Head and Neck Anatomy Review
Embryology (Where it all began)

Gastrulation

Formation of trilaminar from bilaminar disc

Week 3 of development
Ectoderm; Mesoderm; Endoderm;
Primitive node and streak

14-15 days
Epiblast
Hypoblast

Endoderm

16 days
Mesoderm
Definitive endoderm

Ectoderm: Epidermis and CNS
Mesoderm: Musculoskeletal; Cardiovascular and Urogenital systems
Endoderm: Lining of GIT and respiratory tract

The Gastrula

Mesenchyme

Differentiation

Bone
Cartilage
Connective Tissue
Adipose Tissue

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Embryology

- Ectoderm
  - Nervous system
  - Sensory epithelium of eye, ear, nose
  - Epidermis, hair, nails
  - Mammary and cutaneous glands
  - Epithelium of sinuses, oral and nasal cavities, intraoral glands
  - Tooth enamel
Embryology

- Mesoderm
- Muscles
- Connective Tissue Derivities: Bone, cartilage, blood, dentin, pulp, cementum, PDL
Embryology

- Endoderm
- Gastro-intestinal tract epithelium and associated glands
Branchial Arches
Mandibular (1st) Arch

- Forms
  - Trigeminal nerve
  - Muscles of mastication
  - Mylohyoid
  - Ant. belly of digastric
  - Tensor tympani
  - Tensor veli palatini
Mandibular (1st) Arch

• Forms (continued)
  • Malleus and incus
  • Ant. ligament of malleus
  • Sphenomandibular ligament
  • Portions of the sphenoid bone
  • Lower lip, lower face and mandible

Associated with Meckel’s cartilage
Hyoid (2nd) Arch

- Forms
  - Facial nerve
  - Stapedius muscle
  - Muscles of facial expression
  - Posterior belly of digastric
  - Stylohyoid

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Hyoid (2nd) Arch

- Forms
  - Stapes and portions of malleus and incus
  - Stylohyoid ligament
  - Styloid process of temporal bone
  - Lesser cornu of the hyoid bone
  - Upper portion of body of the hyoid

Associated with Reichert’s cartilage
Osteology Review
Cranial Bones

- Occipital bone
- Frontal bone
- Parietal bones
- Temporal bones
- Sphenoid bone
- Ethmoid bone

Facial Bones

- Vomer
- Lacrimal bones
- Nasal bones
- Inferior nasal conchae
- Zygomatic bones
- Maxillary bones
- Mandible
For **Handouts** and other cool stuff, go to KiwiLive.com

**Keyword = Spencer**
Bony Openings in the Skull

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• Foramen cecum: emissary vein
• Cribiform plate: olfactory nerves
• Optic canal: optic nerve
• Sup. Orbital fissure: oculomotor nerve (III), trochlear nerve (IV), Ophthalmic division of Trigeminal nerve (V1), Abducens nerve (VI)
• Foramen rotundum: Maxillary division of Trigeminal nerve (V2)
• Foramen ovale: Mandibular division of Trigeminal nerve (V3),
- Foramen spinosum: Meningeal branch of V3
- Foramen lacerum: greater petrosal nerve
- Carotid canal: int. carotid artery
- Internal acoustic meatus: Facial nerve (VII), Vestibulocochlear nerve (VIII)
- Jugular foramen: Glossopharyngeal nerve (IX), Vagus nerve (X), Accessory nerve (XI)
- Hypoglossal canal: Hypoglossal nerve (XII)
OPHTHALMIC DIVISION – TRIGEMINAL NERVE
MAXILLARY DIVISION – TRIGEMINAL NERVE
Pterygomaxillary fissure
MANDIBULAR DIVISION – TRIGEMINAL NERVE
Muscles of the Head and Face
Muscles: Rules of Innervation

• The muscles of facial expression are all innervated by the facial nerve, which also supplies the stapedius, stylohyoid and the posterior belly of the digastric.
Muscles of Mastication
Muscles: Rules of Innervation

• The muscles of mastication are all innervated by the trigeminal nerve, which also supplies the tensor veli palatini, tensor veli tympani, the mylohyoid and the anterior belly of the digastric.
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Muscles of Mastication

- **Masseter**
  - Origin: Zygomatic Arch
  - Insertion: Angle and Ramus
  - Innervation: Masseteric n.
  - Actions: Elevates the Mandible
Muscles of Mastication

