Anatomy of the Head and Neck with Clinical Application

Henry A. Gremillion, DDS, MAGD
LSU School of Dentistry

Goals of Comprehensive Dentistry

- Optimum oral health
- Anatomic harmony
- Functional harmony
  - TM joints
  - musculature
  - occlusion
- Orthopedic stability

Chief concern
- bitemporal headache
- pain with jaw function
- sore teeth upon waking
- neck pain

Should I treat this patient?
What is/are the diagnosis(es)?
How should I treat this patient?
What factors are important in this case?

The Puzzle

Pain Pathways

The Many Faces of Pain

What We See
What We Don't See/Know!!!
Differential Diagnosis

The systematic consideration of the patient's signs and symptoms in order to distinguish one disease from another.

Differential Diagnosis

- Teeth
- Paranasal sinuses
- Otologic
- Joint
- Muscle
- Vascular
- Neurogenous

DIAGNOSIS IS THE KEY!

Must Consider:
- anatomy
- physiology
- neurology
- psychology

Osteology

Anatomy of the Skull

Supraorbital foramen- supraorbital nerve and vessels
Optic canal- optic nerve, ophthalmic artery
Superior orbital fissure- nasociliary, frontal, and lacrimal branches of V1, oculomotor nerve, trochlear nerve, abducens nerve, superior and inferior ophthalmic veins
Inferior orbital fissure- V2, zygomatic nerve, infraorbital vessels
Battle's sign, also called mastoid ecchymosis, consists of bruising over the mastoid process (just behind the auricle), as a result of extravasation of blood along the path of the posterior auricular artery. It is an indication of fracture of the base of the posterior portion of the skull, and may suggest underlying brain trauma.
Cone Beam Computed Tomography (CBCT)

LeFort I, II, III Fractures

LeFort III Facial Fracture
**CORONOID HYPERTROPHY**

- Limited range of motion (gradually developing)
- May be painless
- Most common in adolescent males

**EAGLE’S SYNDROME**

- Pain on swallowing
- Pain upon palpation of lateral pharyngeal wall
- Pain on turning head (associated dizziness?)
Surgical Removal Of Styloid Process
WORRISOME HEADACHE RED FLAGS
“SNOOP”

- Systolic symptoms (fever, weight loss) or secondary risk factors (HIV, systemic cancer)
- Neurologic deficits lateralizing to side of pain or abnormal signs (confusion, impaired alertness, or consciousness)
- Onset: sudden, abrupt, or split-second
- Older: new onset and progressive headache, especially in middle-age >50 (giant cell arteritis)
- Previous headache history: first headache or different (change in attack frequency, severity, or clinical features)

ANATOMY OF THE ORAL CAVITY and FLOOR of MOUTH
Tongue position and its relationship to sleep-related breathing disorders such as sleep apnea... genioglossus activity

SLEEP-RELATED BREATHING DISTURBANCES

Enlarged & Inflamed Tonsils

Nasal Cavity & Paranasal Sinuses

Obstructed Oropharynx
- cribiform plate
- frontal sinus
- sphenoidal sinus
- nasal septum
- choanae
- lateral process of septal nasal cartilage
- major alar cartilage
- nasal vestibule
- anterior nasal spine
- incisive canal
- oral cavity
- tongue
- soft palate
- choanae
- nasal septum
- major alar cartilage
- nasal vestibule
- sphenoidal sinus
- lateral process of septal nasal cartilage

Paranasal Sinuses
- Recesses of nasal mucosa growing into bones
- starts in late fetal period – after birth
- considerable variations:
  (interindividual & intraindividual)
  - onset and continuation of growth
  - size
  - shape
  - tiny cribs
  - small recesses
Mucous Retention Cyst

DISPLACED ROOT / TOOTH
1. Under flap
2. Sinus
3. Infratemporal Fossa

Root Tip in Maxillary Sinus
Third Molar Displaced into Maxillary Sinus

Third Molar Displaced into Infratemporal Foss

Fractured Tuberosity with Maxillary Sinus Exposure

Sinus Lift with Iliac Bone Graft

PARANASAL ORIGINS OF PAIN
Paranasal Sinuses

Headache and facial pain are commonly related to infection, inflammation, and/or obstruction of the outflow of the tracts of the paranasal sinuses.

