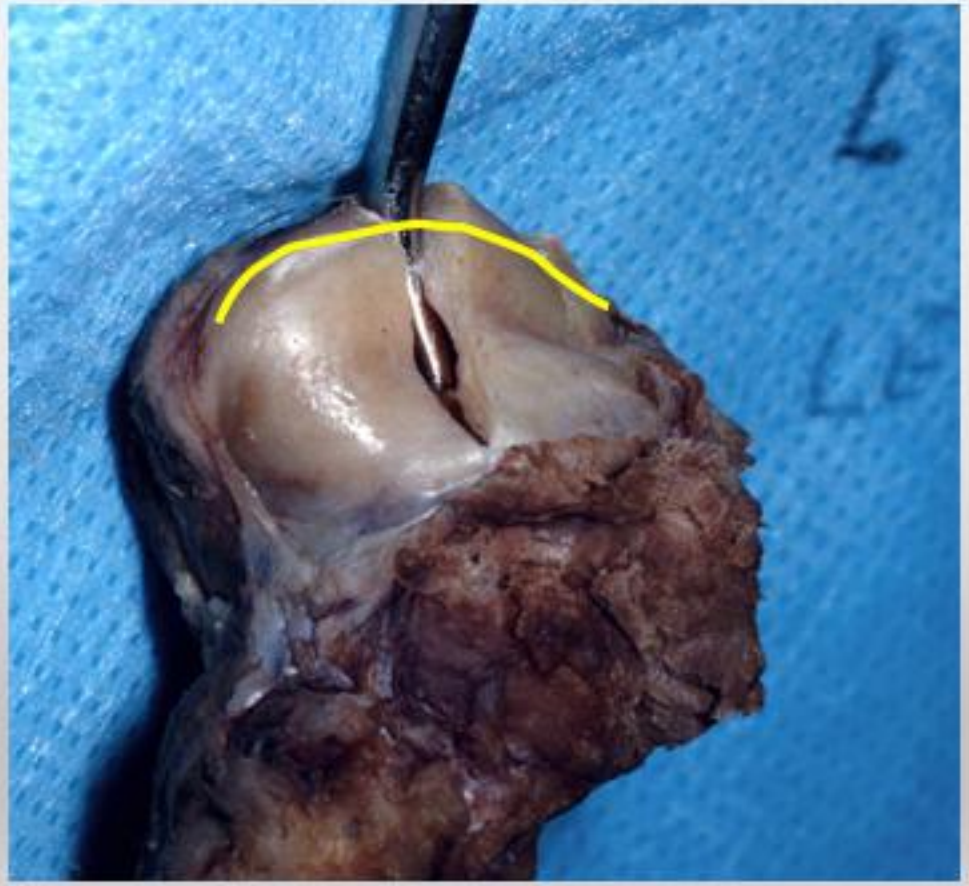
85% of all damaged joints adapt favorably without treatment

Cartilage sliding on tissue creates vibrations that can be detected



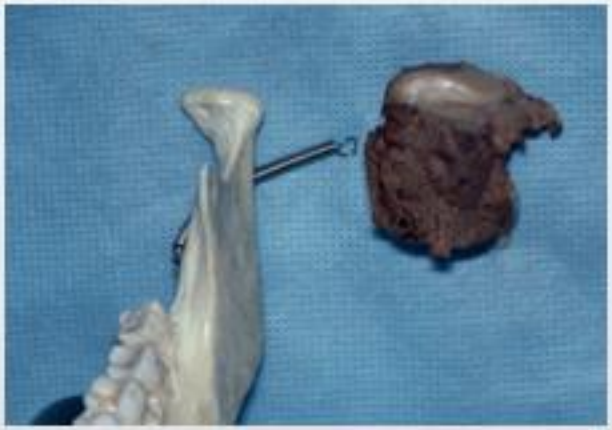

Condylar and Disk
Movements in Dissected
TMJ Autopsy Specimens

Left TMJ
Normal Disc postion
Thick posterior band sits on top of condyle

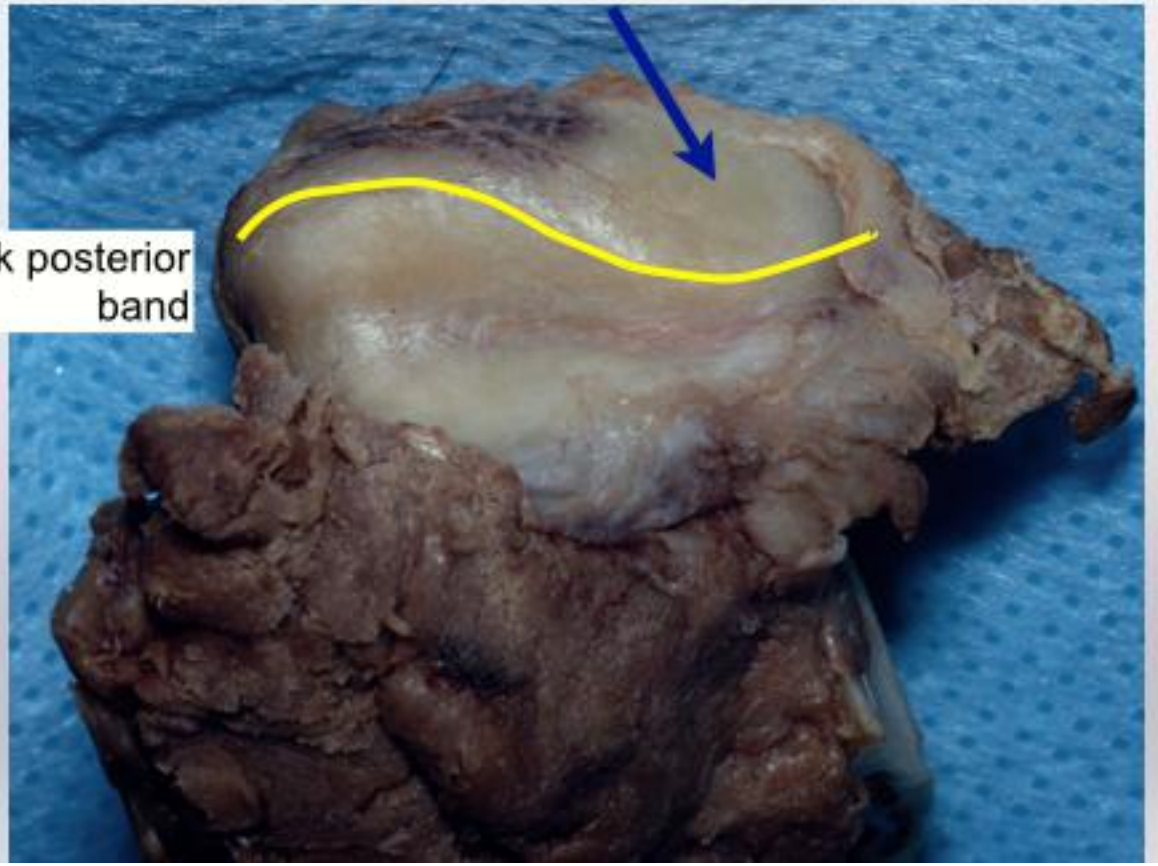


Lateral

Left TMJ Piper 3

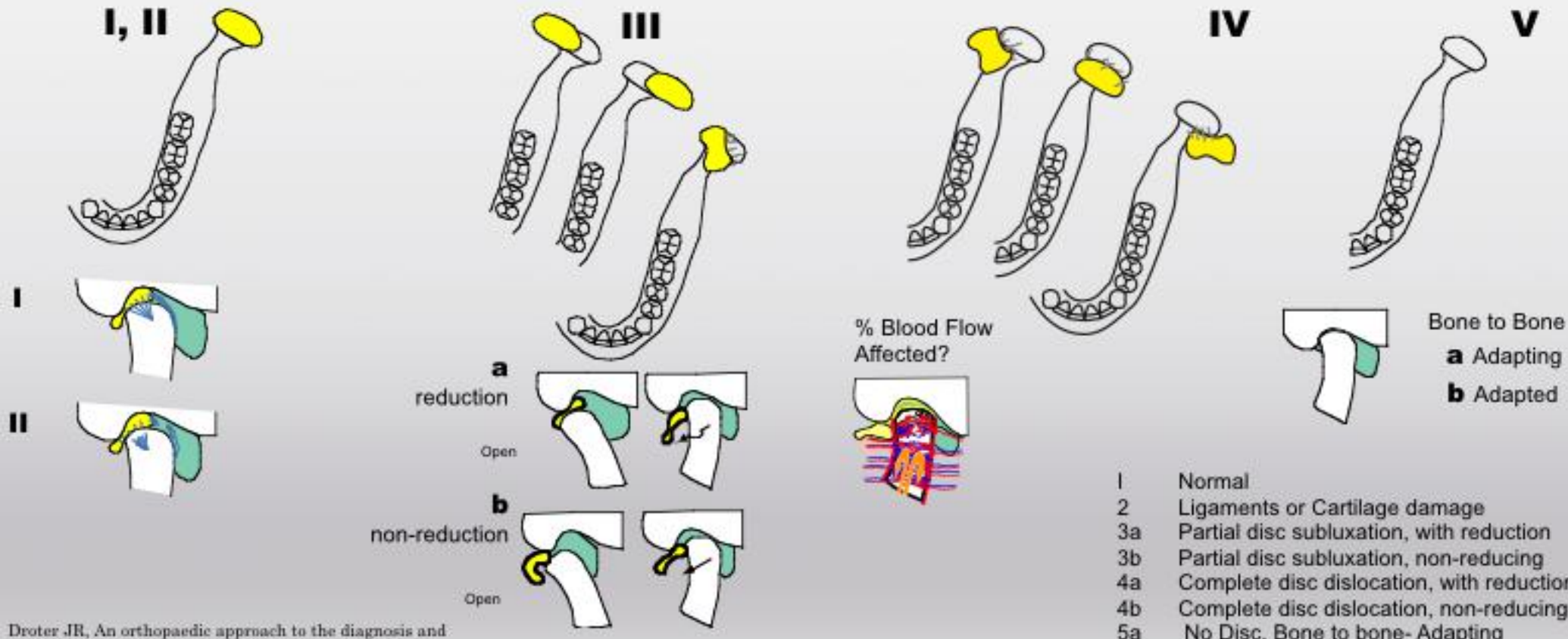


Pseudo-disc
Fibrous adaptation of displaced retrodiscal tissue



Dr. Mark Piper's Classification

Left TMJ



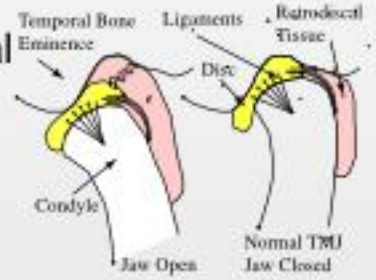
I	Normal
2	Ligaments or Cartilage damage
3a	Partial disc subluxation, with reduction
3b	Partial disc subluxation, non-reducing
4a	Complete disc dislocation, with reduction
4b	Complete disc dislocation, non-reducing
5a	No Disc, Bone to bone- Adapting
5b	No Disc, Bone to bone- Adapted

Droter JR, An orthopaedic approach to the diagnosis and treatment of disorders of the temporomandibular joint. Dent Today 2005 Nov;24(11):82, 84-8

Differential Diagnosis of TMJ Clicking

Disc Reduction

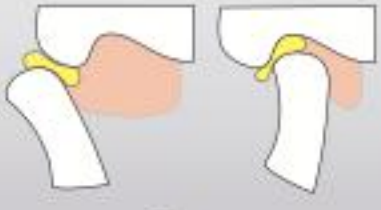
Normal



Adhesive Click

"Sticky Disc" - Disc sticks after prolonged clenching, then releases

Eminence Thud

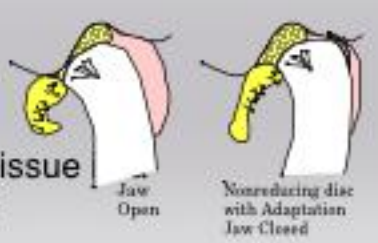


A hypermobile condyle moves past the crest of the eminence and makes a thud sound

3a Condyle Distalized, Disc is in proper location, Lateral pole click on translation

Adhesion Crackle

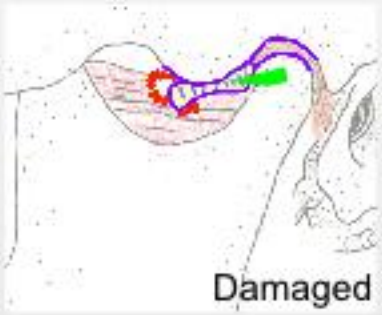
A small piece of fibrous tissue 4b joint is moved across

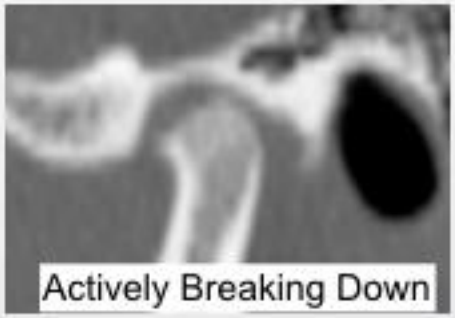


Basic Orthopedics

Joints are either
- Healthy or
- Damaged


Healthy


Damaged


Actively Breaking Down

If damaged, joints will be either:
- Actively Breaking Down
- Adapting
- Adapted Favorably Structurally and Mechanically
- Adapted Unfavorably

TMJ Imaging: When and How?

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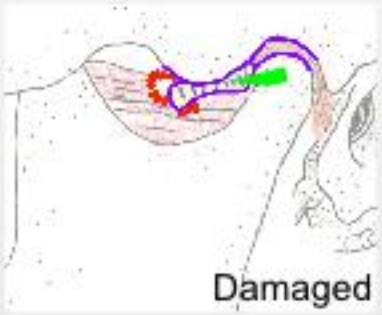
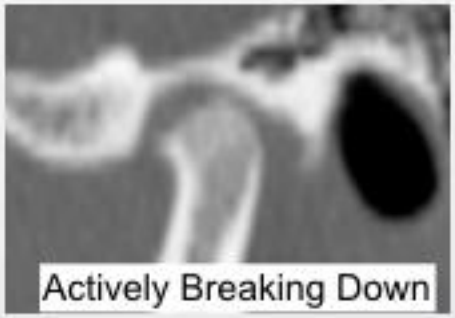
Detailed

Basic Orthopedics

Joints are either
- Healthy or
- Damaged


Healthy


Damaged


Actively Breaking Down

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Facial Pain Diagnosis

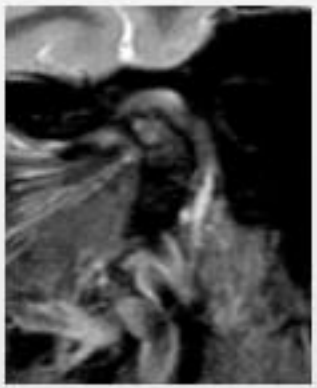
Diagnostic Tools

1 Written and Oral History
2 Observation
3 Physical Exam
- Muscle Palpation
- Joint Palpation
- Joint Auscultation
- Joint Motion

4 CT Scan
5 Dx Orthotic- D-PAS
6 Sleep Airway Screening
7 MRI

<u>Biometrics</u>
- Joint Vibration
- Jaw Tracker
- Electromyography
- T-Scan

Occlusion: CR Mounted Study Models
Complete Dental Exam
Clinical Photographs
Dx Blocks
Blood test
Dx Orthotics- Brux Checker, CR Orthotic



Facial Pain Diagnosis

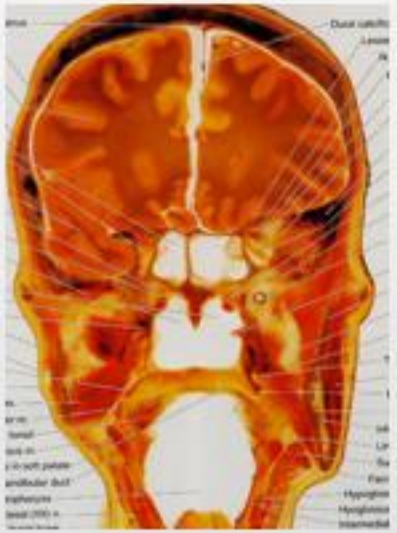
Diagnostic Tools

1. Written and Oral History
2. Observation
3. Physical Exam
   - Muscle Palpation
   - Joint Palpation
   - Joint Auscultation
   - Joint Motion

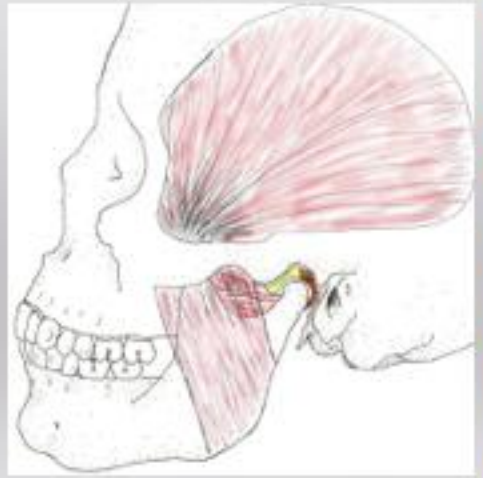
The 6 Most Important Muscles

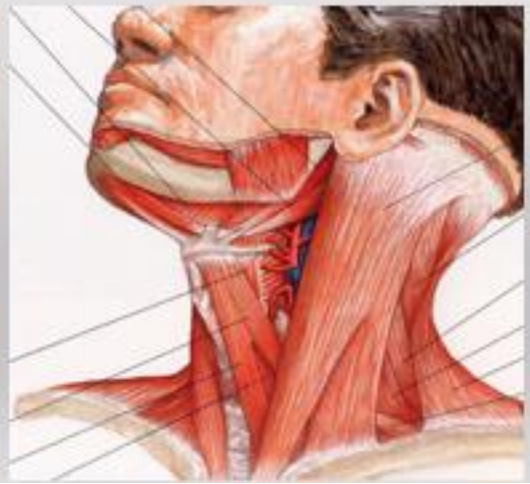
Anterior Temporalis
Masseter
Lateral Pterygoid