• Lateral Pterygoid: Inf. Belly
  • Origin: Lateral surface of the lateral pterygoid plate
  • Insertion: Condylar neck; joint capsule; articular disc
  • Innervation: Lateral pterygoid n.
  • Action: Depresses mandible (translation)
Muscles of Mastication

- Lateral Pterygoid: Sup. Belly
  - Origin: Inf. Surface of the greater wing of the sphenoid
  - Insertion: Articular disc; condylar head and joint capsule
  - Innervation: Lateral pterygoid n.
  - Actions: Maintains articular disc position during condylar rest and movement.
Muscles of Mastication

• **Medial Pterygoid**
  • Origin: Medial surface of the lateral pterygoid plate
  • Insertion: Medial surface of the mandible
  • Innervation: Medial pterygoid n.
  • Actions: Protrudes the mandible, elevates the mandible
Muscles of Mastication

• Temporalis
  • Origin: Temporal fossa
  • Insertion: Coronoid process of the mandible
  • Innervation: Temporalis n.
  • Actions: Elevates the mandible and retrudes
The Trigeminal Nerve
Cutaneous Nerves of the Head and Neck
The Temporomandibular Joint
The Temporomandibular Joint

- An “arthroginglymoidal” joint

- Rotation occurs in the upper joint compartment (arthrodial)

- Translation occurs in the lower compartment (ginglymoid)
The Temporomandibular Joint

• Innervation - Branches of the Mandibular Division

  • Auricular branch of the auriculotemporal nerve (75%)
  • Posterior deep temporal nerves
  • Masseteric nerve
“RETRODISCAL PAD”

Posterior temporal attachment or “superior lamina”

Posterior mandibular attachment or “inferior lamina”
Fibers of the superior head of the lateral pterygoid muscle attach to the disc.
Pinto’s ligament – malleomandibular ligament
Craniofacial Pain Examination

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Initial Examination

• Health history: what to look for
  • Current use of SSRI antidepressants
  • Trauma
  • Rheumatoid Arthritis/inflammatory diseases
  • Previous Treatment
  • Migraine headaches: temporalis headaches
SSRI Induced Bruxism

• Buspirone as an Antidote to SSRI Induced Bruxism in 4 Cases
  J Clinical Psychiatry, December 1999, Bostwick, Jaffee
Initial Examination

• Health history: what to look for
  • Current use of SSRI antidepressants
  • Trauma
  • Rheumatoid Arthritis/inflammatory diseases
  • Previous Treatment
  • Migraine headaches: temporalis headaches
Acetaminophen, Aspirin, and Caffeine
Acetaminophen, Aspirin, and Caffeine
Advil® Migraine

This is the most current labeling information and may differ from labels on product packaging. If there are any differences between this website labeling and product package labeling, this website labeling should be regarded as the most current.

### Drug Facts

<table>
<thead>
<tr>
<th>Active ingredient (in each brown oval capsule)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solubilized ibuprofen equal to 200 mg ibuprofen (NSAID)*</td>
<td>Pain reliever</td>
</tr>
</tbody>
</table>

*nonsteroidal anti-inflammatory drug
The **Mystery** is in the **History**
O = onset
P = palliate or provoke
Q = quality
R = region
S = scale
T = time
Jam on Spencer
Onset

• What were you doing when it started?
Provoke or Palliate

• Does anything make it worse?

• Does anything make it better?
Provocation or Palliation

• Does anything make it worse?

• Does anything make it better?
Quality

• Can you describe it (the pain) to me? Is it sharp, dull, constant, intermittent, throbbing, electrical, an ache?
Region and Radiation

• Where exactly does it hurt (point with one finger)?

• Does the pain start in one place and move to another place or places?
Severity

• On a scale of 0 to 10, where 10 is **being burned alive**, how bad is the pain...
  • On average?
  • At its worst?
  • At its best?
When does this (pain) bother you the most?