Acute / Chronic Sinusitis:

**PAINFUL COMPLICATIONS**

- Mucosal inflammation and thickening in cases of acute sinusitis
- Partial or complete obstruction of sinus ostia
- Pressure sensation
- Maxillary mucoceles
- Osteomyelitis

**Sinus involved**

- Sphenoid sinus
- Frontal sinus
- Ethmoid sinus
- Maxillary sinus
- Pansinusitis

**Site(s) of referral**

- Vertex, other parts of the cranium
- Frontal region
- Between the eyes
- Maxilla, dental structures
- Pain may be coalescent, less localized, associated with frontal headaches, constant pressure

Pansinusitis
**MUCOSAL CONTACT HEADACHE**

- Dull and aching
- Diffuse peri-/retro-ocular, supraorbital pain
- History of chronic maxillary sinusitis
- Allergy prone
- Associated with upper respiratory tract infection
- Impedance of normal mucosal activity
Plate 58

Plate 58A

Plate 58B

Pharyngeal Region
**Eustachian tube dysfunction**

- Normal function
  - Dilatation
  - Primarily involves the tensor veli palatini
  - Swallowing causes momentary eustachian tube dilatation which equalizes pressure
  - Secondarily involves
    - Levator veli palatini
    - Salpingopharyngeus
    - Superior constrictor

**Ear Pain (Otalgia)**

- Acute Otitis Externa
- Acute Otitis Media
  - Severe ear pain often
  - Fluid/pressure behind the TM
  - Most common in children
  - Treatment
    - Antibiotics
    - Myringotomy (ear tubes)
Ear Symptoms and TMJ

- Ear pain (Otalgia)
- Hearing changes-stuffiness most likely related to ET dysfunction.
- Tinnitus (ringing in ear)
- Dizziness

Tonic Tensor Tympani Phenomenon

- Hypertonia of medial pterygoid produces a concomitant reflex hypertonia of the tensor tympani muscle
- Tonic tensor tympani cannot initiate the reflex that increases the tonus of the tensor veli palatini muscle
- Failure of the eustachian tube to open during deglutition

Otomandibular Syndrome

1 or more of the following without pathology in ENT exam plus 1 or more muscles symptomatic

- Pain / fullness in and around ear
- Hearing loss
- Tinnitus
- Loss of equilibrium

Submandibular (Digastric) Triangle

- Superior
  - Inferior border of mandible
- Anterior
  - Superior border of anterior belly of digastric
- Posterior
  - Superior border of posterior belly of digastric

Digastric Triangle
**Patient: Betty**

- 51 year old Caucasian female
- Medical history significant for:
  - left temporomandibular surgery X2
  - hypothyroidism

**Patient: Betty**

- Chief pain concern:
  - “I have pain in my jaw and throat when I eat. The pain radiates to my ear. It feels like a toothache.”

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**Major Salivary Glands**

- Parotid gland: pure serous
- Submandibular gland: primarily serous
- Sublingual gland: primarily mucous
Patient: Betty

- Aggravating factors:
  - chewing and drinking
  - certain aromas
- Alleviating/relieving factors:
  - none identified

Sialolithiasis

- History
  - pain with salivation
- Inspection
- Palpation

- Imaging
  - occlusal
  - lateral jaw
  - panoramic
  - sialogram

Superficial Face
**BELL’S PALSY**

- Cranial nerve VII paralysis
- May occur post-dental procedure
- Usually unilateral
- Gradual or sudden onset
- Viral relationship???

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**Patient: Juan**

- 28 year old Hispanic male
- Medical history:
  - unexplained intermittent facial swelling and lymphadenopathy
  - previously treated with Pen VK 500 mg

**Patient: Juan**

- Chief pain concern(s):
  - “pain on the right side of my face; headaches in the temples; clicking in my right jaw; face feels numb and tingles on the right side; throbbing when I eat”

**Patient: Juan**

- Aggravating factors:
  - eating
  - opening wide
  - yawning
- Alleviating/relieving factors:
  - antibiotics (Pen VK 500)
  - analgesics (Ibuprofen) -- “takes the edge off”
Parotido-Masseteric Hypertrophy
Traumatic Occlusion Syndrome

- Parotid swelling
  - duct obstruction
  - pain
- Sialodochitis
  - bacterial infection due to retrograde travel of organisms from the oral cavity
- Traumatic occlusion

Treatment

- Antibiotic therapy
- Analgesics
- Occlusal therapy
- Control parafunctional habits

Patient: Bernadette

- 78 yr. old Caucasian female
- Medical history:
  - hypertension
  - osteoporosis
  - intermittent, migrating joint swelling
  - fatigue of recent onset
  - depressed mood
  - progressively worsening vision

Chief pain concern(s):
- "I have facial pain all over both sides of my face. I have severe pain upon chewing. My
Patient: Bernadette

- Aggravating factors:
  - eating
  - talking
  - clenching

- Alleviating/relieving factors:
  - jaw rest
  - “eating in stages”

Temporal Arteritis

- Characteristics
  - Jaw claudication
  - Craniofacial pain
    - dental pain
    - TM joint pain
    - otalgia
    - headache