Deep Temporalis
Posterior Digastric
Superior Oblique Capitus



TMJ Anterior Lateral Pole
TMJ Posterior Lateral Pole





CT Scans

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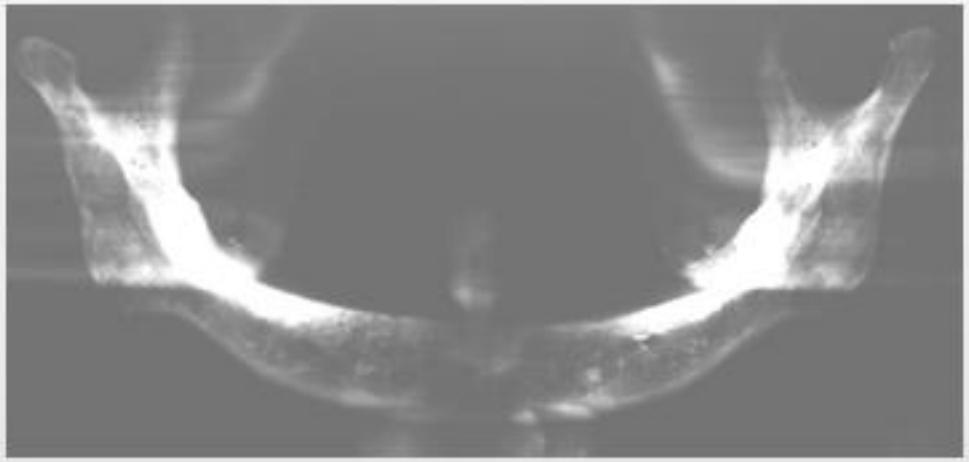
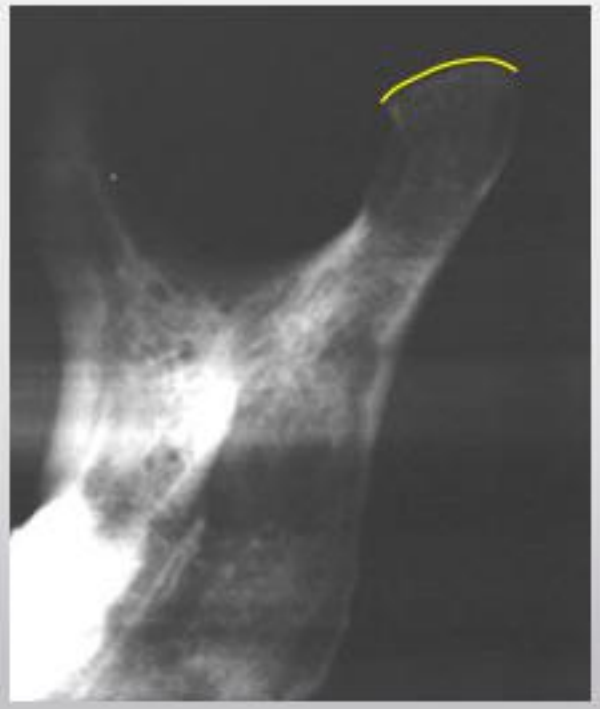
Pan-X of Skull
Mandible



Note: This Mandible had plastic teeth added

Pan-X not Accurate

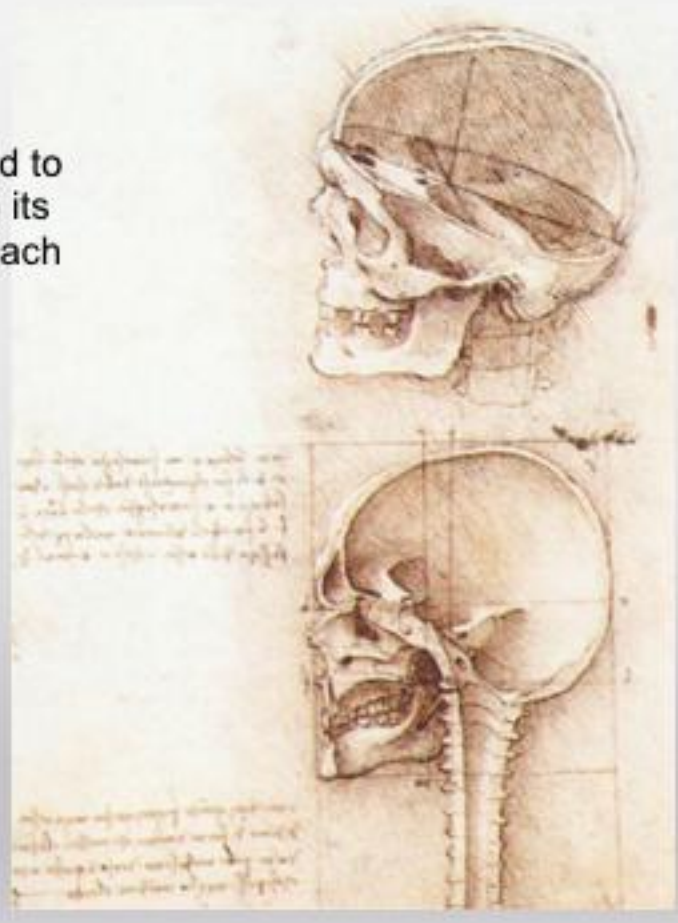


Fallon S, Fritz G, Laskin D, Panoramic Imaging if the Temporomandibular Jointa: An experimental Study Using Cadaveric Skulls. J Oral Maxillofac Surg 64:223-229, 2006

Leonardo da Vinci

Year 1510 - 500 years Ago

If you wish thoroughly to know the parts of the man anatomically, you are required to see it from different aspects, considering it from below and from above and from its sides. Therefore my drawings will demonstrate three different points of view for each part.

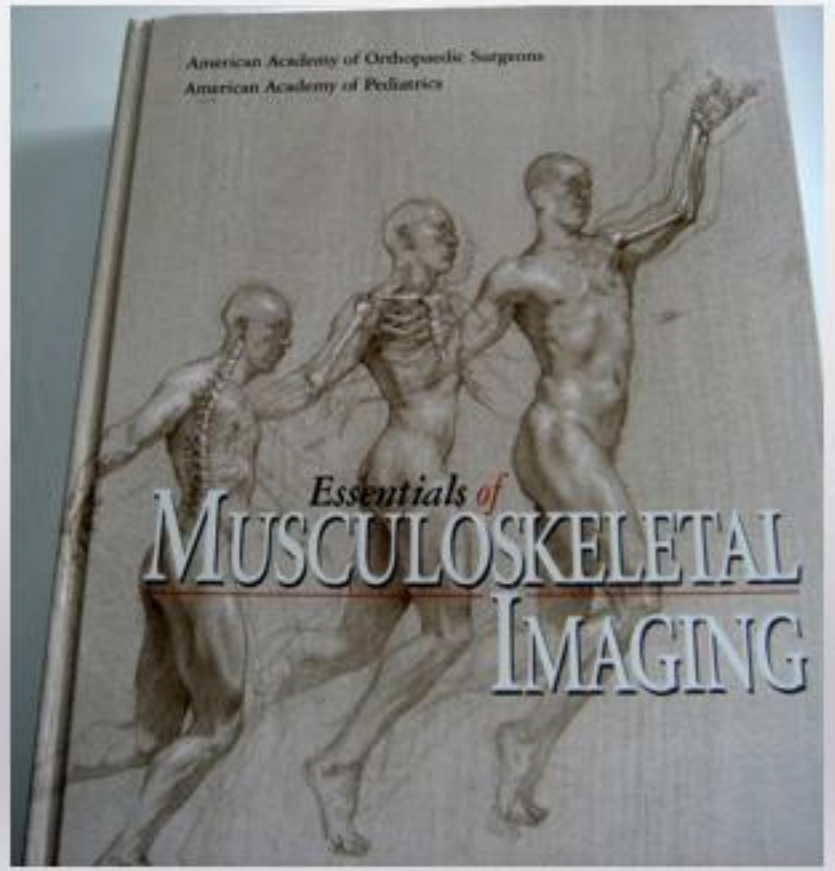


First Scientist to do Cross-sectional anatomy Drawings

Medical Standard of Care: Radiology of Damaged Joints

Standard Radiographs
- 3 views
- Minimum of 2 views 90º to each other

MRI scan in addition if suspect meniscus damage



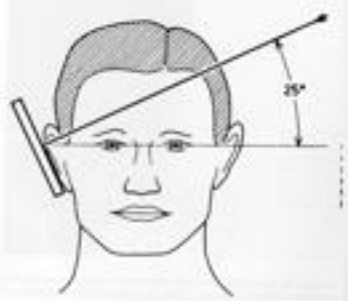
Options to See TMJ Bone

Standard Radiography
- Transcranial
- Transcoronal
- Submental Vertex

Spiral Computerized Tomography (CT)
with Multiplanar Reconstructions

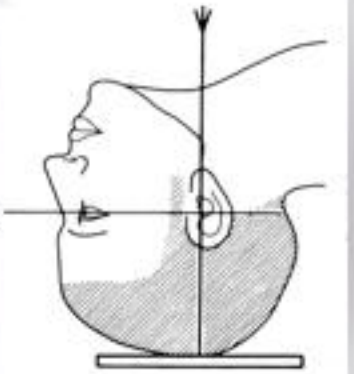
Cone Bean Computerized Tomography (CBCT)

Transcranial



Transcoronal

Submental Vertex



Computerized Axial Tomography (CT, CAT)

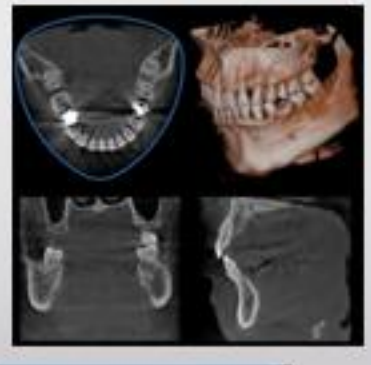
Spiral CT Scanner
12 sec acquisition Time

Note: prior to 2001 CT Scan took 25 min

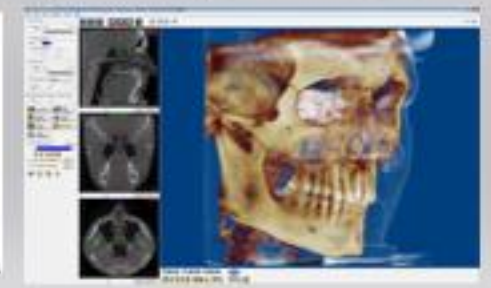
Cone Beam CT Scanner
20 sec acquisition time

iCAT

MORITA
Thinking ahead. Focused on life.



NewTom
what's next



Spiral CT

Note Suture Lines

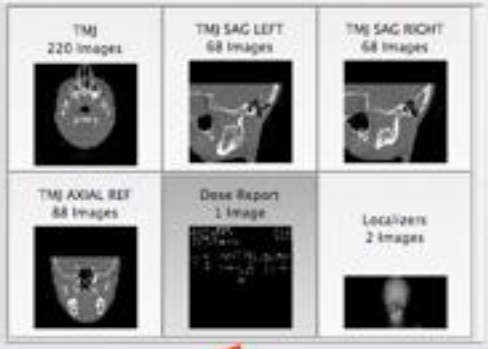
iCAT- Same Patient

Much less Resolution and Contrast

??Cortex R Condyle??

Radiation Exposure Comparison

Daily Background/day	0.008 mSv	
Panoramic	0.02 mSv	
1 Trans Atlantic Flight	0.03 mSv	
Chest Film	0.1 mSv	(0.1-0.2 mSv)
i-CAT Head	0.1 mSv	
Full Mouth Series Digital	0.12 mSv	
Full Mouth Series F Speed	0.17 mSv	
Conventional CT Head	0.5 mSv	
Spiral CT Head	2.7 mSv	
Daily Background/year	3.1 mSv	
Airline Crews	4.6 mSv/year	
Highest Safe Dose	20 mSv/year	
Max Exposure US Worker	50 mSv/year	



Spiral CT Dose Report
1244 mGy/cm x .0022 = 2.7 mSv

Gy= Gray (Joules/kg)
Sv=Sievert (Joules/kg)

Spiral CT 27x more than CBCT, but about half of airline crews yearly exposure.

MRIs have no Radiation.
Radiation is cumulative over lifetime.
Safe dose of a harmful substance?

Orientation Terminology

Often Sagittal refers to corrected Sagittal

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

CT Scan
Coronal View

CT Scan
Sagittal View

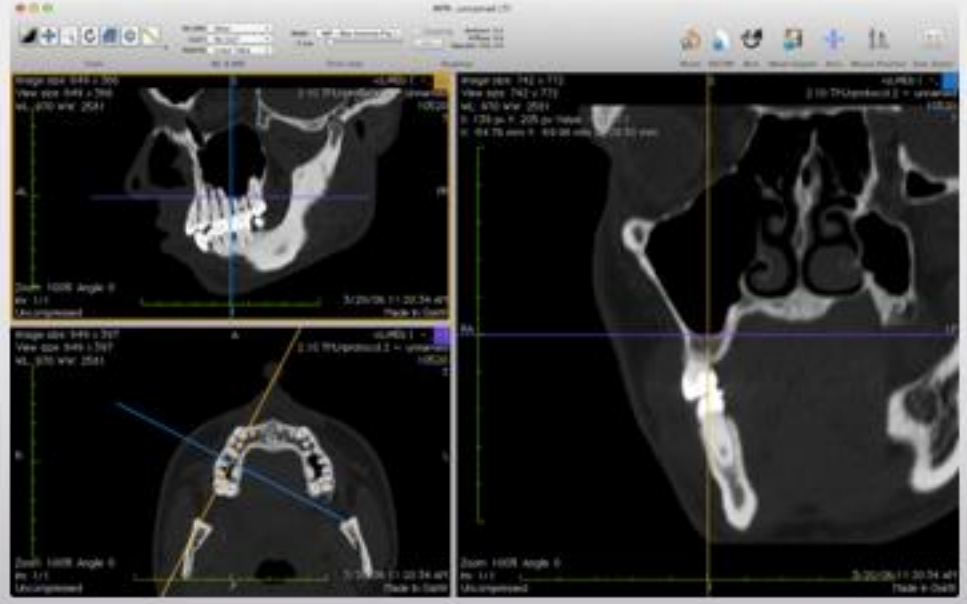
Would you do full mouth rehabilitation with only a set of bitewing radiographs?

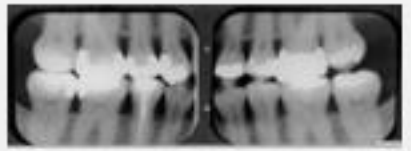
If you need to see all of the tooth surfaces,
why would you not want to see all of the TMJ surfaces?

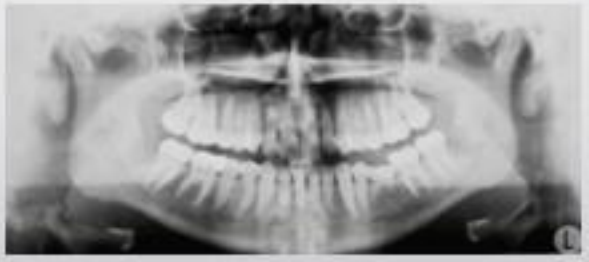
FMX, PanX

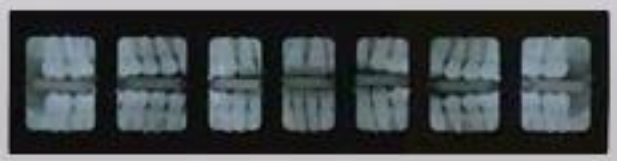
FMX, CBCT

CBCT, 7 vertical BW







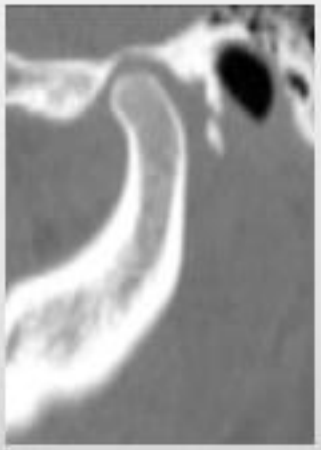


2.5x more PAP found With CBCT

Patel S, Wilson R, Dawood A, Mannocci F., Detection of periapical pathology using intraoral radiography and cone beam computed tomography - a clinical study. Int Endod J. 2011 Dec 21

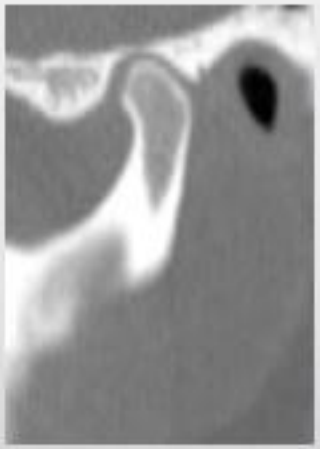
Which Disc is out?