- All the time
- Morning, afternoon, evening
- Random
- After meals, when eating
Initial Examination

- History of TMD
  - WHAT is the chief complaint
  - WHERE does it hurt
  - WHEN did the symptoms start
Initial Examination

- History of TMD
- WHAT is the chief complaint
- WHERE does it hurt
- WHEN did the symptoms start
Range of Motion

- “Normal” = 48-52mm, or 3 Fingers
- Hyper = >55mm or 3 knuckles or more
- Reduced = 30-40mm, 2 fingers to 2 knuckles
  - Suspect chronic non-reducing disc
- Limited = 26mm
  - Suspect acute non-reducing disc
- Severely limited = <20mm
  - Suspect trismus if after an IA block
Initial Examination

• Palpation of TM joints
  • Reducing Disc Displacement (RDD)
  • Crepitus
  • Normal
  • Unilateral or bilateral
  • Able to capture with anterior positioning (RDD)
  • Patient perceives noise on the same side you detect it
  • Unable to detect noise the patient hears
  • Eminence “clicking”
Initial Examination

• Spray and Stretch Procedure
  • Ethyl chloride or Fluori-Methane
  • Spray over painful joint or muscle on stretch
  • Have the patient open and close a few times, measure their MO, and then have them relax
  • Ask the patient “does that make the discomfort worse, better or no change?”
Initial Diagnosis

- No Tx indicated
- Initial trial of anti-inflammatories, home PT, and Aqualizer
  - 600 mg ibuprofen q6h for 6 days
  - Ice 10 minutes with gentle stretching followed by 10 minutes moist heat
  - Aqualizer as much as possible and definitely at night
The AQUALIZER™

Float away tension, muscle pain and headaches.

• PRE-MADE READY TO INSERT ORAL SPLINT
  Fast. No Waking, Bolting or Fitting

• INCREASE YOUR SUCCESS TREATING:
  Headaches, TMD, Tension, Neck and Shoulder Pain

The AQUALIZER’s water system perfectly balances and cushions the bite. Muscles relax, moving the jaw into the most comfortable position stopping the occlusal trigger of spasms and referred pain throughout the head, neck and shoulders.

ORDER TODAY
1-800-HELP-TMD
(1-800-435-7863)

Aqualizer Size Selection: All Aqualizer models are available in three different vertical dimensions: “Low,” “Medium” and “High.” The thickness is controlled by the amount of fluid in the Aqualizer.

Medium volume Aqualizers are used by most (90%) patients.

Low volume Aqualizers are used for bite registration and Patients with restricted opening or inadequate freeway space.

High volume Aqualizers are used when a patient has excessive freeway space and/or needs a greater vertical dimension to fill the space between the upper and lower occlusal surfaces.
Initial Treatment Plan

- Refer for Physical Therapy
- Refer to another healthcare provider

- Or, obtain further records
  - Study models
  - Radiographs
  - MRI
Imaging Records

- Computer Aided Tomography
- Magnetic Resonance Imaging
Left Closed  Left Open  Right Closed  Right Open

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Additional Records?
Dr. Spencer’s Super Awesome TMJ Diagnosis Kit

On sale now!
TMD: Basic Differential Diagnosis

• Or…Everyday,

Normal Dental Office,

Craniofacial Pain Disorders
Capsulitis

- Diagnosis
  - History of Trauma
  - Continuous TMJ Pain
  - Tenderness to Palpation
  - ROM not necessarily reduced
  - Acute malocclusion on injured side
  - Pain with Clenching
  - No pain with clenching on a tongue depressor
Capsulitis

- Treatment
  - Anti-inflammatories
  - Physical Therapy
  - Aqualizer or soft splint
  - Hard splint if necessary
Capsulitis Treatment

- Anti-inflammatories
  - 600 mg Ibuprofen q6h for 4-7 days
  - Medrol dose pack (methylprednisolone)
Capsulitis Treatment

• Iontophoresis
  • A non-invasive method of pushing medication transdermally using a charged pad.

• Phonophoreis
  • A non-invasive method of pushing medication transdermally using ultrasound.
Capsulitis Treatment

- Splint therapy
  - Any splint for acute capsulitis should be temporary—for use until the inflammation is resolved.
  - The perfect splint for a capsulitis case would self adjust as the inflammation reduces...
Capsulitis Treatment

• Splint therapy
  • Once the initial capsulitis has resolved, a nightguard or daysplint (or both) may be indicated to reduce adverse joint loading.
Capsulitis Recap

- Pain in/around the TM joint
- Posterior open bite
- Pain on trying to occlude
- No pain biting on a **tongue depressor** on the affected side

- **Anti-inflammatory**s and an Aqualizer
Internal Derangements

What is that CLICKING?
Normal  RDD  NRDD

Dr. Per-Lennart Westesson and Dr. Lars Eriksson
University of Lund, Sweden.