- Diagnosis
  - Clinical
    - decreased pulse
    - fibrotic, tender artery
  - Laboratory
    - Westergren erythrocyte sedimentation rate (> 50mm/hr)
    - Elevated C-reactive protein

Temporal Arteritis

- Characteristics
  - Visual symptoms
  - Anorexia
  - Anemia
  - Low grade fever/malaise
  - Neurologic deficits
  - Systemic involvement
    - polymyalgia rheumatica

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**Temporal Arteritis**

**Diagnosis**
- Biopsy
  - usually the superficial temporal artery
  - 1.5 cm segment due to “skip” lesions

**Temporal Arteritis**

**Treatment**
- Glucocorticoid therapy
  - parenteral (in patients with visual symptoms)
  - oral
    > Prednisone 40-60 mg / day initially with gradual taper over 6-12 months
1. Muscles active on jaw opening-lateral pterygoid (inferior belly), suprahyoid and digastric muscles
2. Muscles active on jaw closure-temporalis, masseter, medial pterygoid muscles, lateral pterygoid (superior belly)
3. Excursive movements-lateral pterygoid

**Muscles involved in joint function**

**Important Associated Structures**

**Functional Anatomy/Biomechanics of the Masticatory System**

**Temporomandibular Joint**

**Masticatory System: Unique Features**

- Right and left function as one unit
- Articulating surfaces are fibrocartilaginous
- Articular disc separates the joint into two compartments
- Ginglymoarthrodial joint (hinge-gliding)
**Masticatory System: Unique Features**

- Right and left function as one unit
- Articulating surfaces are fibrocartilaginous
- Articular disc separates the joint into two compartments
- Ginglymoarthrodial joint (hinge-gliding)
- Articulation has a rigid end point on closure of the teeth

**OSSEOUS STRUCTURES**

1. Part of temporal bone
2. Glenoid fossa is concave structure covered with thin layer of fibrocartilage
3. Articular eminence is convex, posterior slope has an average angle of 60°

**Soft Tissues**

1. Made up of three zones
   - Posterior band – 3 mm thick
   - Intermediate zone – 1 mm thick
   - Anterior band – 2 mm thick
2. Consists of avascular connective tissue with some cartilaginous elements

**Condyle**

1. Adult condyle is elliptical
2. Mediolateral dimension is about 20 mm and is twice the size of its antero-posterior width
3. Articular surface is covered by a layer of fibrocartilage

**Articular Disk (Meniscus)**

1. Bioconcave structure, divided the joint space into superior and inferior spaces
2. Attachments
   - Anterior-capsule and superior belly lateral pterygoid
   - Posterior-bilaminar zone (retrodiscal tissues)
   - Medial/lateral condyle
**SOFT TISSUES**

Articular Disk (Meniscus)

5. Functions
   a. Load adapter
   b. Fluid distribution
   c. Divides joint space into two compartments allowing complex movements consisting of rotation and translation

**JOINT SPACES**

Synovial Membrane

1. Lines all non-loaded surfaces
2. Made up of intimal layer of cells 1–4 deep
   a. Type A – phagocytic
   b. Type B - secretory
3. Functions of synovial fluids
   a. Lubrication
   b. Nutrition
   c. Maintains and protects articular cartilage

**TM Joint Surfaces**

**Without lubrication**

- relatively smooth
- have high surface energy
- may shear and rupture

**TM Joint Biomechanics**

*The role of lubricant*

- Reduces area of contact
- Reduces surface energy
- Reduces shearing

**TM Joint Biomechanics**

*Lubrication*

- Boundary
- Surface (weeping)
Synovial Organ

Functions
- Semi-permeable membrane which allows for adjustment of pressures within the TM joint.


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Synovial Fluid

As the intra articular pressure increases, the viscosity of the synovial fluid decreases.

This may impair the lubricating ability of the fluid... thus increasing the frictional resistance.

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TM Joint Mechanical Stress

Increased sustained TM joint pressures result in:
- impaired diffusion
- local ischemic changes
  - may lead to cell death
  - free radical formation
- decreased lubrication
  - increased frictional resistance

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IMPORTANT ASSOCIATED STRUCTURES

Sensory Innervation of the TMJ

1. Branches of the 3rd division of the trigeminal nerve
   a. Auriculotemporal
   b. Masseteric
   c. Deep temporal
2. Fibers for pain and proprioception are mainly located in the bilaminar zone and capsule

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TM Joint: Normal Biomechanics

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Degenerative temporomandibular joint disease is the result of maladaptation to increased joint loading.

Westesson, Rohlin 1984
Axelson, et al. 1992, 1993
Stegenga, et al. 1992
deBont, Stegenga 1993