R Sagittal

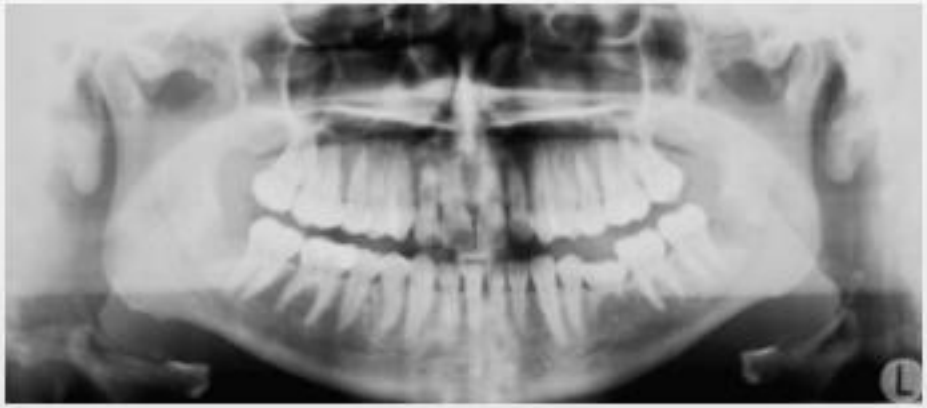


Coronal View

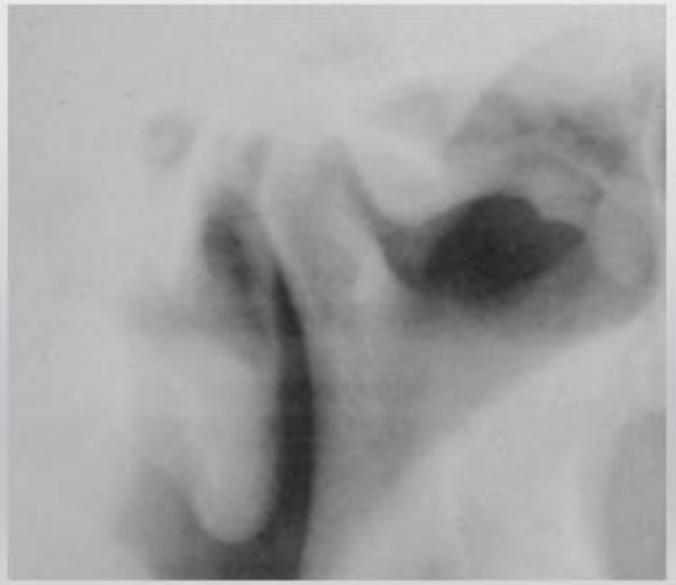
L Sagittal

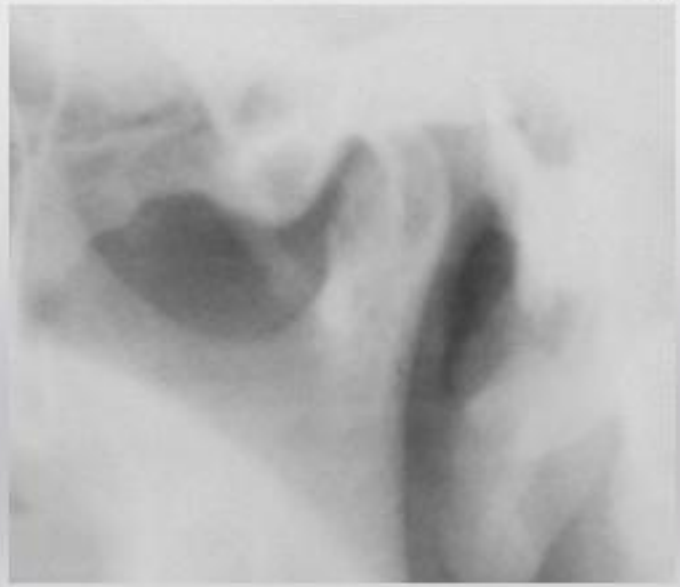


Age 25
Psych Tx R Facial Pain

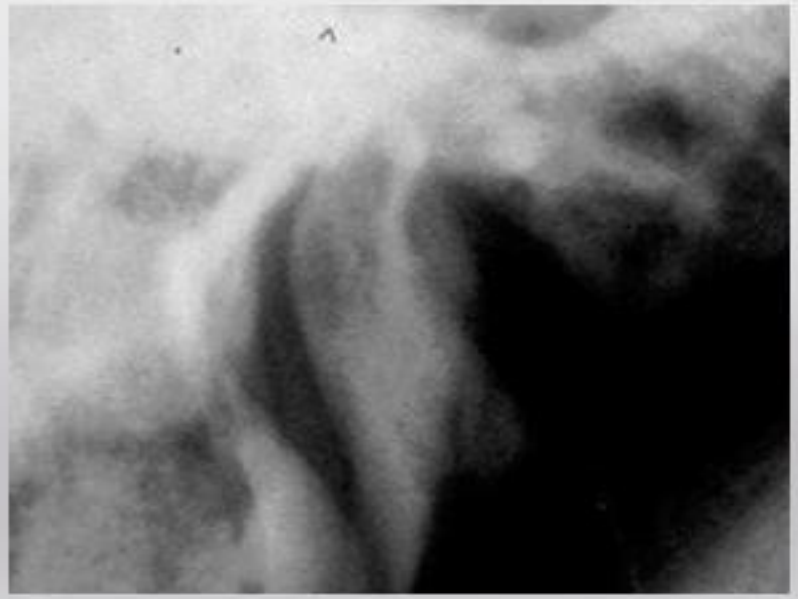


Panorex

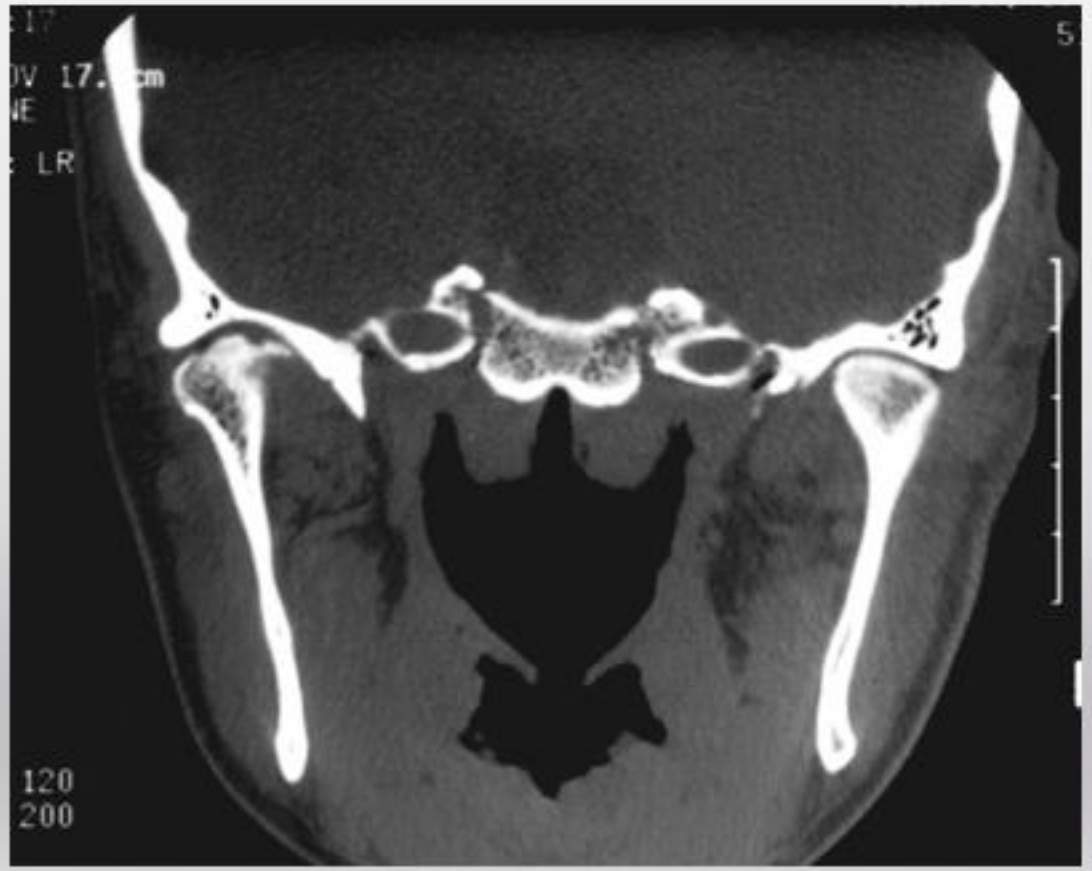




Transcranial
Right TMJ



CT scan
Age 25



Right

Left

CT - Show YB 1,1

Editing Note:
I have chosen to use in my presentations the best representative views of a patient's CT or MRI scans. Many views are left out in the interest of time and to simplify the learning process for those just beginning scan interpretation. I find teaching principles in 2 dimensions is easier for most doctors. I do offer a hands on course where I use cases that all angles and images are used allowing one to refine the skills of viewing a joint 3 dimensionally.

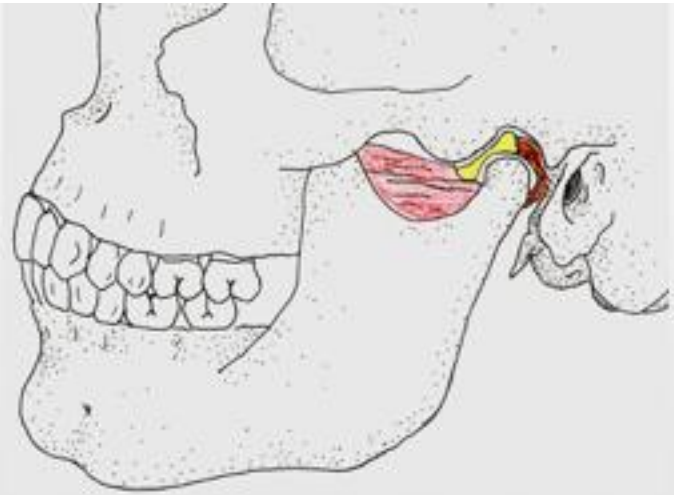
MRI Scans

John R. Droter, DDS

Annapolis, Maryland

MRI- T1 Oblique Sagittal View

MRI you can see soft tissue



Find the...

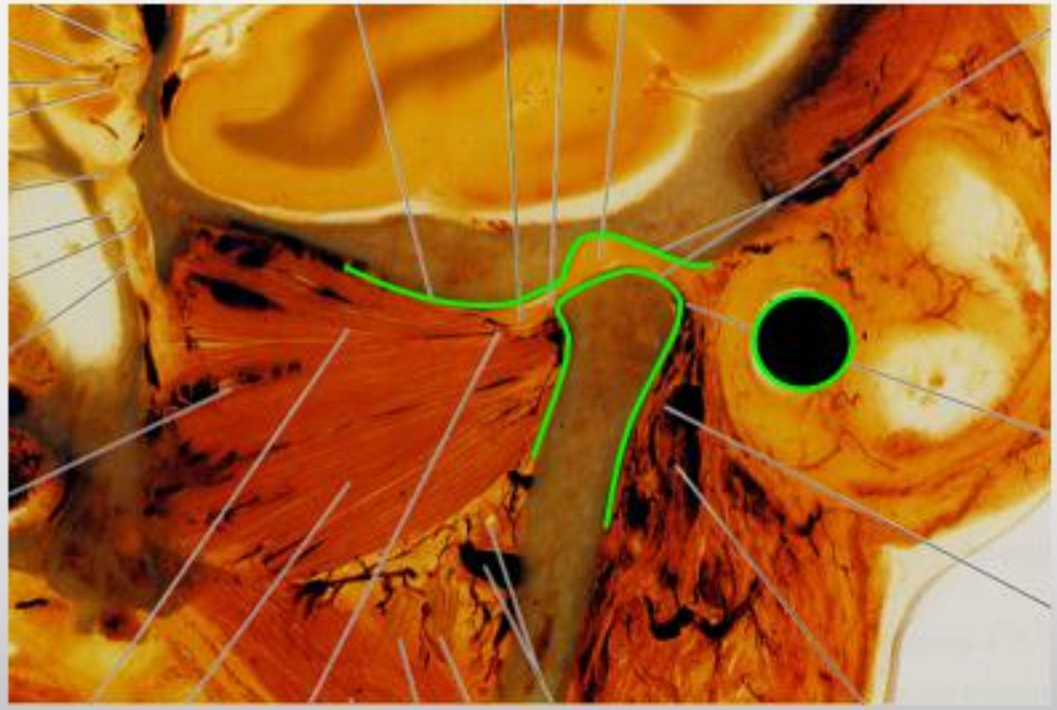
Ear

S-shaped Bone

Condyle

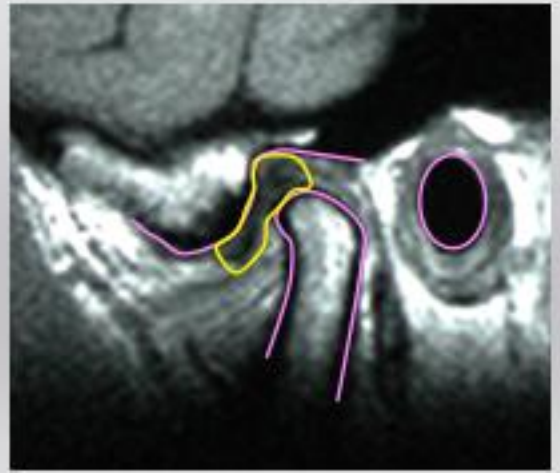
Disc

Oblique Sagittal View

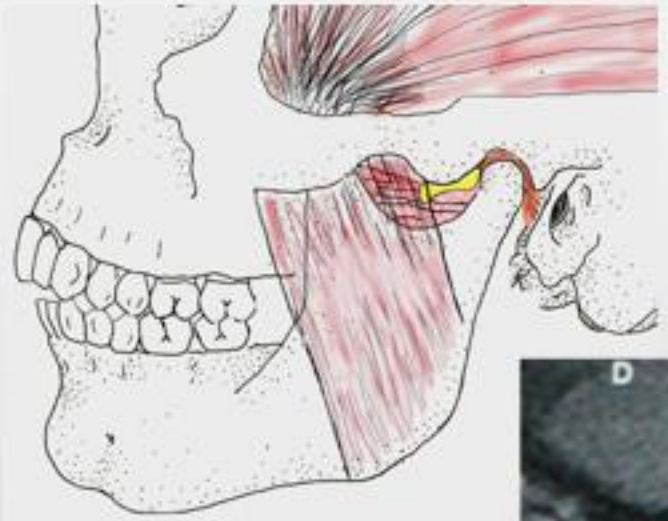


T1 Inverted

T1 Sagittal Closed



Dislocated Disc and Condyle Subluxation



MRI Scanners

MRI Scanner
1.5 Tesla
Magnet Strength

Open MRI Scanner
0.7 Tesla

Dual TMJ Coils

Shoulder Coil

How an MRI Works

Magnet lines up protons: Water and fat

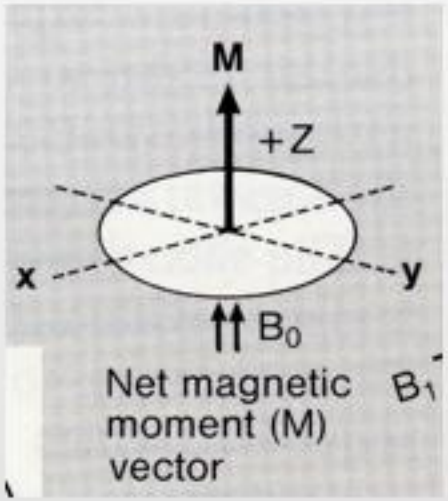
- Magnet is on the whole time

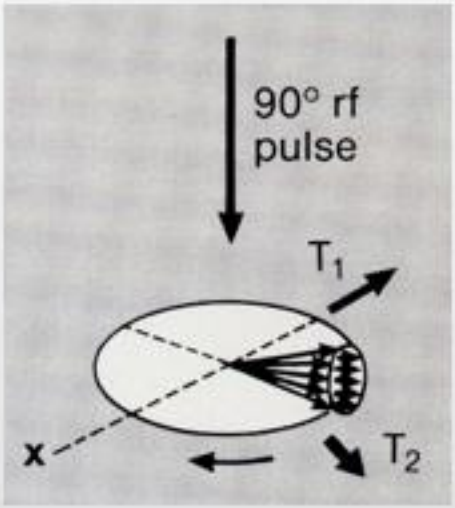
RF Pulse (Radiofrequency): 1 millisecond

- Knocks protons out of alignment

Time Constant: RF pulse off and then look

- T1 : Shows more fat
- T2 : Shows more water
- PD Proton Density- Between T1 and T2
- STIR Short T1 Inversion Recovery- Shows more water

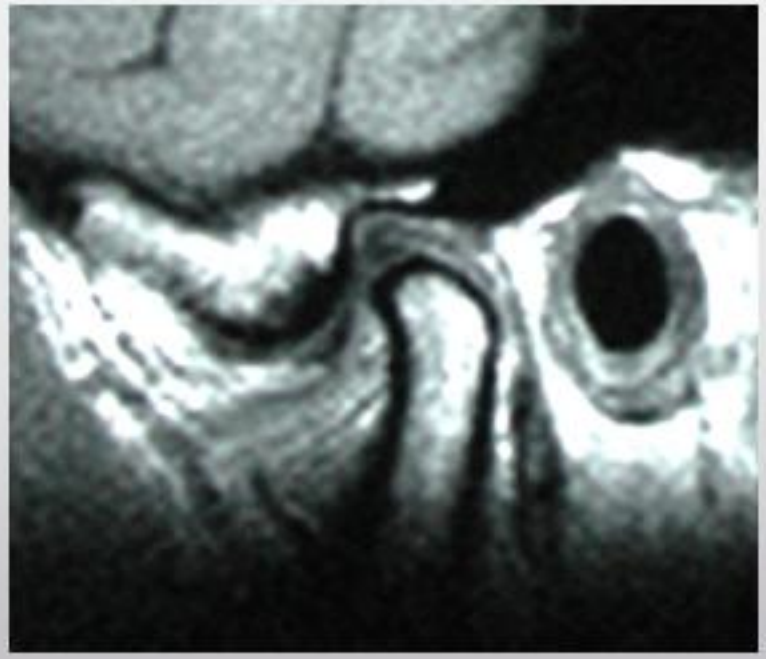




Tissue	T1	T2
Fat	Very Bright	Intermediate
Water	Dark	Very Bright
Tissue	Intermediate	Dark
Bone	Dark	Dark
Air	Dark	Dark
Meniscus	Dark	Dark
O_2 Poor Plasma	Dark	Very Bright

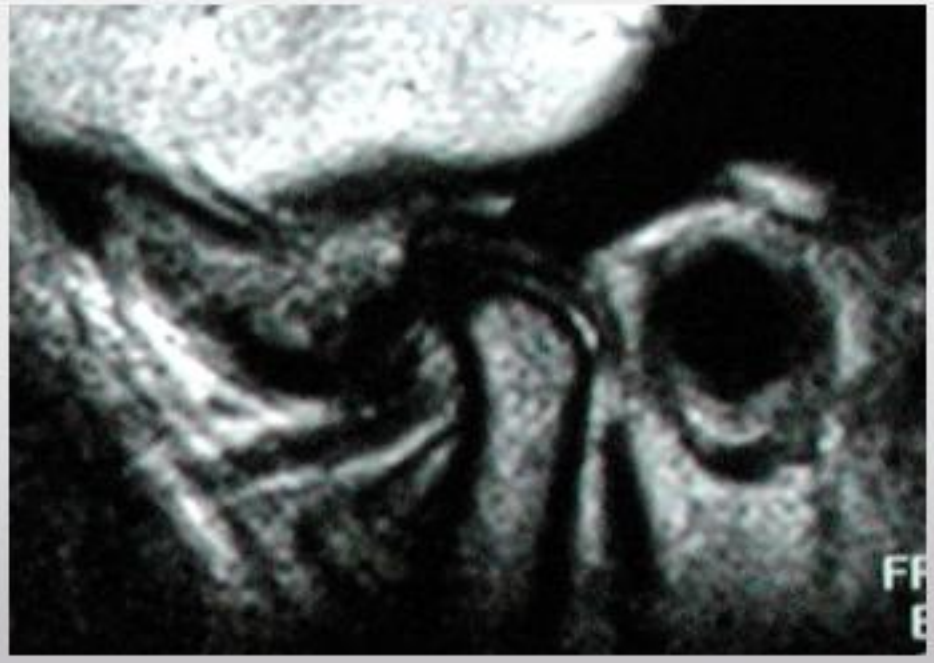
Normal MRI T1 and T2

T1 Sagittal Closed



T1 shows more fat

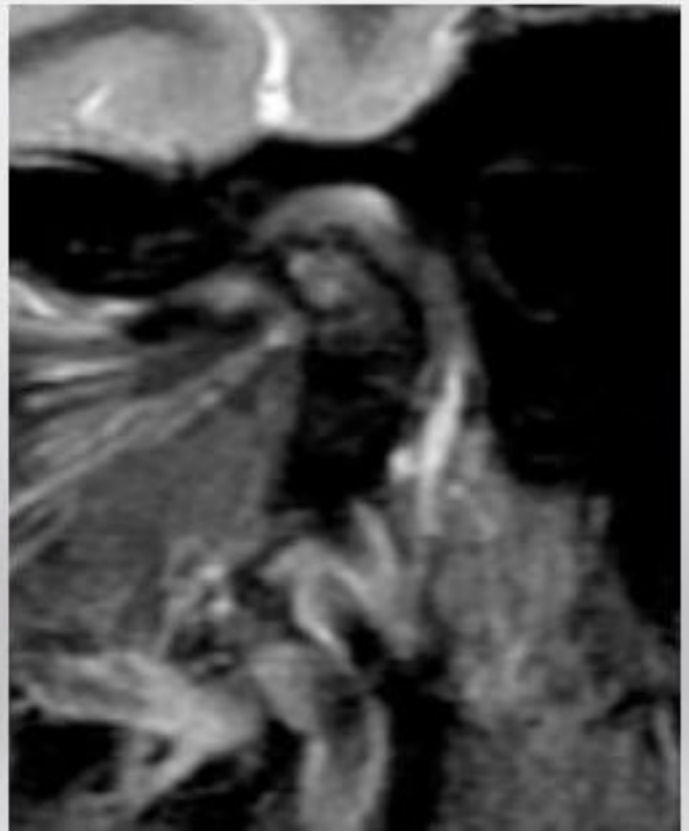
T2 Sagittal Closed



T2 shows more water:
Inflammation
Pathology

MRI STIR Image

STIR- Short T1 Inversion Recovery



STIR- "Supercharged" T2

Retrodiscal Inflammation

Marrow Edema

Diff Dx is active AVN, Osteoarthritis, Lyme Ds, RhA, Hypoxic Progressive Condylar Resorption

STIR and T2 shows water as white

When is TMJ Imagining Indicated?

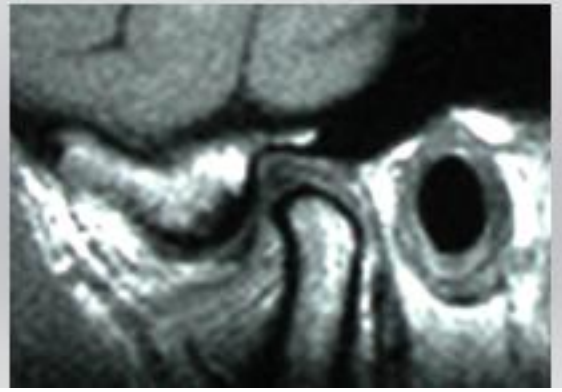
After a thorough history, observation of patient, physical examination of the TMJ and muscles, then.....
Imagining is to find answers to specific questions:

CT or CBCT

- Is the bone cortex intact of the TMJ condyle and fossa?
- Where does the joint load in centric relation?
- Is the TMJ actively breaking down?
- Is there any pathology in the TMJ or surrounding tissues?
- Is the condyle distalized?