Internal Derangements

DJD
Internal Derangements

- A (Very) Simplistic Overview
  - Reducing Disc Displacement
  - Non-Reducing Disc Displacement
The Normal TM Joint
Discal Dislocation with Reduction
And now, a brief discussion of...
And now, a brief discussion of...

Centric Relation
GPT 5th Edition 1987

• “the maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the shapes of the articular eminencies.”
centric relation \se˘n’trǐk ri˘-lā’shun\ 1: the maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the shapes of the articular eminencies. This position is independent of tooth contact. This position is clinically discernible when the mandible is directed superior and anteriorly. It is restricted to a purely rotary movement about the transverse horizontal axis (GPT-5) 2: the most retruded physiologic relation of the mandible to the maxillae to and from which the individual can make lateral movements. It is a condition that can exist at various degrees of jaw separation. It occurs around the terminal hinge axis (GPT-3) 3: the most retruded relation of the mandible to the maxillae when the condyles are in the most posterior unstrained position in the glenoid fossae from which lateral movement can be made at any given degree of jaw separation (GPT-1) 4: The most posterior relation of the lower to the upper jaw from which lateral movements can be made at a given vertical dimension (Boucher) 5: a maxilla to mandible relationship in which the condyles and disks are thought to be in the midmost, uppermost position. The position has been difficult to define anatomically but is determined clinically by assessing when the jaw can hinge on a fixed terminal axis (up to 25 mm). It is a clinically determined relationship of the mandible to the maxilla when the condyle disk assemblies are positioned in their most superior position in the mandibular fossae and against the distal slope of the articular eminence (Ash) 6: the relation of the mandible to the maxillae when the condyles are in the uppermost and rearmost position in the glenoid fossae. This position may not be able to be recorded in the presence of dysfunction of the masticatory system 7: a clinically determined position of the mandible placing both condyles into their anterior uppermost position. This can be determined in patients without pain or derangement in the TMJ (Ramsford).
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3: the most retruded relation of the mandible to the maxillae when the condyles are in the most posterior unstrained position in the glenoid fossae from which lateral movement can be made at any given degree of jaw separation (GPT-1) 

4: The most posterior relation of the lower to the upper jaw from which lateral movements can be made at a given vertical dimension (Boucher) 

5: a maxilla to mandible relationship in which the condyles and disks are thought to be in the midmost, uppermost position. The position has been difficult to define anatomically but is determined clinically by assessing when the jaw can hinge on a fixed terminal axis (up to 25 mm). It is a clinically determined relationship of the mandible to the maxilla when the condyle disk assemblies are positioned in their most superior position in the mandibular fossae and against the distal slope of the articular eminence (Ash) 

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7: a clinically determined position of the mandible placing both condyles into their anterior uppermost position. This can be determined in patients without pain or derangement in the TMJ (Ramsford)
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7: a clinically determined position of the mandible placing both condyles into their **anterior uppermost position**. This can be determined in patients without pain or derangement in the TMJ (Ramsford)
Discal Dislocation without Reduction
Discal Dislocation without Reduction

- Diagnosis
  - Based on History
  - Based on History plus MRI
Discal Dislocation without Reduction Diagnosis

- Based on History
  - Maximum opening of approximately 26mm.
  - Typically deflection to the affected side.
  - History of reducing disc displacement.
  - Often, history of locking episodes.
  - History of a traumatic event (accident, injury, iatrogenic, etc.), or the patient will usually wake locked.
Macro Trauma
Micro Trauma
The cause of bruxism???
Discal Dislocation without Reduction

• Acute
  • Sudden onset with pain and swelling
  • Pain with forced maximum intercuspation
  • Deflection to the affected side on opening
  • Maximum opening is usually around 26mm
Discal Dislocation without Reduction

• Chronic
  • History of joint clicking
  • History of reduced range of motion (usually in the 30’s)
  • Usually no pain
Diagnostic Imaging

- MRI
  - Needed to absolutely confirm DDw/oR.
  - Critical to have the MRI taken correctly.
  - Write the prescription for closed and wide open views.
  - Provide a bite block for the open view.
  - Read the film yourself and discuss with the radiologist if you disagree with the interpretation.
Discal Dislocation without Reduction

