Internal Derangement of the Temporomandibular Joint

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Objectives

• Clinical significance
• Imaging using MRI
• Normal anatomy of the temporomandibular joint
• MRI findings of TMJ internal derangement
• Review examples
20-30% of population
Internal derangement and clinical significance

• Most frequent disorder of the TMJ
• Abnormal positional and functional relationship between the articular disk and its articulating surfaces
• F:M = 3-5:1
• Fourth decade
• Bilateral abnormalities 60-70%
Internal derangement and clinical significance

- Disk position can be abnormal in up to 33% of asymptomatic individuals.
- 82% of patients presenting with pain and functional disturbance have displaced disks on MRI.
- Progressive disorder eventually resulting in ankylosis and osteoarthrosis of varying severity.
- Symptoms become quiescent over a period of 6-10 years.
Etiology?

- Not understood
- Trauma
- Iatrogenic
- Ligamentous laxity
- Organic changes in the teeth, malocclusion, bruxism
- Changes in composition of synovial fluid
- Improper activity of lateral pterygoid muscle
Imaging of the TMJ:

- Transcranial radiography
- Panorex
- SPECT using 99mTc MDP/HMDP
- Ultrasound
- CT
- Arthrography
- MRI
Imaging TMJ- MRI

- T1 spin echo coronal or axial localizer
- PD or T1 and T2 sagittal and coronal in closed- and open-mouth positions

Sommer, O. J. et al. Radiographics 2003;23:14
Imaging TMJ- MRI

- 3 mm slice thickness with a spacing of 0.5 or 1 mm
- FOV 12-14 cm
- Matrix 256 x 192
- Small surface coils; dual
- Gradient echo- pseudodynamic; static images at progressive increments of mouth opening
Temporomandibular joint

- Craniomandibular articulation
- Ginglymoarthrodial joint
- Joint surfaces covered by fibrocartilage instead of hyaline cartilage
- Synovial membrane lines parts of the joint not covered by fibrocartilage
Anatomy-Osseous components
Mandibular component

- Condylar head atop mandibular neck
- Lateral pole and medial pole
Mandibular component

- Morphology of condyle variable
Anatomy - Temporal bone component

- Articular eminence
- Articular tubercle
- Preglenoid plane
- Glenoid fossa
- Postglenoid process
Anatomy- Articular Disk

- Biconcave fibrocartilagous disc
- Divides joint into larger upper and smaller lower compartments
- Firmly attached to articular capsule circumferentially except for medially and laterally where it is attached to medial and lateral poles of condyle by collateral condylodiskal ligaments
Articular Disk

- Anterior band
- Intermediate band
- Posterior band
- Retrodiskal tissue (bilaminar zone)
  - 2 laminae
  - Neurovascular structures

Sommer, O. J. et al. Radiographics 2003;23:14
Normal superior lamina (elastic fibers)  Normal inferior lamina (collagen fibers)
Biomechanical Properties of the Disc

- Disc has to be able to absorb peak loads, distribute force
- Inhomogeneous distribution of collagen, elastin, proteoglycans and fluid
- Plastic deformation, local and progressively
- Adaptive response
Collateral Ligaments

Strong lateral ligament
- 2 layers:
  1) superficial
     - fan-shaped
     - oblique course
     - taut in protraction
  2) deep
     - narrow
     - anteroposterior course
     - taut in retraction
Muscles

• Muscles of mastication:
  – Abductors (jaw opener)
    • Lateral pterygoid
  – Adductors (jaw closers)
    • Temporalis, masseter, and medial pterygoid
Lateral pterygoid

- **Superior belly:**
  - Pass through joint capsule connecting with anterior band of disk
  - Responsible for proper disk movement in coordination with movement of lower jaw especially during closing and ipsilateral movements

- **Inferior belly:**
  - Pulls condyles forward during opening
  - Alternate contracting allows contralateral movement
What is normal?

Normal TMJ motion

• Opening—two different motions:
  1) **Rotation** around a horizontal axis through the condylar heads
  2) **Translation**
      condyle and meniscus move together anteriorly beneath the articular eminence;
      intermediate zone of the meniscus becomes the articulating surface between the condyle and the articular eminence
Protraction
Retraction
Classifications of Internal Derangement

Direction

• Direction of displacement (ant, med, lat, posterior, anteromedial, anterolateral)
• Multidirectional displacements more frequent than unidirectional ones
• Posterior displacement rare
• Oblique orientation of lateral pterygoid muscle and angulation of condyle direct most meniscal displacements in anteromedial path
Classification – Direction plus altered motion

- Anterior displacement with reduction during opening
- Anterior displacement without reduction during opening
- Anterior displacement with perforation of the disk
- Stuck disk, adhesions
Anterolateral displacement
Secondary signs

- Morphology of disc: biconvex, rounded, irregular or flat usually indicates more advanced disease
- Presence of joint effusion
- Rupture of retrodiscal ligaments
- Decreased signal intensity of the disc
- Increased T2 SI of retrodiscal tissue - due to higher degree of vascular supply
- Lateral pterygoid muscle: hypertrophy, atrophy or contracture
Abnormal morphology
Joint Effusions

- Significantly more prevalent in painful vs. nonpainful joints
- Large joint effusions seen only in symptomatic patients
- Presence of joint effusion unusual sign in asymptomatic individuals
- Generally seen surrounding anterior band
Changes in retrodiskal tissue

- TMJs with pain and dysfunction have higher signal intensity in retrodiskal tissue than those without.
- Indicates higher degree of vascularity in RDT in painful vs nonpainful.
Abnormal enhancement of RT

Normal side

Osteoarthrosis

- Second most common abnormality of TMJ
- 20% of patients with internal derangement have OA at time of initial presentation
- Rare in joints with normal disk position
- OA in large proportion of older individuals completely asx
Osteoarthritis

- Flattening, irregularity of articular surfaces, subchondral decreased signal, subchondral cystic change, osteophytosis, erosions

Treatment of Internal Derangement

- 1\textsuperscript{st} line: conservative and reversible approaches
- NSAIDS, muscle relaxants
- splints, home care procedures
- cognitive-behavioral information program
Treatment of Internal Derangement

- Surgery:
- Diskal plication with repositioning
- Arthroscopy with lysis of adhesions
- Diskectomy and alloplastic disc implant or autograft
Postoperative

- Failed implants resulting from foreign body reaction - bone erosions similar to septic arthritis and RA

- Clinical findings and MRI appearances correlate poorly
Case review:

- Position and mobility
- OA changes
- Effusion
- Morphology
- Signal intensity (disk and retrodiskal tissue)
Open mouth
Closed mouth Coronal
Closed mouth Coronal
27 y.o with left TMJ pain

Right Closed

Left Closed
Anterior disc displacement without reduction
Posterior band rupture
Normal

Tomas, X. et al. Radiographics 2006;26:765-781
Lateral displacement
Posterior displacement

Anterior dislocation without recapture and perforation posterior attachment

Stuck disk
35 y.o. F pain on jaw movement; difficult with mouth opening x past two years

Anterior dislocation without reduction upon opening

http://www.herkules.oulu
Summary

• Internal derangement most common abnormality affecting the TMJ

• MRI modality of choice

• Symptomatology may not correlate with imaging findings

• Frequently sequential progression:
  – ADDWR
  – ADDWOR
  – Perforation
  – Stuck

• POEMS: (position and mobility, OA, effusion, morphology, signal intensity)
The End

Thanks to Christine and Tudor!
References:

References


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