MRI

- What is the size, shape, and location of the disc?
- Is the disc injury old or new?
- Is there inflammatory tissue in the joint?
- is the bone marrow inflamed?
- Is the TMJ actively breaking down?
- Is there any pathology in the TMJ or surrounding tissues?
- Is the condyle distalized?



When is TMJ Imagining Indicated?

History
- Any unexplained changes in the occlusion
- Clicking that has changed in past two years
- TMJ is locking on opening

Severely painful joints to palpation or loading

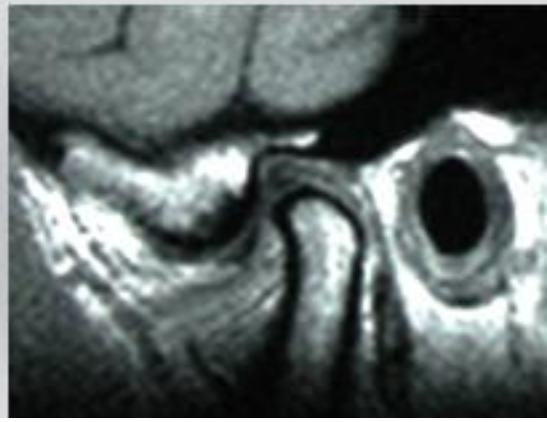
Slightly painful joint that does not resolve after 2-6 weeks of therapy
- NSAID and CR Orthotic (D-PAS)

Prior to any significant modifications to the occlusion
- Orthodontics, full mouth reconstruction, orthognathic surgery

When you need to minimize the risk of redoing the dentistry
- Large $$ cases, Multiple crowns/veneers, Multiple Implants

Imaging is but one part of a diagnostic process.
We need to become orthopedic doctors of the TMJ

A CBCT and JVA are the minimal needed in all the above circumstances.



C.T. Scan of the Temporomandibular Joint
• Spiral CT- (No Contrast) (revised 5/09)

John R. Droter, D.D.S.
4000 Mitchellville Rd,
Suite 3308
Bowie, MD, 20716
301-805-9400
drjr@mac.com

_____
date

Please evaluate _____

Significant History: ☐ See Exam Form

☐ Facial Pain 784.0
☐ Avascular Necrosis 526.4
☐ Osteoarthritis 715.3

• At Anne Arundel Medical Center, Radiologist Kerry Thompson, MD is to read the scans.
• Other Centers- Do not take scan if not able to send DICOM images to me.
• Must be a spiral CT scanner, 16 or 64 slice. Do not show the head holder in any images.

1. Please review the 'Patient Instructions' with the patient before starting the scan.

2. Axial C.T.
   Head stabilization to prevent movement, pads on eyeglass
   Superior/Inferior
   Bone Algorithm/ No contrast
   Teeth together. If patient has Dr. Droter's appliance, that is to be worn.
   1mm slices or less. The smaller the better.
   Start 1 cm superior to the roof of the TMJ fossa and
   continue down to include the hyoid bone and C4.
   Be sure to capture the tip of the chin and the back of the Occipital Bone

3. Reconstruct Coronal and Corrected Sagittal Views off of the Axial Scan
   1mm slice thickness or less

☐ If Checked: Direct Coronal C.T.
   Head stabilization, 2-3 weight on Zygoma (1) on chin
   Focus on chin in superior not posterior
   Teeth together. If patient has Dr. Droter's appliance, that is to be worn.
   Bone Algorithm/ No contrast
   PA, both right and left TMJ in same slice.
   1mm slices or less. The smaller the better.
   Start behind auditory canal and continue past the crest of the eminence.
   This usually takes about 25 slices
   Align slices so they are parallel with the posterior ramus

4. Printed images not acceptable. Must be Dicom digital images.
   Do not take the scans if you can not send DICOM images.

5. Please be sure to have the radiologist read 'Notes to the Radiologist' for what I need in the report.

THANK YOU

MRI Scan of the Temporomandibular Joint

John R. Droter, D.D.S.
4000 Mitchellville Rd,
Suite 3308
Bowie, MD, 20716
301-805-9400
drjr@mac.com

_____
date

Please evaluate _____

Significant History: ☐ See Exam Form

☐ Facial Pain 784.0
☐ Avascular Necrosis 526.4
☐ Osteoarthritis 715.3

• Printed images not acceptable. Must be DICOM Digital Images
• Do not do scan if not able to do DICOM Digital Images
• Use TMJ coils. Use 1.5 Tesla magnet. Do not use an open MRI. Do not use a short flip angle.
• Bone orientation views
• Closed views are with teeth together. If patient has Dr. Droter's appliance, that is to be in for all closed views.
• Use a roll of tape (3M Transpore Tape 1 inch wide) for the open view. The roll is two inches in diameter.
  Have patient open as wide as they can comfortably and place the tape roll as far back as possible with the flat side toward the teeth. They should be biting into the tape with their back molars on both sides.
• Copy DICOM images to a CD and give to patient or mail to me Fed-Ex.
• If at Anne Arundel Medical Center, Radiologist Kerry Thompson, MD is to read the scan.
☐ Patient has wax stales to wear so teeth to stabilize jaw for closed view.
☐ Gave Rx for _____ They will take it 1 hour before scan.
☐ Patient to get braces off molars before scan. No orthodontic wire in place.

1. T1, mouth closed, corrected sagittal projection, right and left TMJ.
   8 or more views: lateral, medial, 4 cuts through condylar head.

2. T2 scan mouth closed, corrected sagittal projection, right and left TMJ.
   8 or more views: lateral, medial, 4 cuts through condylar head.

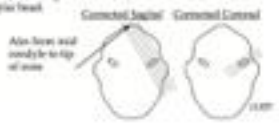
3. STIR (T1 inversion recovery) corrected sagittal projection, right and left TMJ.
   8 or more views: lateral, medial, 4 cuts through condylar head.

4. Proton Density, mouth closed, corrected sagittal projection, right and left TMJ.
   8 or more views: lateral, medial, 4 cuts through condylar head.

5. Proton Density, mouth closed, corrected coronal projection, right and left TMJ.
   8 or more views: in front of condylar head, through condylar head, behind condylar head.
   Be sure to get at least one slice medial, and one slice lateral to condylar head.

6. Proton Density, mouth open 5cm; corrected sagittal projection, right and left TMJ.
   8 or more views: lateral, medial, 4 cuts through condylar head.
   Use roll of tape for open view as described above.
   Take this view last.

Corrected Sagittal Corrected Coronal



Also Scan axial condyle to tip of nose

Thank You

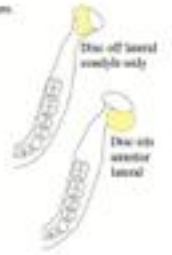
CT and MRI Scans of the TMJ
Notes to the Radiologist

John R. Droter, D.D.S.
4000 Mitchellville Rd,
Suite 3308
Bowie, MD, 20716
301-805-9400
drjr@mac.com

Please rule out:
Osteoarthritis, avascular necrosis, osteochondritis dessicans,
marrow edema, synovitis, cystic degeneration, cancer

CT Scan- Normal
Cortex intact- No cysts, no hypercalcifications
Intermedullary bone has a good pattern
Normal Size and shape of right and left condyle (70% condyle to fossa)
  Non congruent ovoid shape of condyle with respect to fossa
  No flat areas
CR Load Zone- Right and Left Condyles load on superior medial condyle
  Closest bone distance between the condyle and fossa is at superior medial articular surface
Right and Left Condyles are centered medial-laterally. The Mandible sits centered under the skull base
The inferior border and angle of the mandible on the right and left are equidistant to the fossa
Right and left Condyle are 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

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 with respect to fossa
  No flat areas, No lipping
Right and Left Condyles are centered anterior-posteriorly in fossa
No edema in the joint, synovial tissue or bone marrow on the T2 and STIR images
No lesions or tumors in the TMJ and surrounding areas

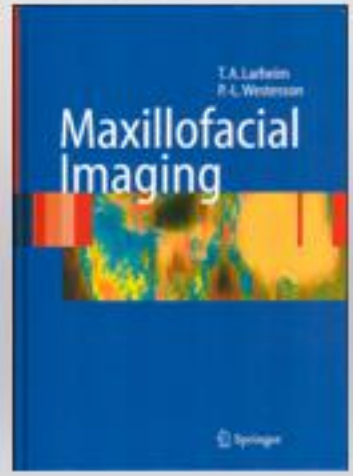


My Core Belief

The TMJ is a synovial joint of the human body and will undergo the same disease processes as any other synovial joint

Understanding orthopedic medicine is the key to understanding joints, including the TMJ

Buy Salter's Orthopedic Textbook.
When you have a patient with specific disease (i.e. osteoarthritis), read that chapter.



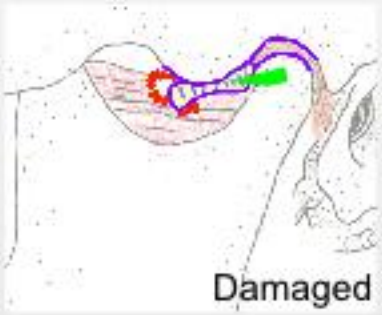
Textbook of Disorders and Injuries of the Musculoskeletal System
Robert Salter MD

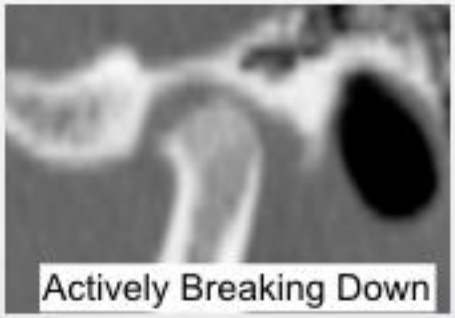
Maxillofacial Imaging
Larheim
Westesson

Basic Orthopedics

Joints are either
- Healthy or
- Damaged


Healthy


Damaged


Actively Breaking Down

If damaged, joints will be either:
- Actively Breaking Down
- Adapting
- Adapted Favorably Structurally and Mechanically
- Adapted Unfavorably

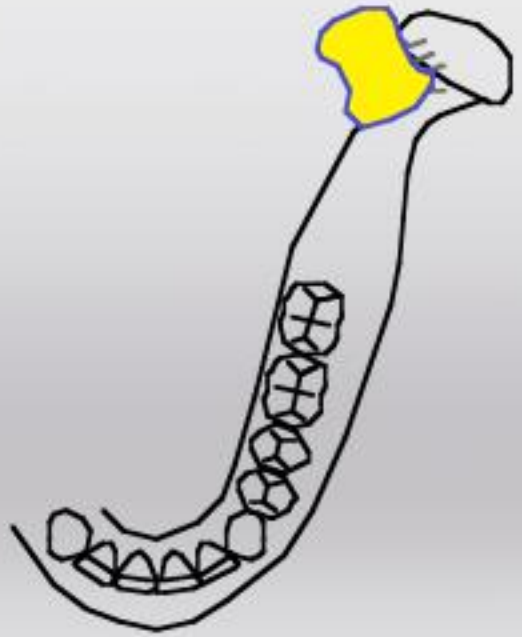
What is the Clinical Relevance of TMJ Damage Pre-Puberty?

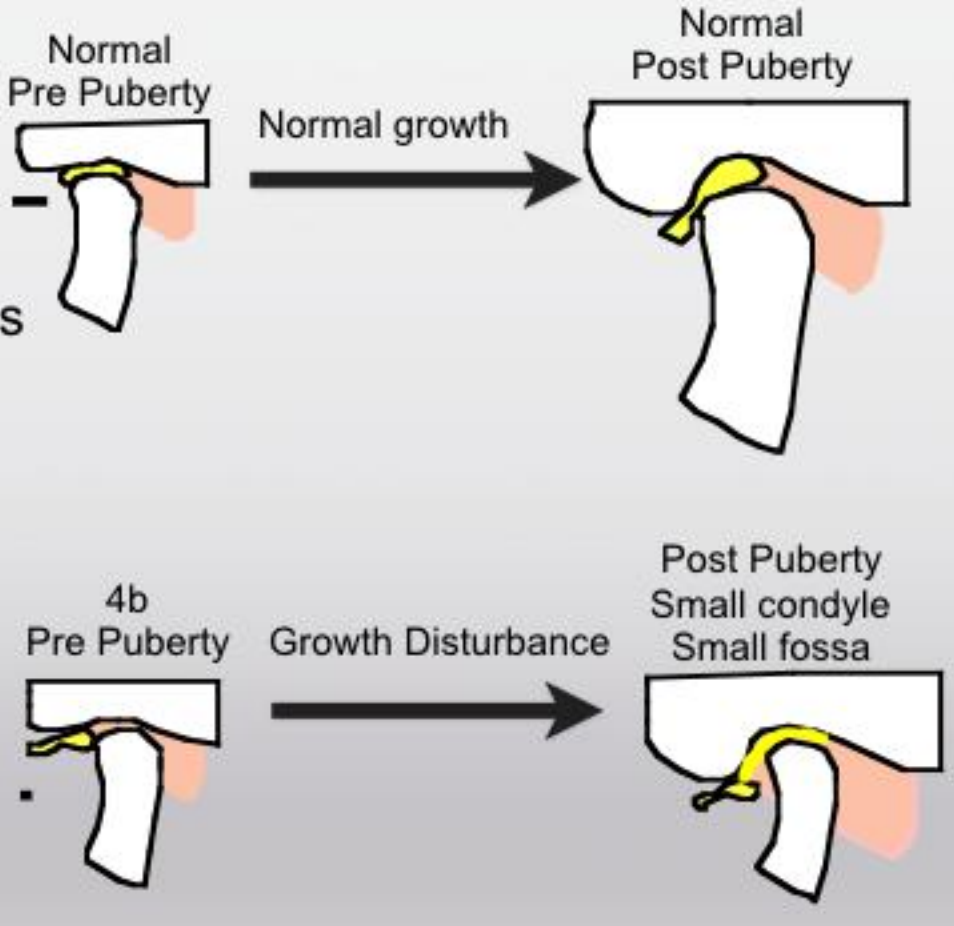
John R Droter DDS
Annapolis, Maryland

TMJ Damage Prepuberty

4b Pre-puberty is not a degenerative process

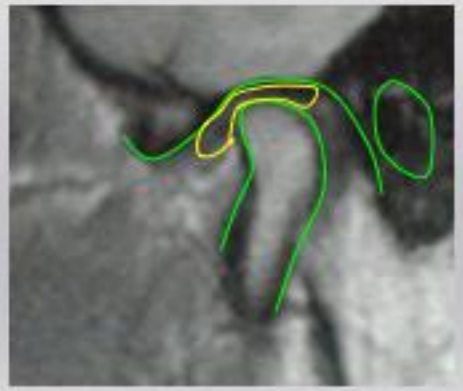
Can affect growth

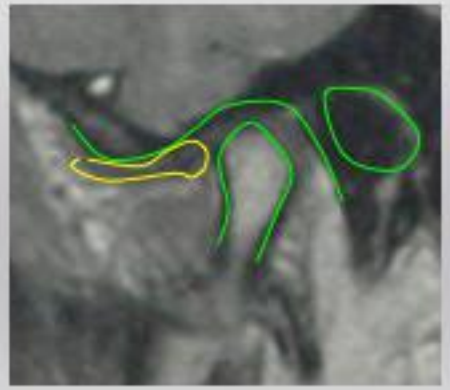




Age 17

R TMJ





L TMJ

Identical Twin Sister Age 17

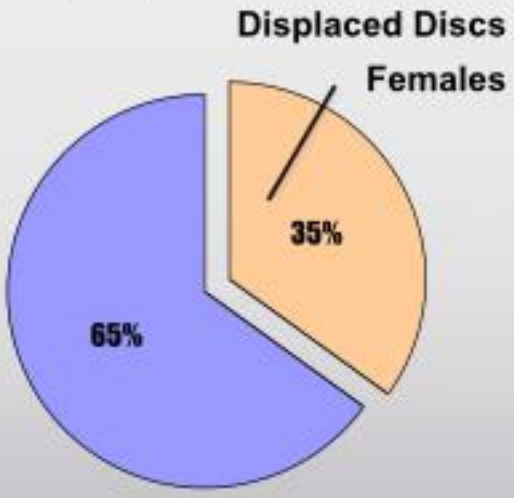
Pt of Ed Zebovitz, DDS

Şakar, O., Çalişir, F. (2013). Evaluation of the Effects of Temporomandibular Joint Disc Displacement and Its Progression on Dentocraniofacial Morphology in Symptomatic Patients Using Posteroanterior Cephalometric Analysis. Cranio, 31(1), 23–31.

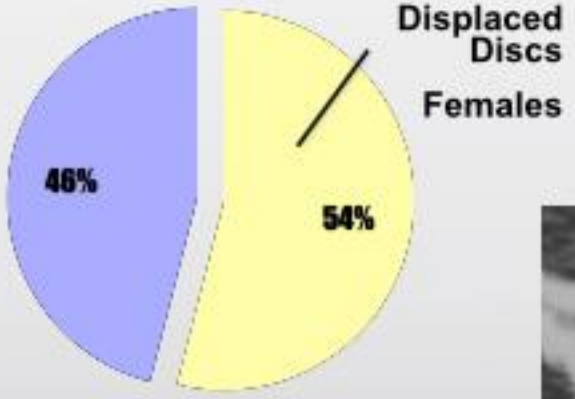
TMJ Damage Prepuberty

Prevalence Displaced Discs

Asymptomatic Volunteers



Presenting to Ortho Office



In patients with Displaced Discs
Condyles of Females Distalized
Significantly more than Males

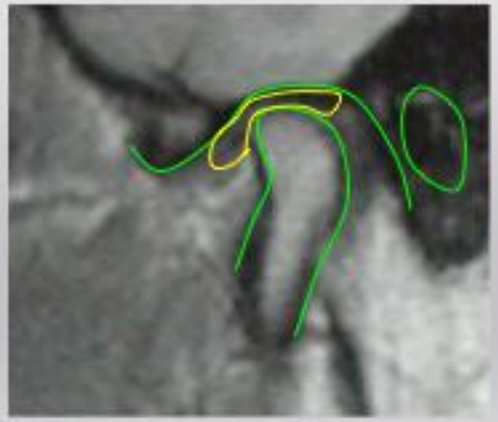
The Prevalence of Disc Displacement in Symptomatic and Asymptomatic Volunteers
Ribeiro R, Tallents R, Katzberg R, J Oral Facial Pain 1997 ;11:37-47

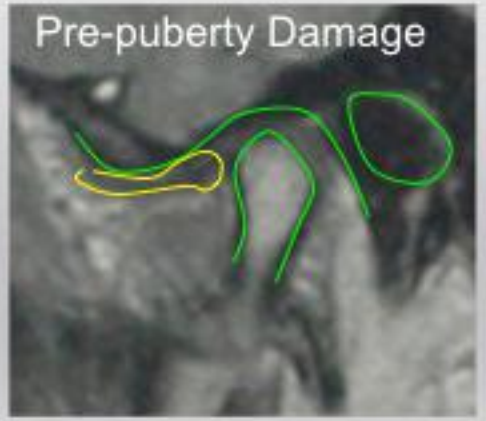
Osseous Morphology and Spatial Relationships of the TMJ Comparisons of Normal and Anterior Disc Positions, Kinniburgh R, Major P, Nebbe B, Angle Orthod 2000;70:70-80

Basic Orthopedics

Joints are either
- Healthy or
- Damaged

If damaged, joints will be either:
- Actively Breaking Down
- Adapting
- Adapted Favorably Structurally and Mechanically
- Adapted Unfavorably





Small condyles due to TMJ damage:

Pre-puberty TMJ damage, the joints adapted, but did not grow.