• Treatment
  • Acute
    • Attempt to Reduce (yourself or give the patient exercises)
    • Treat with splint, PT and meds
  • Chronic
    • Attempt to Reduce?
    • No treatment
    • Palliative (meds, home PT, splint)
Reduction ("unlocking") Technique
Spencer Bilaterally Indexed
Gnathological Early Guidance Orthotic
Spencer
BIG EGO
Patient Education

- It is EXTREMELY important to educate the patient to help them feel and know when they are locked and when they are unlocked.
Follow Up

• The patient is to call the next morning

• The patient returns in one week for follow up

• The patient is educated as to the importance of nightguard therapy or daysplint therapy to stabilize the proper disc position (CR)
Thermal Plastic Temporary Splint Fabrication
What about Arthrocentesis?

- Images from Mayoclinic.org
METHODS: Eighty-five joints (85 patients) with unilateral internal derangement or osteoarthritis that were successfully treated were included in this study. The patients were divided into four groups as follows: splint therapy group, pumping manipulation group, arthrocentesis group, and arthroscopic surgery group. Changes in the disc position, mobility, and morphology before and after treatment were compared among the four groups using MRI. Ohnuki, T. Fukuda, M. Nakata, A. Nagai, H. Takahashi, T. Sasano, T. Miyamoto, Y.

Evaluation of the position, mobility, and morphology of the disc by MRI before and after four different treatments for temporomandibular joint disorders. Dento-Maxillo-Facial Radiology. 35(2):103-9, 2006 Mar.
RESULTS: All discs showed anterior disc displacement (ADD) without reduction before treatment. Only 10% of the joints became ADD with reduction after treatment, and the other joints remained ADD without reduction in spite of treatment. Discs treated by arthroscopic surgery were located more anteriorly compared with pre-treatment. The disc deformity advanced after arthrocentesis and arthroscopic surgery.

Evaluation of the position, mobility, and morphology of the disc by MRI before and after four different treatments for temporomandibular joint disorders. Dento-Maxillo-Facial Radiology. 35(2):103-9, 2006 Mar.
Study design. The study comprised 28 patients with a clinical unilateral TMJ disorder of internal derangement type III and capsulitis/synovitis. Bilateral MRI was immediately performed preoperatively and at a 2-month follow-up.

- Magnetic resonance imaging findings of internal derangement, osteoarthrosis, effusion, and bone marrow edema before and after performance of arthrocentesis and hydraulic distension of the temporomandibular joint

Rüdiger Emshoff, MD, DMD,a Stefan Gerhard, MD, DMD, Thomas Ennemoser, MD, DMD, and Ansgar Rudisch, MD, Innsbruck, Austria
Comparison of the pretreatment MRI findings with the 2-month follow-up data showed for the TMJ internal derangement type III and capsulitis/synovitis side a slight decrease in the diagnoses of internal derangement from 28 (100%) preoperatively to 25 (89.3%) postoperatively, and a slight increase in those of OA

- Magnetic resonance imaging findings of internal derangement, osteoarthrosis, effusion, and bone marrow edema before and after performance of arthrocentesis and hydraulic distension of the temporomandibular joint

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NRDD Recap

• Approximately 26mm inter-incisal opening
• History of clicking
• History of occasional locking episodes or “catching”
• No clicking since the jaw “locked”

• Perform unlocking procedure or refer ASAP (for unlocking procedure… not to PT or Chiro)

Jamison Spencer
Myofascial Pain Dysfunction
Myofascial Pain Dysfunction

• Not specific to TMD
• Variable muscle pain
• Restricted ROM
• Trigger Points with referral patterns
Trigger Points

- Definition: A hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band. The spot is painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction, and autonomic phenomena.

Travell & Simons’ Myofascial Pain and Dysfunction
A, B, C, D
Figure 5.2. Overlapping pain referral patterns (red) from myofascial trigger points (Xs) in various masticatory and cervical muscles produce typical unilateral or bilateral migraine or tension-type headache pictures.
Capsulitis:
- Tongue Depressor Test
- Aqualizer and Advil

Non-Reducing Disc Displacement:
- 26mm of range of motion, without clicking, with a history of recent clicking
- Unlocking procedure (or refer ASAP)

Myofascial Trigger Points:
- Tender points in muscles that give rise to characteristic referred pain patterns
- Trigger point injections and/or Physical Therapy
Not Understanding Their Symptoms
Someone That Understands Now

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