Post-puberty TMJ damage will be a degenerative process.

Note ratio condyle size to fossa size

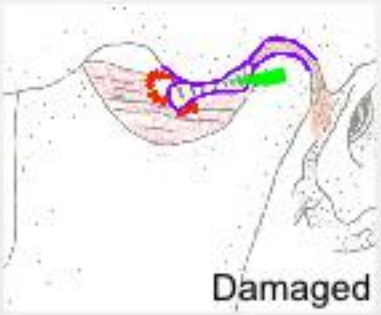
What is the Clinical Relevance of TMJ Damage Post-Puberty?

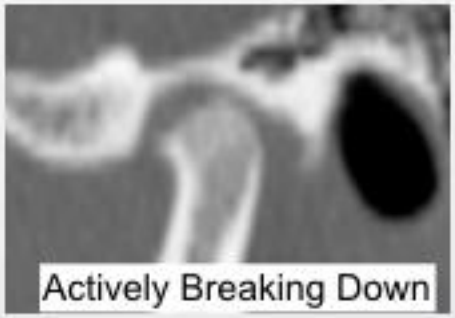
John R Droter DDS
Annapolis, Maryland

Basic Orthopedics

Joints are either
- Healthy or
- Damaged

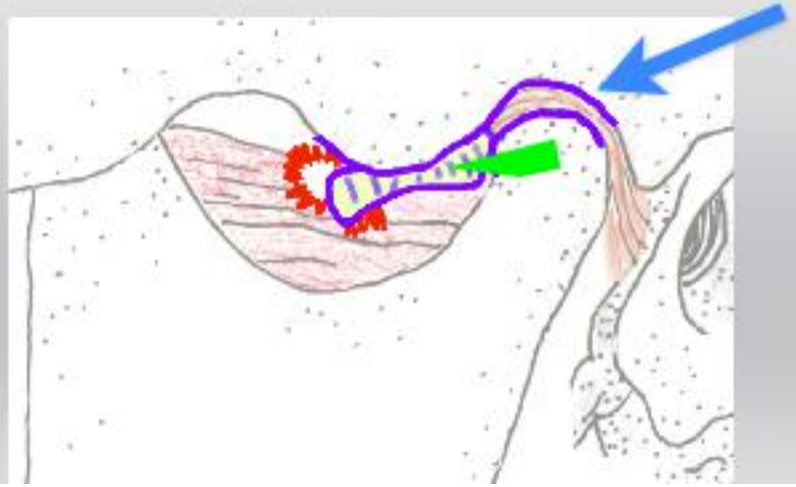

Healthy


Damaged


Actively Breaking Down

If damaged, joints will be either:
- Actively Breaking Down
- Adapting
- Adapted Favorably Structurally and Mechanically
- Adapted Unfavorably

Majority of damaged TMJs adapt favorably



Posterior ligament, synovium, and retrodiscal tissue adapt to form a

Pseudo-disc

Tissue Fibrosis

Symptoms of Temporomandibular Joint Osteoarthrosis and Internal Derangement 30 years after Non-Surgical Treatment.

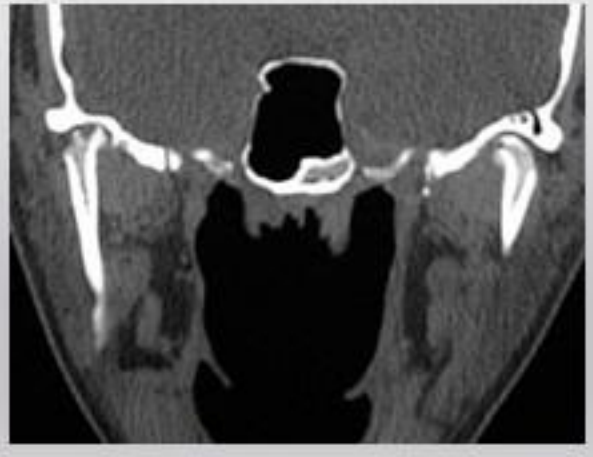
Leeuw, Boering, Stegenga, Bont,
Journal of Craniomandibular Practice, April 1995, vol. 13, No. 2

- University Hospital, Netherlands: 134 TMD patients, 30 year follow up
- Patients received good clinical work up and diagnosis 30 years ago, but basically no treatment
  - (Reassurance, PT, exercise, limited occlusal adjust)
- 70% satisfied with results
- 25% still had pain on movement
- 15% not able to eat hard foods
- 35 control patients had no apparent symptoms

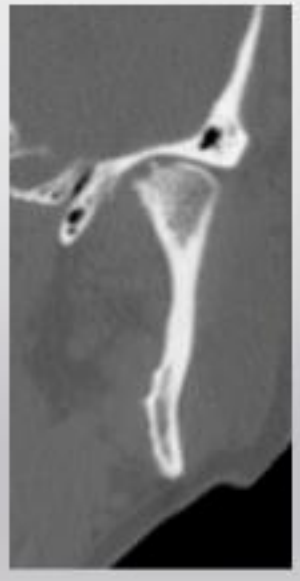
If you have a disease that is one in a thousand, it is 100% for you

There is no love sincerer than the love of food.

G. B. Shaw



Damaged TMJs



Adapt Favorably **85%**
Adapt Fairly **14%**
Adapt Poorly **<1%**

→ Occlusal Muscle Dysfunction
→ Osteoarthritis

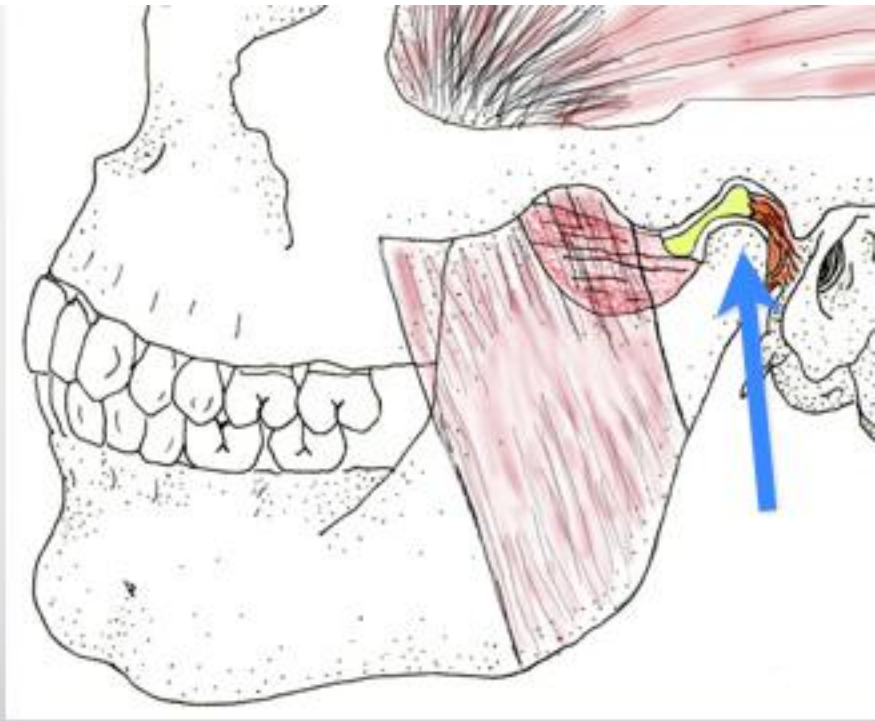
→ Avascular Necrosis
→ Progressive Condylar Resorption

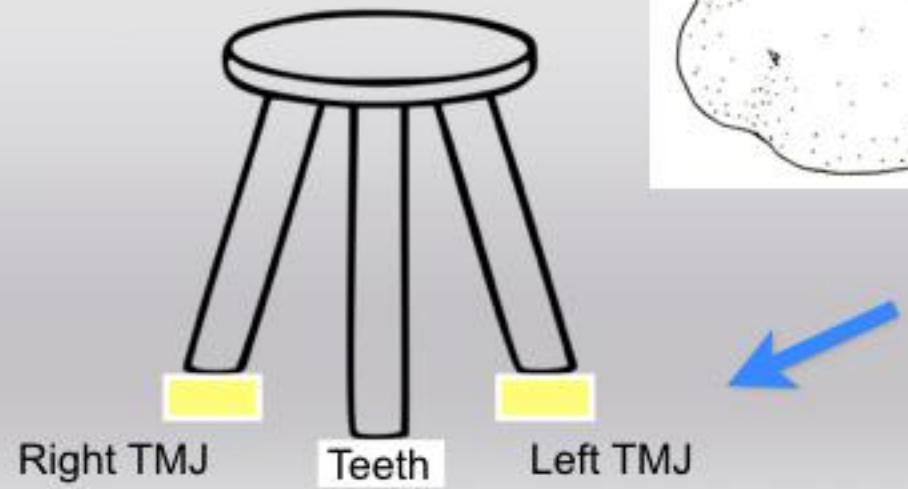
*These are my guesses on %, no research to back up to backup

Normal Joint with Normal Occlusion

All teeth touch evenly with condyles seated in fossa

What happens to the occlusion if the disc is dislocated?





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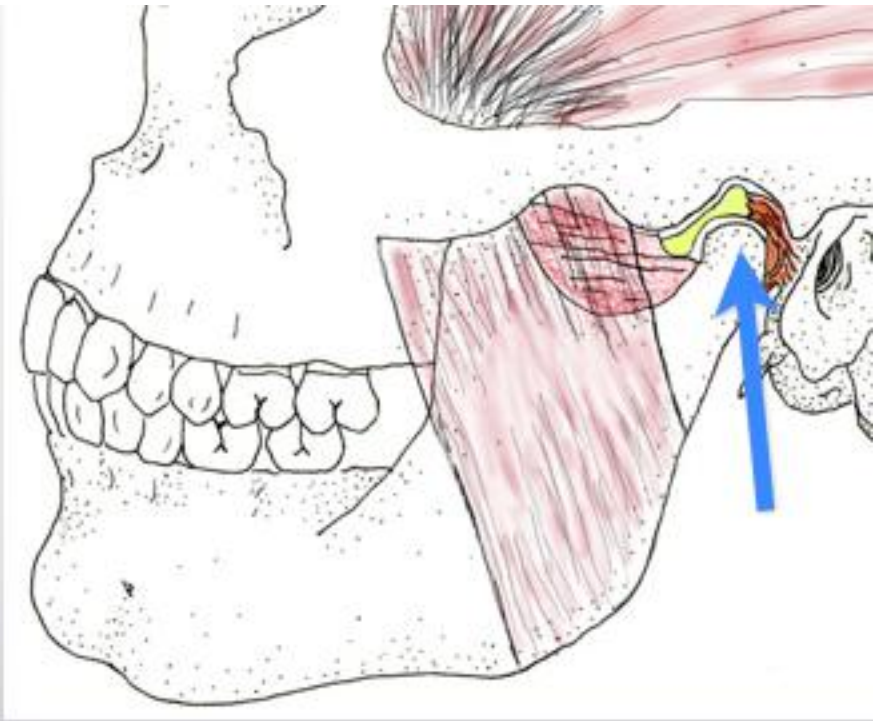

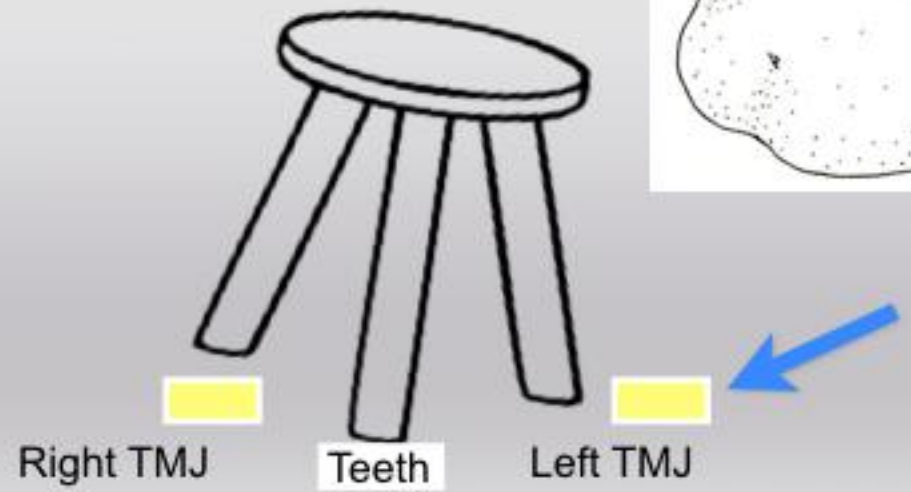

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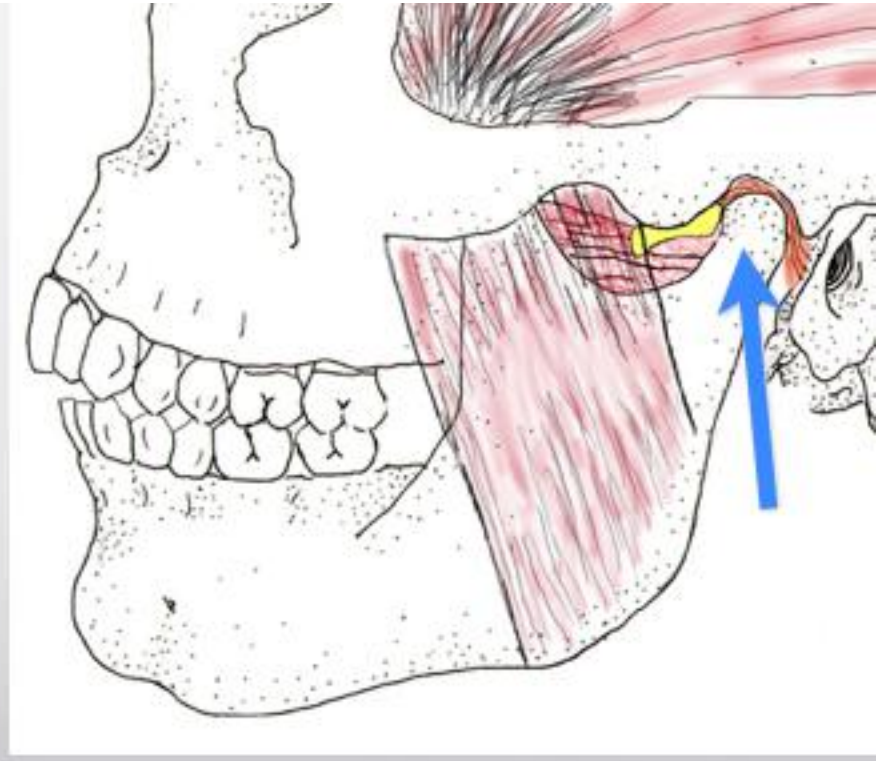
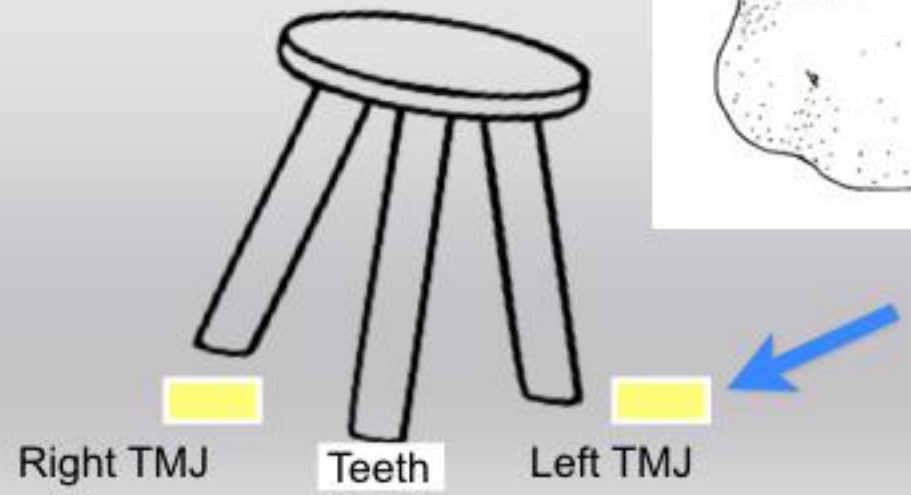




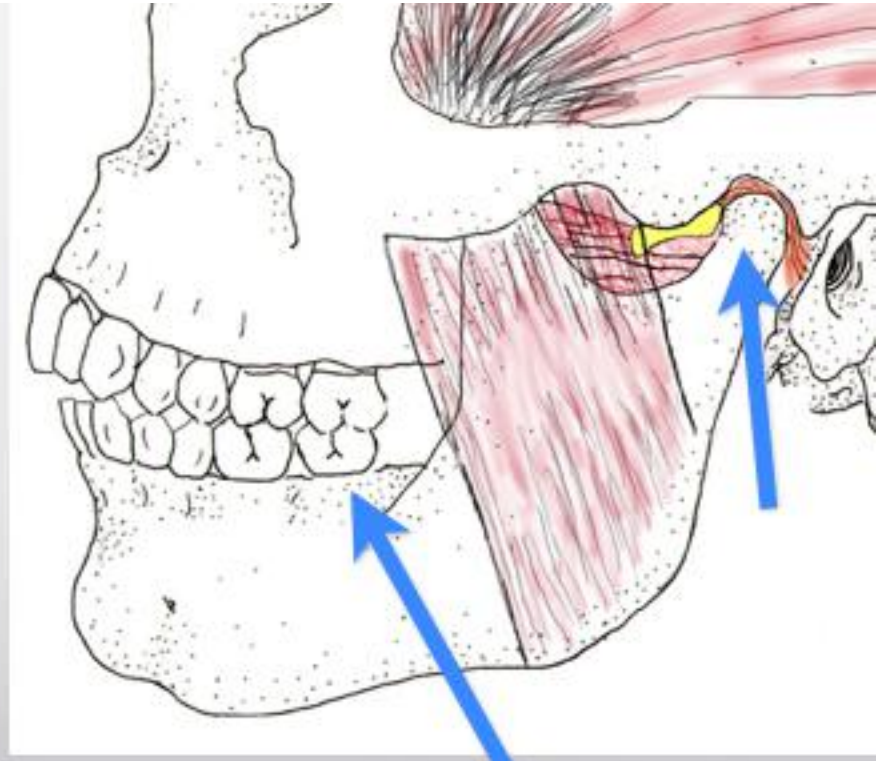
Damaged Joint w/ OMD

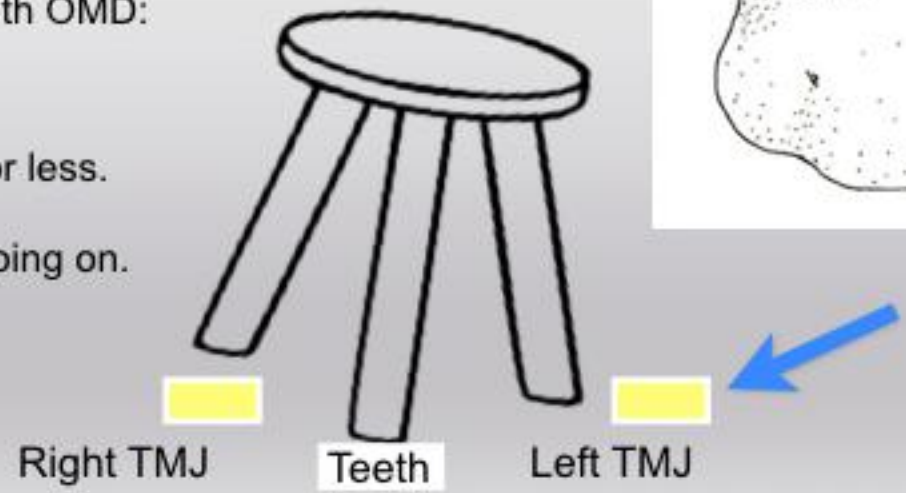
85% damaged joints adapt favorably with respect to the TMJ.

Anteriorly Dislocated Disc changes occlusion.
Occlusal muscle dysfunction develops.

Treat favorably adapted joints with OMD the same as healthy joints with OMD:
Occlusal Adjustment

CR≠MaxIC should be 2mm or less.
(Anterior Posterior 2mm)
If >2mm something else is going on.





Contact of most posterior tooth

Occlusal Muscle Dysfunction

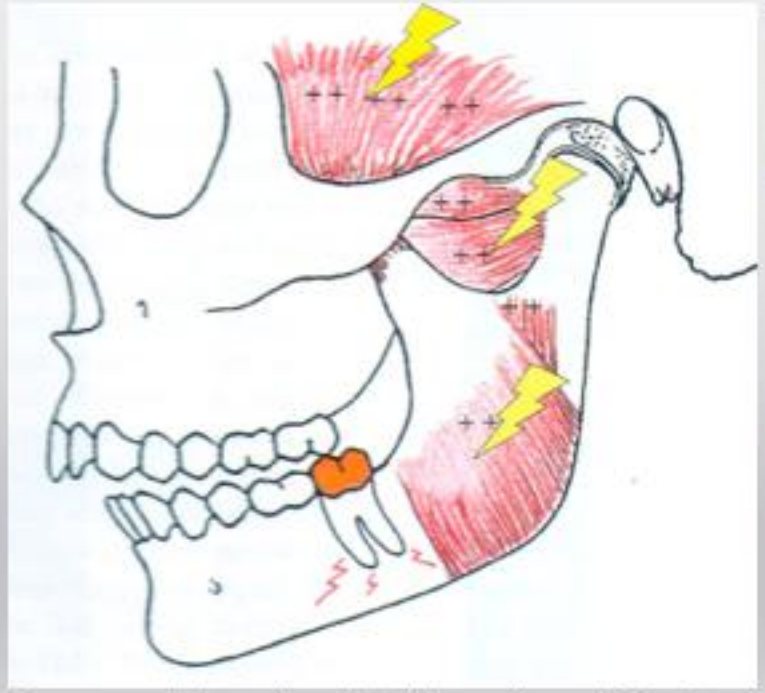
Uneven tooth contact with condyles fully seated triggers muscle activity

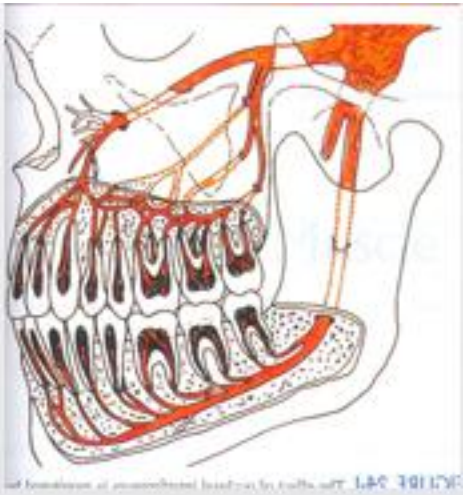
Lateral pterygoid fires out of sequence to create even tooth contact on closure

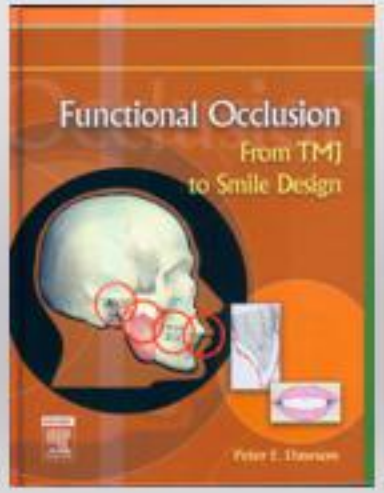
Disharmony in all muscles: Splinting/Bracing

Muscles sore from overuse

Muscles do not think- CNS input







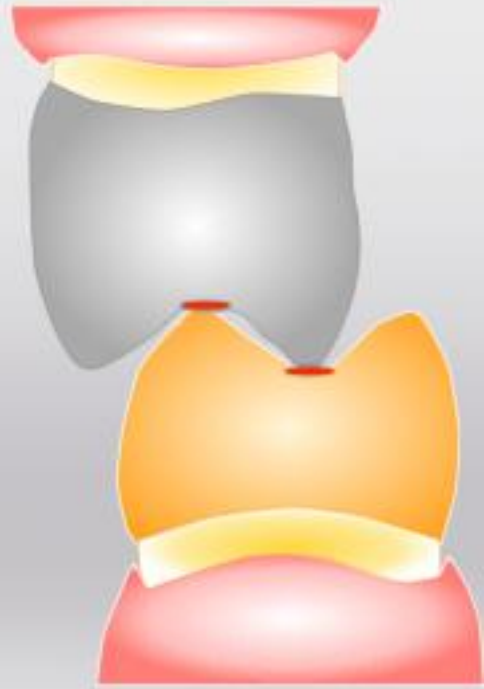
from Dawson's Textbook, "Functional Occlusion"

Treat Occlusal Muscle Dysfunction- Adjust the Occlusion

Step 1: Trial ideal occlusion on hard orthotic

Step 2: Reshape teeth

Add: Composite
Subtract: Burs



LD Pankey's 3 Rules of Occlusion

(Clyde Schuyler)

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.

Bonus Rule- Harmonious Anterior Guidance. Cuspid guidance directs the mandible slightly forward, not backward, with smooth cross over from cuspid to anterior teeth. Protrusive contact even on both central incisors.

Bonus Observation- All the above work much better the closer the teeth are to being on the curve of Spee and Curve of Wilson

Why LD Never wrote a text book

Treat Occlusal Muscle Dysfunction- Adjust the Occlusion

Teeth reshaped so all teeth hit even with condyles seated in fossa. Posterior teeth separate on lateral and anterior excursions.

Before

After

Diseases that cause bone loss in Joints

Osteoarthritis
Avascular Necrosis
Hypoxia Induced- Progressive Condylar Resorption

Rheumatoid Arthritis
Infection- Lyme Ds, Syphilis, Staph
Crystalline Deposition Disease
Various other Autoimmune Arthritis
Autoimmune Rheumatic Fever
Cancer

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Systemic Disease of Synovium
Overgrowth of Synovium into joint space
Pannus- Inflammatory tissue in joint
Cartilage dies lack of synovial fluid flow

Weird = Lyme Disease
Lyme Test has many false negatives

Gout
Uric Acid crystallizes in joint

Psoriatic Arthritis: Look for dry skin patches

Rule cancer out early, rule it out often.
Any sudden onset pain after 50 is suspect

Diseases that cause bone loss in Joints

3 diseases are associated with TMJ disc dislocation

Osteoarthritis
Avascular Necrosis
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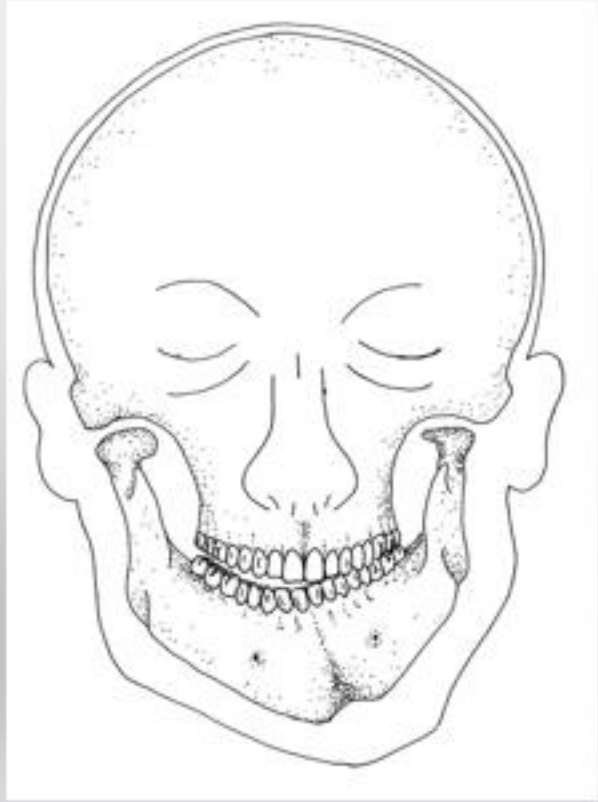
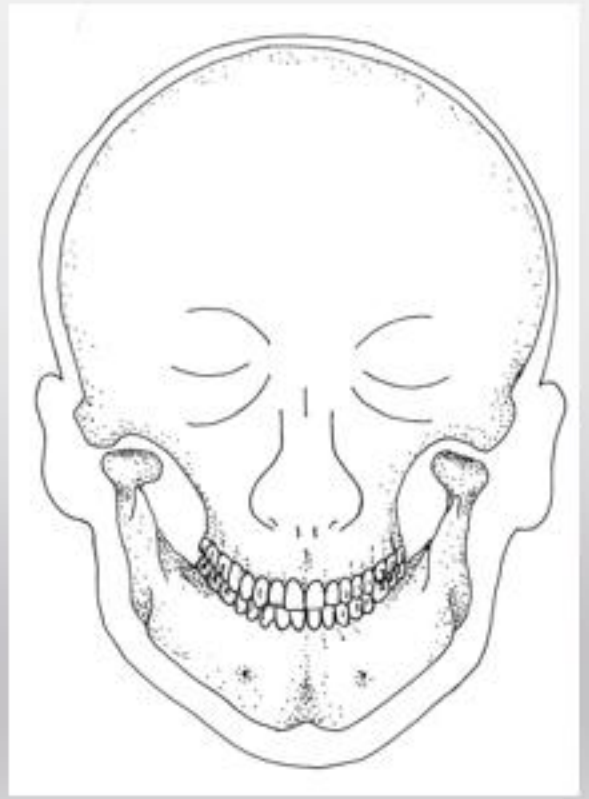
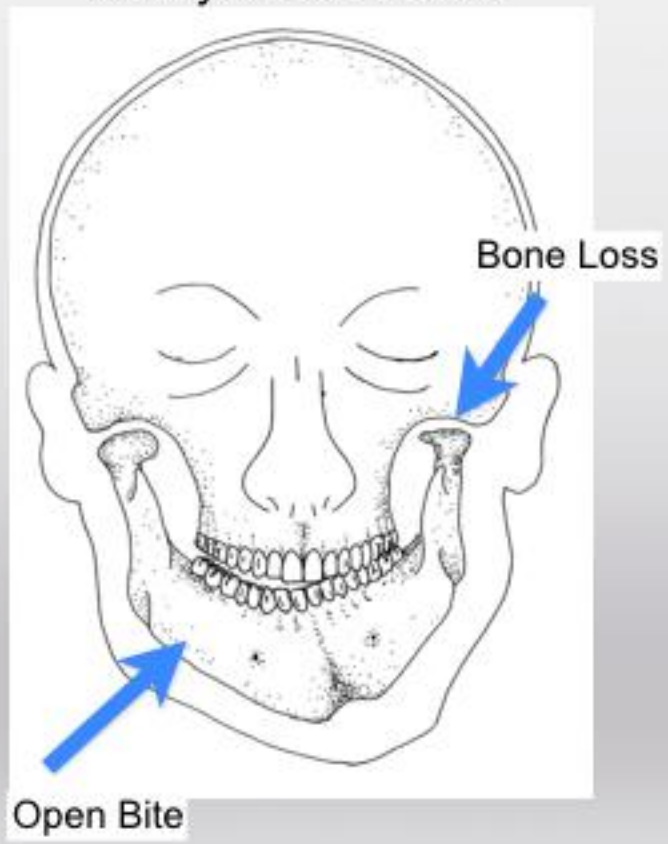


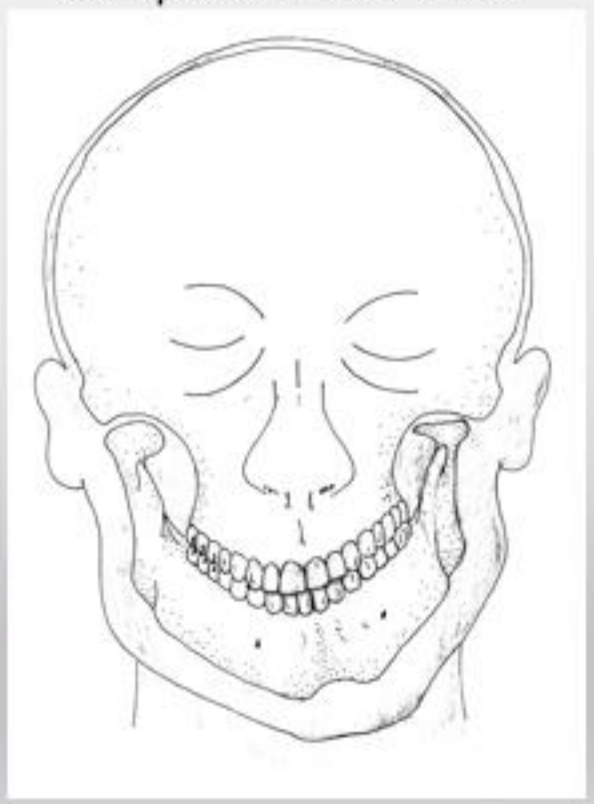
Diseases that cause bone loss in the TMJ alter the Occlusion



Condylar Bone Loss



Adaptation Over Time



What happens if you lose 2mm joint height in both Right and Left TMJ?

Can lose joint height with bone loss or disc displacement

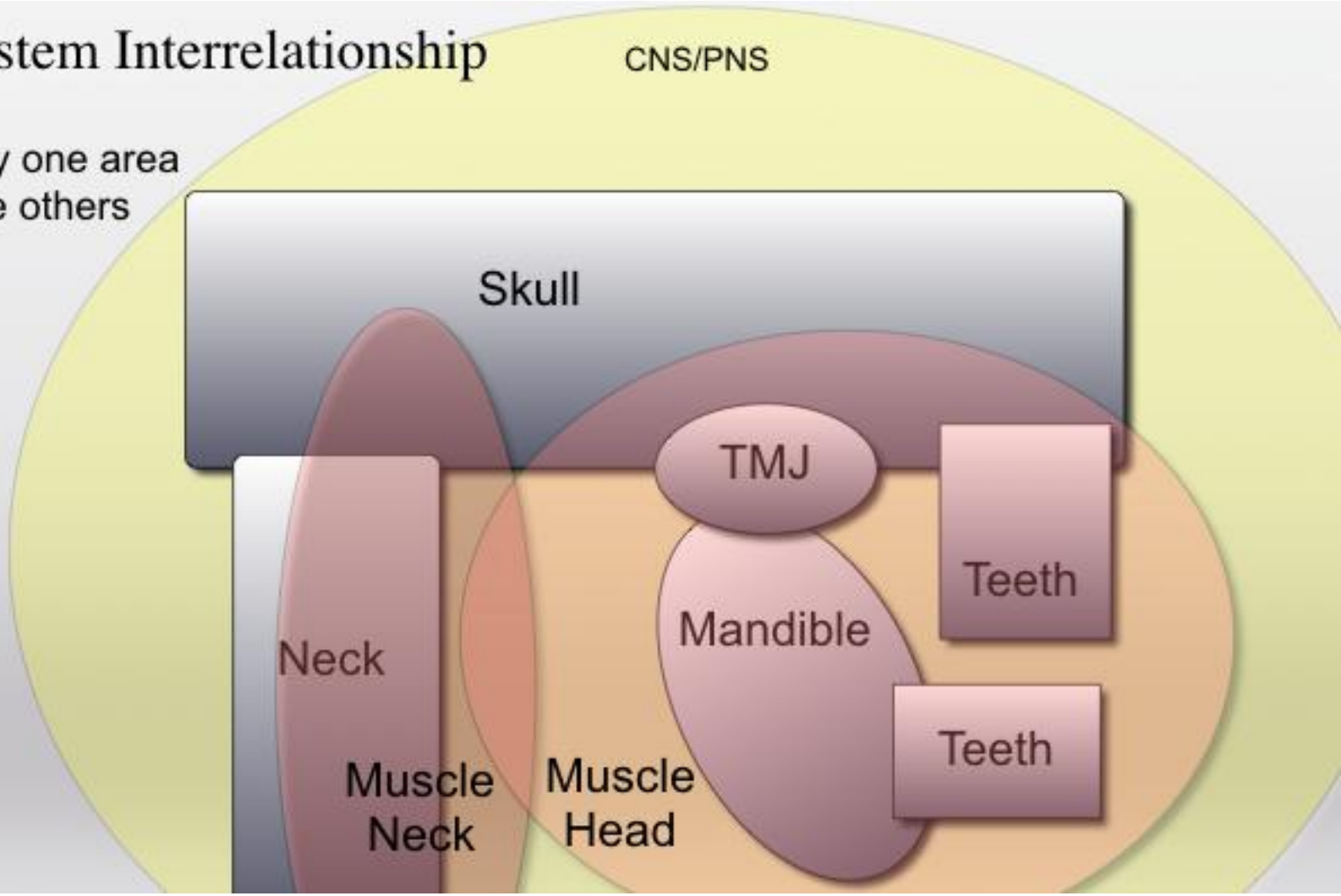
Minus 2mm TMJ RL joint height

Stomatognathic System Interrelationship

A change in any one area will affect the others

"Adaptation"

This is a **dynamic** orthopedic System



venn diagram

Diseases that cause bone loss in Joints

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Infection- Lyme Ds, Syphilis, Staph
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Various other Autoimmune Arthritis
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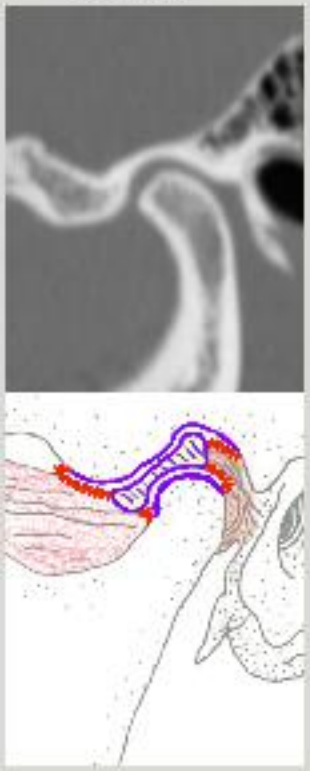
Cancer

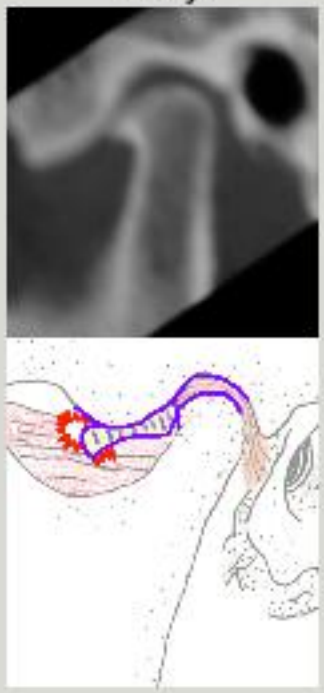
Osteoarthritis/ Osteoarthosis

Healthy joints have no friction or wear.
Damaged joints have Friction. Friction causes wear.
OA is a wearing out of a joint which starts in cartilage.
Parafunction increases wear.

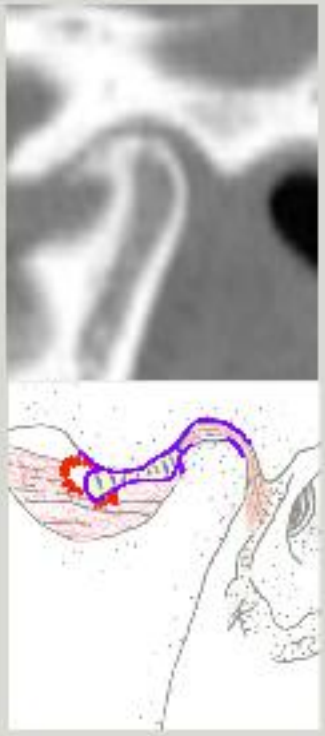
Normal



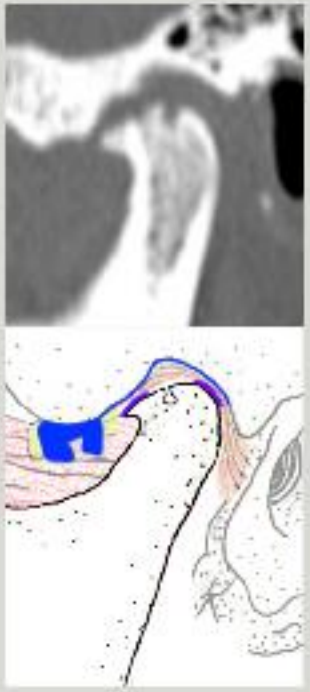
Early



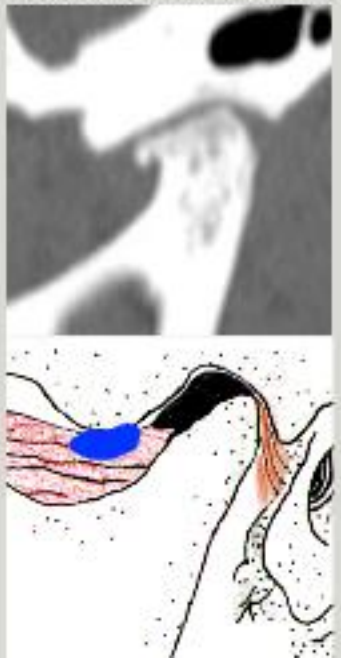
Early/ Moderate



Moderate



Severe OA, Eburnation

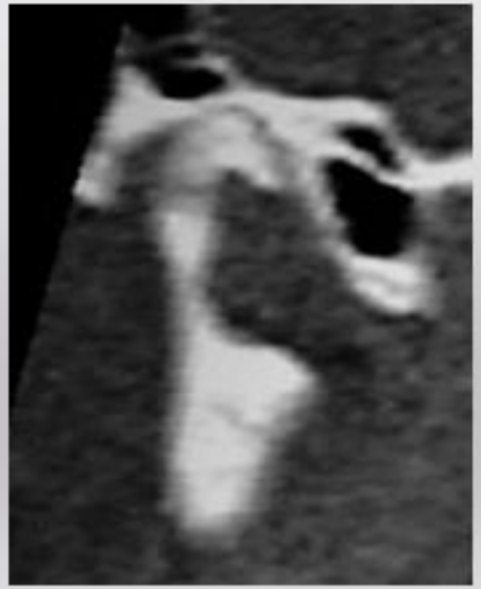


Representative examples of OA
in different patients

Adaptation Chronic Bilateral OA

Mandible recedes Slowly
Teeth Move/ Adapt
Anterior Guidance gets steeper as Condylar Guidance get shallower

OA Right and Left Bone Loss
#8 Ankylosed



Diseases that cause bone loss in Joints

Disease of Cartilage.
Slow Bone loss over 10+ years.

Osteoarthritis
Avascular Necrosis
Hypoxia Induced- Progressive Condylar Resorption

Death of Subchondral Bone.
Single event bone collapse.
May lead to Inflamed Tissue.

Rheumatoid Arthritis
Infection- Lyme Ds, Syphilis, Staph
Crystalline Deposition Disease
Various other Autoimmune Arthritis
Autoimmune Rheumatic Fever
Cancer

Disease of Subchondral Bone
Progressive bone lose over several months/years

Diseases that cause bone loss in Joints

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Disease of Subchondral Bone
Progressive bone lose over several months/years

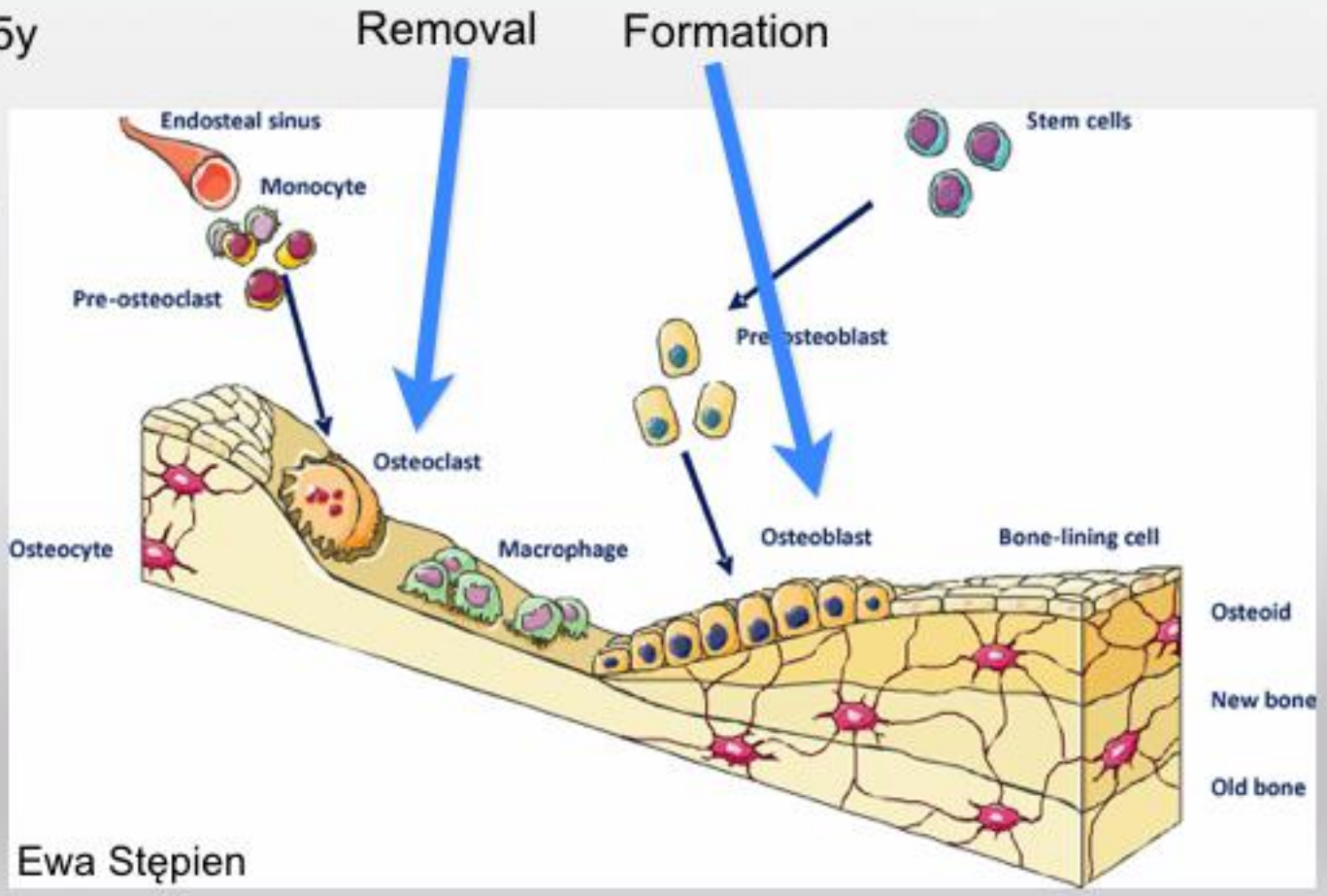
Bone is not a static tissue

Constant turnover- 6 months to 1.5y

There is a delicate balance of cell activation/deactivation between the osteoclast and osteoblast.

Osteoclasts
Resorption- Bone removal

Osteoblasts
Bone Formation



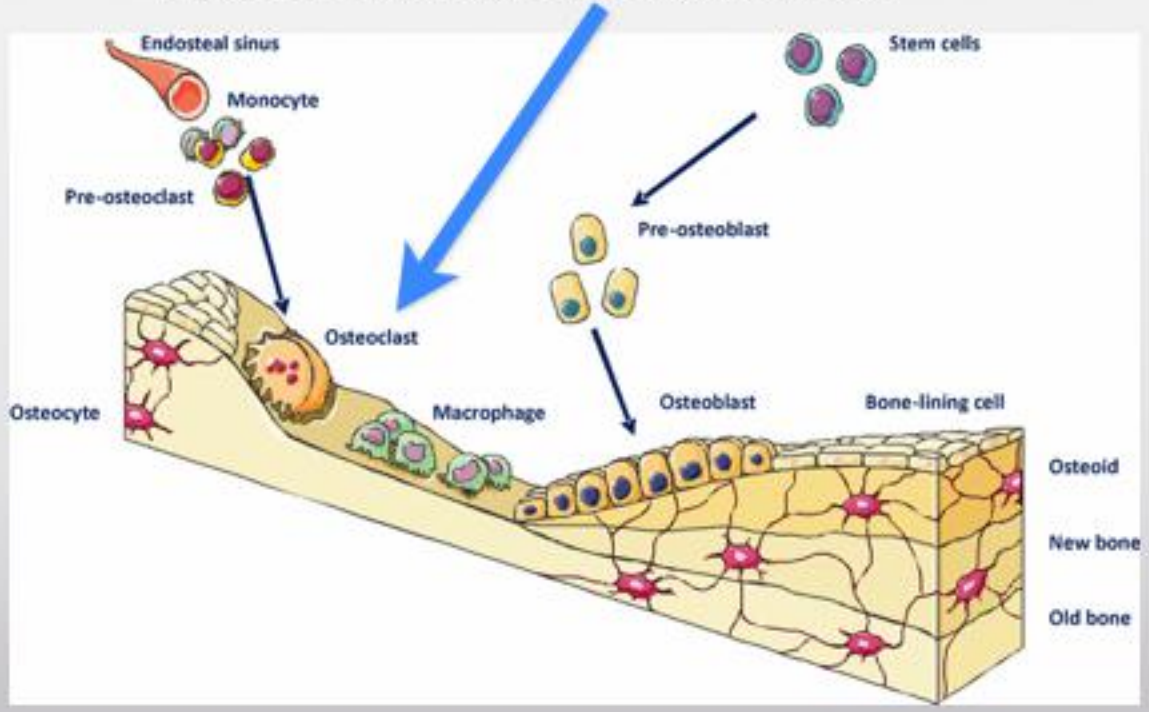
Low Oxygen: Hypoxia

Hypoxia induces pathological bone resorption by activating osteoclast, inhibiting osteoblast

Hypoxia and reperfusion maintains osteoclast activation

Progressive Resorption

Hypoxia increases Osteoclasts

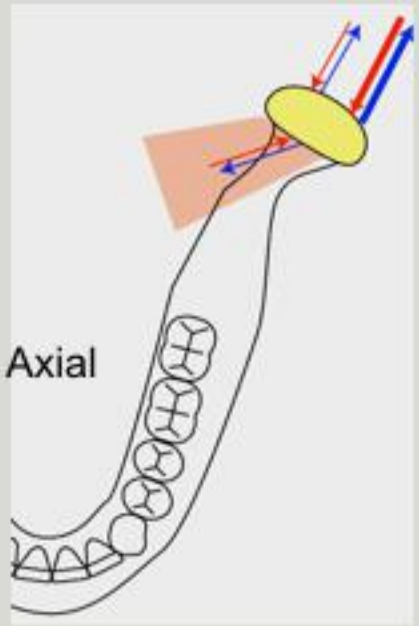


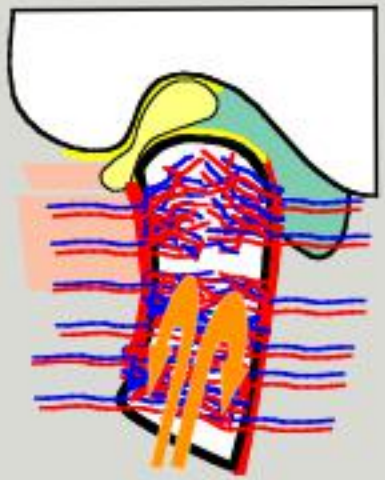
Knowles, H.J. & Athanasou, N.A., 2009. Acute hypoxia and osteoclast activity: a balance between enhanced resorption and increased apoptosis. The Journal of Pathology, 218(2), pp.256–264.

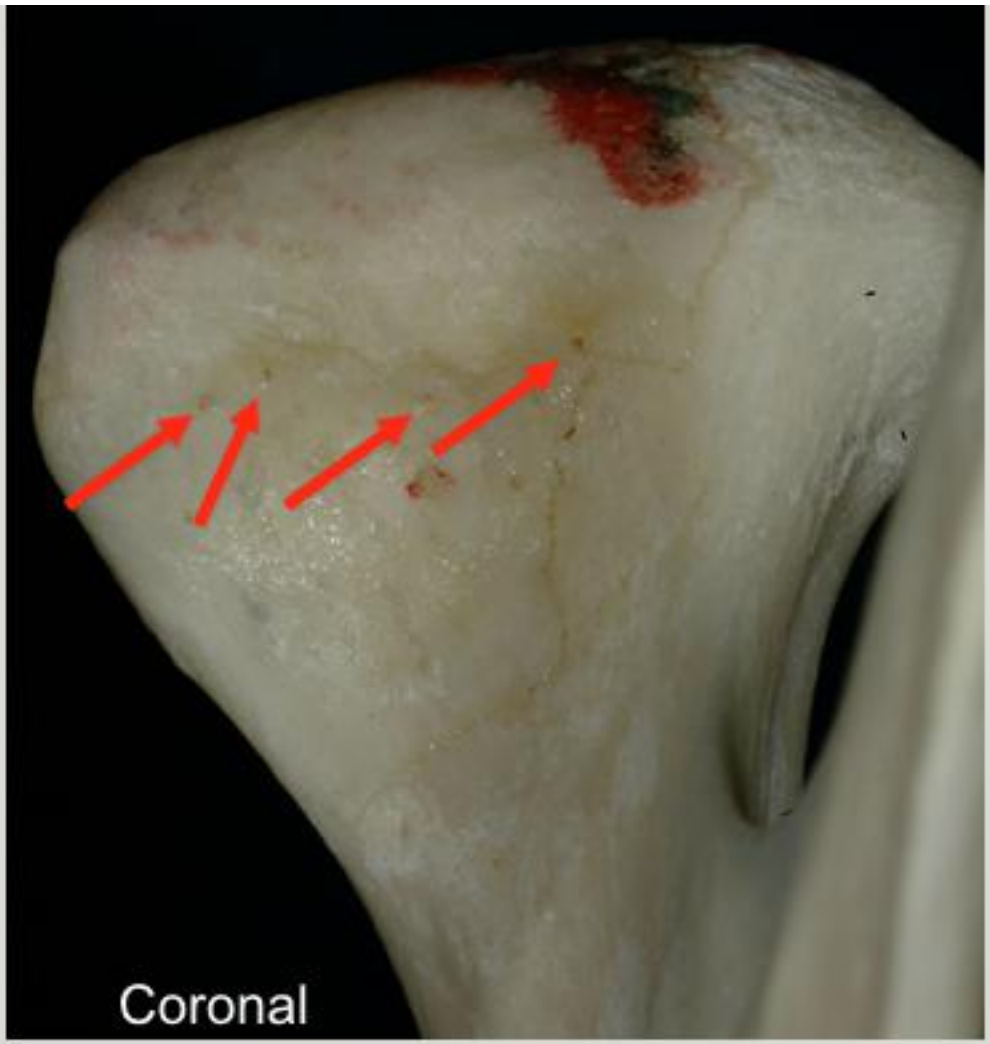
Knowles, H.J. et al., 2010. Hypoxia-inducible factor regulates osteoclast-mediated bone resorption: role of angiopoietin-like 4. FASEB journal : official publication of the Federation of American Societies for Experimental Biology, 24(12), pp.4648–4659.

Condylar Perfusion

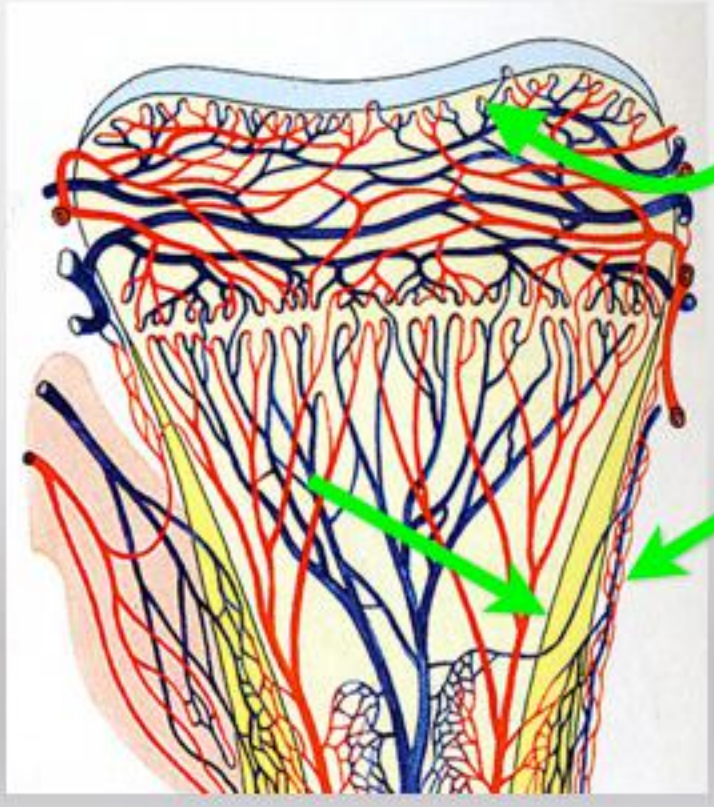
Blood flows in and out of the condylar head through vessels that pierce the cortex







Subchondral Bone only has blood vessels from intramedullary



Cortical bone gets blood vessels from both intramedullary and periosteum

Abundant collateral circulation

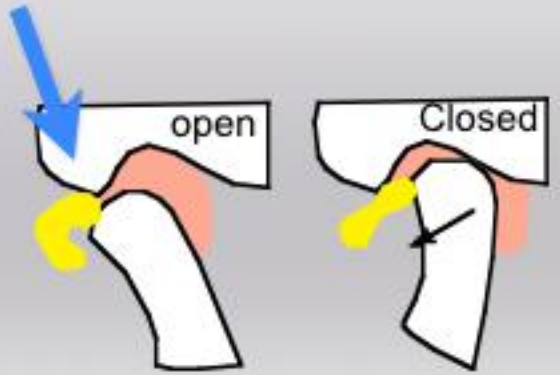
When the clicking stops (4a to 4b):

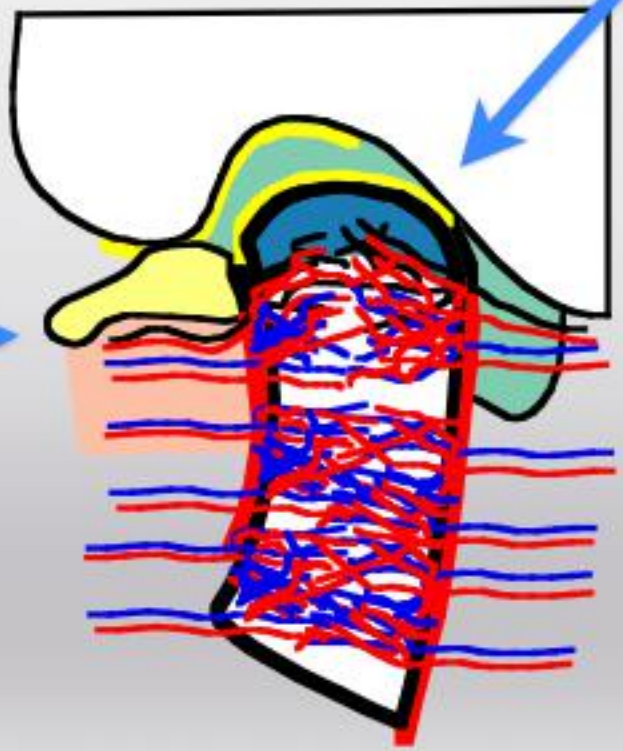
Condyle Distalized

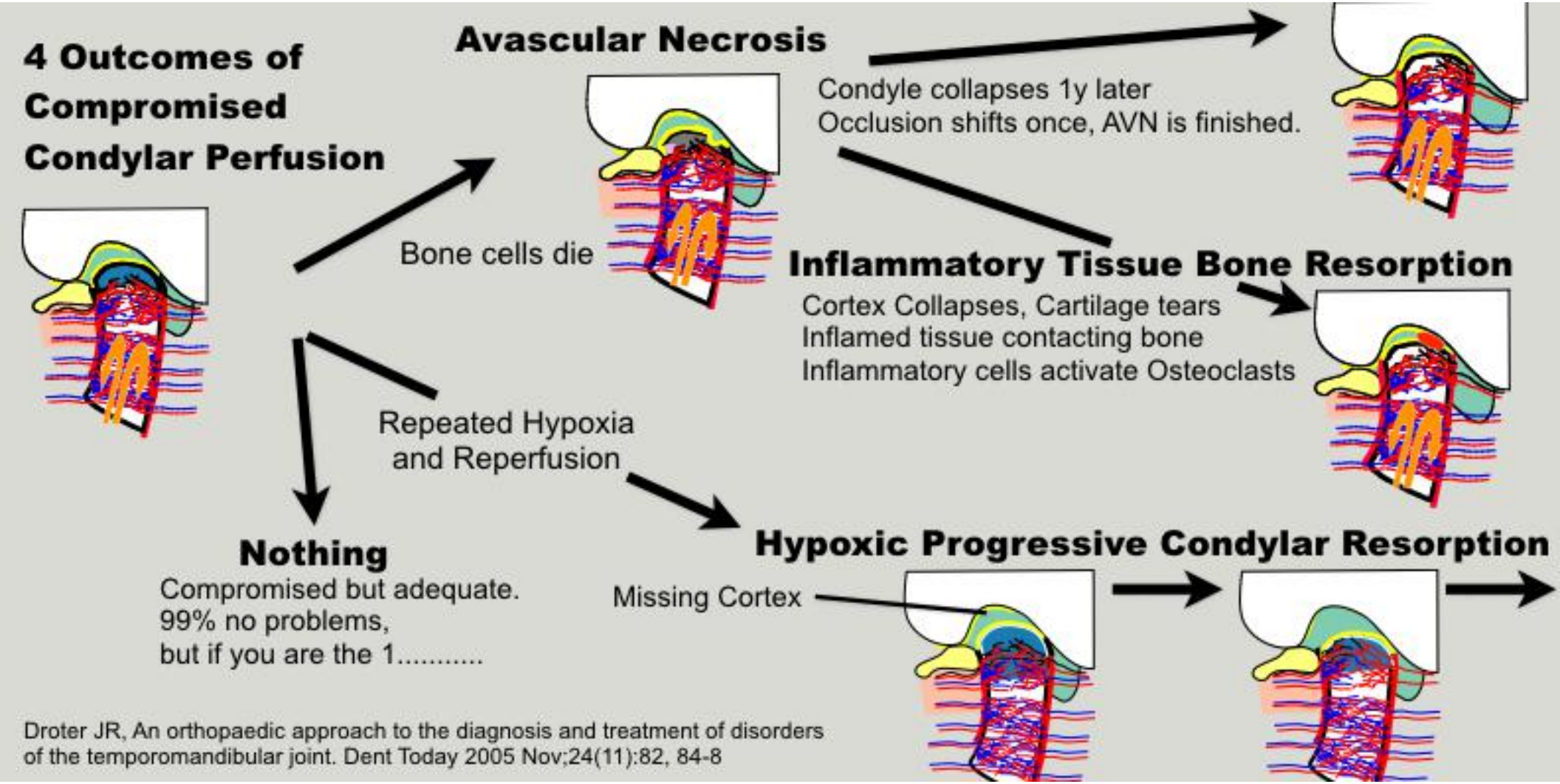
Venous return compromised

Compromised Condylar Perfusion
Blood flow through condyle is decreased

Disc Anterior







Droter JR, An orthopaedic approach to the diagnosis and treatment of disorders of the temporomandibular joint. Dent Today 2005 Nov;24(11):82, 84-8

AVN TMJ Controversy

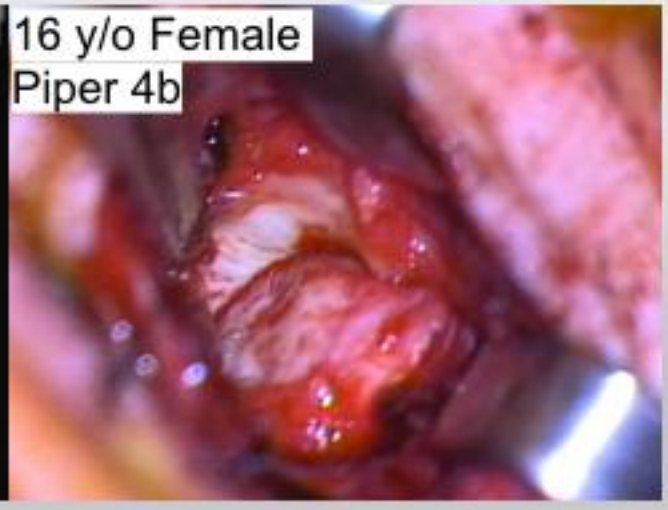
AVN does exist, only rare if you don't look for it

AVN affects all joints of the human body, including the TMJ

The only disease process that occurs underneath intact cartilage

Larhein/Westesson Core Biopsy Study

Competing Theories: Estrogen, Venereal Disease, OA, Idiopathic

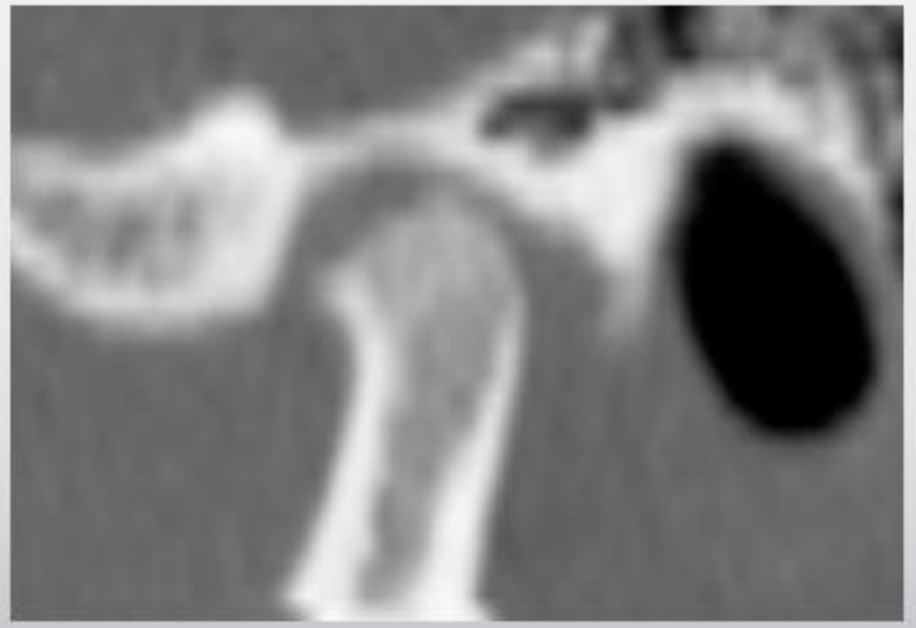


Larhein TA, Westesson PL, Osteonecrosis of the Temporomandibular Joint: Correlation of Magnetic Resonance Imaging and History, Jour OMS, 1999

Hypoxia Induced Progressive Condylar Resorption
HI-PCR

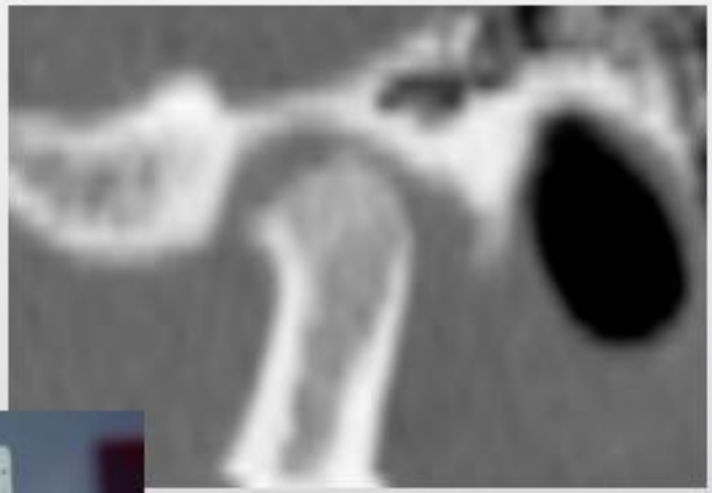
On CT see Flat condylar surface
Missing Subchondral Cortex During Active Phase
Slow, Progressive Condylar Resorption

Occlusion will constantly be changing



1 year after the clicking stops is the "Danger Zone"

Look for TMJ bone loss, anterior open bite developing
- Avascular Necrosis
- Hypoxia Induced Progressive Condylar Resorption

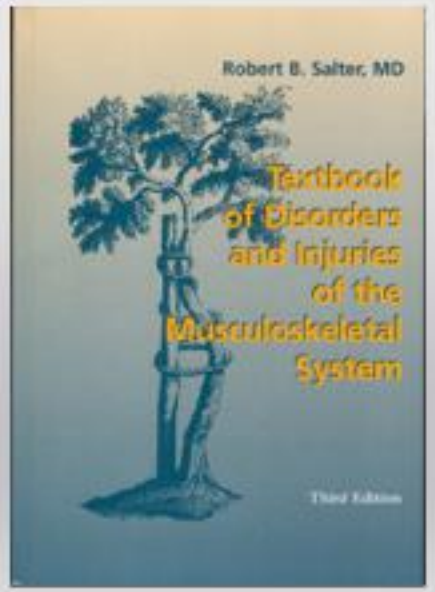


After clicking stops:
- Get CT or CBCT scan of the TMJ
- Maintain jaw motion: PT, exercises
- Get photos
- Mounted models
- Monitor occlusion over the next year
- Follow up CBCT scan 1 year later
- After 1 year "Adapted Favorably"

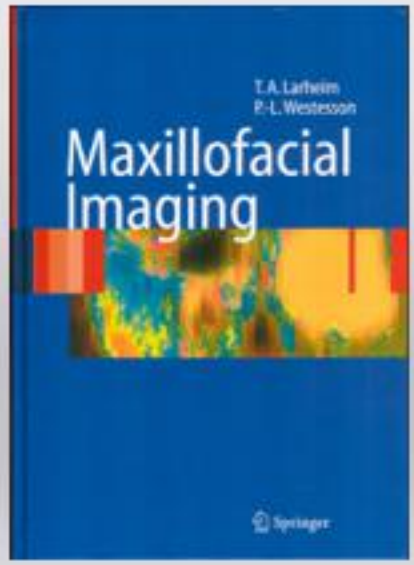
My Core Belief

The TMJ is a synovial joint of the human body and will undergo the same disease processes as any other synovial joint

Understanding orthopedic medicine is the key to understanding joints, including the TMJ



Buy Salter's Orthopedic Textbook.
When you have a patient with specific disease (i.e. osteoarthritis), read that chapter.



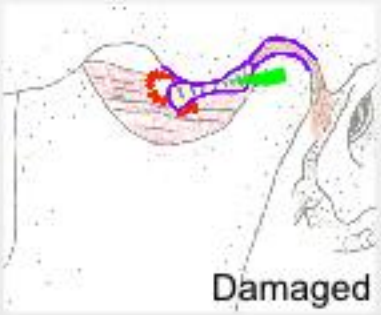
Textbook of Disorders and Injuries of the Musculoskeletal System
Robert Salter MD

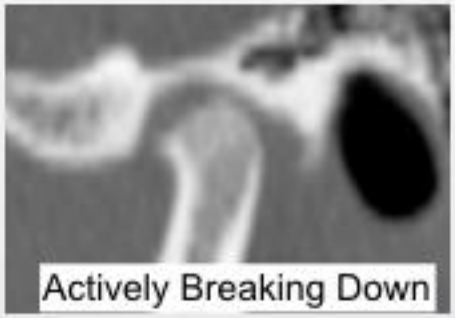
Maxillofacial Imaging
Larheim
Westesson

Basic Orthopedics

Joints are either
- Healthy or
- Damaged

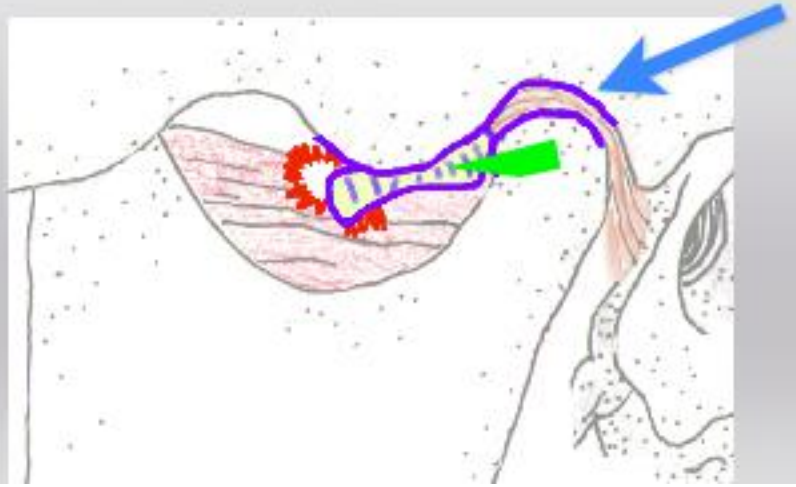

Healthy


Damaged


Actively Breaking Down

If damaged, joints will be either:
- Actively Breaking Down
- Adapting
- Adapted Favorably Structurally and Mechanically
- Adapted Unfavorably

Majority of damaged TMJs adapt favorably

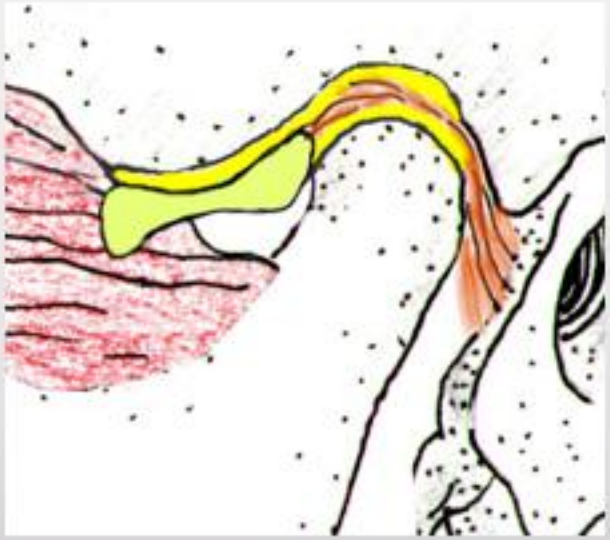


Posterior ligament, synovium, and retrodiscal tissue adapt to form a

Pseudo-disc

Tissue Fibrosis

All Clicking Joints are Damaged



Not so Dangerous Clicks

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

Clicks that need further Evaluation/ Scans

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

Many Dangerous things do not Click

Seattle Study Club

Patient #1
Patient saw their medical doctor for pain left side of face. MD said they have TMJ and to see their dentist.

Patient #2
30 year old patient in hygiene says jaw is clicking.

Patient #3
18 year old patient complains of jaw sticking, clicking on waking. goes away in a few minutes and is fine the rest of the day

How do you handle these three patients in ***your actual*** practice?
How much time for patient #1?
What steps do you take?
What additional information do you need?
How will you acquire it?

Form a group practice protocol

Seattle Study Club

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How will you acquire it?

Form a group practice protocol

Seattle Study Club

How do you handle these two patients in ***your actual*** practice?
What steps do you take?
What additional information do you need?
How will you acquire it?

Patient #1
Patient saw their medical doctor for pain left side of face.
MD said they have TMJ and to see their dentist.

History, Exam, D-PAS

Patient #2
30 year old patient in hygiene says jaw is clicking.

History, Exam
If no History trauma suspect clenching, D-PAS
Trauma or new click, JVA and monitor, warn of risks
If locking refer to TMD specialist
Old click (2yrs), advise pt to notify you if clicking changes

Patient #3
18 year old patient complains of jaw sticking, clicking on waking. goes away in a few minutes and is fine the rest of the day

Patient is clenching
D-PAS PM wear,
Vitamin C prior to bedtime, Vitamin C and glucosamine in AM

Diagnostic Flow sheet for a General Dentists for patients with TMD pain

Finding and treating Occlusal Muscle Disharmony (OMD) and referring out the rest.

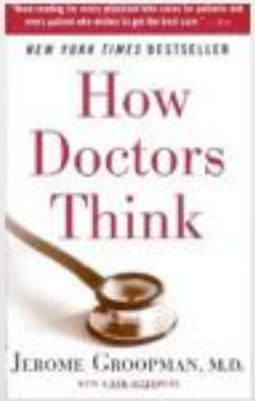
1. Exam/Differential Diagnosis:
   - What is sore- Is it joint, muscle or neck?
   - Take History, Palpate TM Joints, Palpate TM muscles, Palpate Neck
   - Rule out dental causes. What are the choices?

2. Diagnostic Tests:
   - DAT-PAS Appliance for 1 week, Night wear only. Test for Clenching.
   - DAT-PAS Appliance for 1 week, 24/7 wear except to eat.
     - Tests joint mechanical stability.
     - Tests elimination of posterior occlusal interferences.
     - Rules out painful Centric Relation Load Zone
     - Patient gets to experience pain relief, understand and own the disease.
     - Patient can perceive the value/benefit of complete exam and full time appliance.
   - Full Coverage Centric Relation Appliance 3-6 weeks, 24/7 wear
     - Same benefits as above plus testing a fully functioning occlusion
   - Repeat Step 1. If all the pain has gone away then step 3.

3. Occlusal Analysis. Alter Occlusion- See LD Pankey 3 Rules of Occlusion
   - One week before adjust occlusion, use DAT-PAS 24/7 to verify joint stability.

Blinded by the Click

There is no rule that says you only get one disease



Always make a differential diagnostic list
Ask, " It appears to be this, but what else could it be?
Be aware you are blinded by your beliefs

Jaw is clicking, ear pain

Jaw is clicking, sudden onset headache, 53 year old

Jaw is clicking, temple pain, pain increases with chewing, 62 year old

Jaw use to click, Jaw stopped clicking and can not open wide

History is key, physical exam is next most important, palpate the muscles and joint.
Notice the Age group does not fit OMD for the second and third patient.
None of the above patients will pass the D-PAS test.
The third patient does not have time for the D-PAS test


Know Yourself
Know Your Work
Know Your Patient
Apply Your Knowledge
LD Pankey Institute
Write your Dream