UNDERSTANDING THE TMJ
Insight into how the form and function of the TMJ affect imaging findings
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WHAT WE WILL DISCUSS
• TMJ imaging anatomy
• Effect of TMJ on growth and development of the craniofacial complex

THE TMJ IS:
• A ginglymo-diarthroidal joint – Hinge-sliding motion involving two joints
• Freely moving articulation between mandible and squamous portion of the temporal bone
• Special – that’s why you’re here

TMJ COMPONENTS

INTERNAL COMPONENTS
1. Articular surfaces
2. Disc and attachments
3. Joint compartments

OSSEOUS COMPONENTS
A discussion on the effect of the TMJ on the growth and development of the mandible
OSSEOUS COMPONENTS

1. Mandibular condyle
2. Glenoid fossa and articular eminence

CBCT / CT ANATOMY

Sagittal Oblique
Coronal Oblique
Axially Corrected images
MANDIBULAR CONDYLAN FIBROCARTILAGE

• Thin layer of fibrous, cartilage-like tissue unique to the TMJ

• Not innervated or vascularized – takes nourishment from synovial fluid

• Lack of innervation and vascularity allows the articular surfaces withstand the high dynamic load TMJ regime

• Load is exceeded → breakdown of cartilage
TMJ
• TMJ is a Growth Site

• TMJ has a Fibro-Cartilagenous cap that Responds Biomechanical and Biochemical Stimuli

• Mesenchymal Cell Differentiation into Articular Cartilage followed by Endochondral Ossification Contributes to Condylar Growth

MANDIBULAR GROWTH
• Normal: Counter-clockwise direction

MANDIBULAR GROWTH
• Enchondral & Intra-membranous growth
• Mandibular Growth Mirrors TMJ Growth
• Genetic and Epi-Genetic Growth
• Growth Fields

GROWTH SITE/ FIELDS
• Condyles, Rami, Alveolar processes, Coronoid processes, Body

• Sites have genetic potential for Growth through Mesenchymal Cell Differentiation and Cell Division

• Can be Modulated by external factors including neighboring growth sites, hormones, tissue stress/strain and tissue damage

MANDIBULAR GROWTH
Growth directions involving periosteal resorption are indicated by arrows pointing into the bone surface, and growth directions involving periosteal deposition are represented by arrows pointing out of the bone surface.

**Stress Distribution**
- Load Support
  - Cortex
- Load Transfer
  - Trabeculae

**MANDIBULAR DEFORMATION**
**Morphological Adaptations**
- Sagittal Bending (AP)
  - Increased Vertical Dimension
- Transverse Bending (ML)
  - Increased Transverse Dimension
- Torsion (Twisting)
  - Cylindrical Shape

**ADAPTATION TOOLS SET**
- Remodeling
- Modeling
- Displacement
- Positional
- Tooth Eruption

**DEFINITIONS**
**Bone modeling**
- Uncoupled bone deposition and resorption
- Associated with periosteal deposition or resorption of bone leads changes in size, shape, and position of bone

**Bone remodeling**
- Coupled specific sites of bone resorption and formation
- Ongoing secondary process that modifies internal distribution and microstructure of bone to mechanically optimize it

**FACIAL GROWTH PATTERNS**
**FOSSA/ EMINENCE DEVELOPMENT**

- Birth: Shallow slope along cranial base
- Age 3: Half Formed
- Age 12: Complete Adult Shape

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**EMINENCE DEVELOPMENT**

- Function Develops Fossa and Eminence
- Associated with Tooth Development
- Fossa/ Eminence Size and Shape Matches the Dental Development and Occlusal Function

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**SEVERITY OF GROWTH DEFICIT**

- Severity of Insult
- Age of Onset
MANDIBULAR GROWTH

Age

Growth

Post-Puberty

Puberty

Norma

PCR-2

PCR-1

Adult
ARTICULAR DISC AND ATTACHMENTS

- Anterior band
- Posterior band
- Intermediate zone
- Bilaminar zone

Superior lamella = loose elastic tissue
Inferior lamella = taut fibrous tissue.
ARTICULAR DISC
Disc composed of:
- 70-75% water
- Fibroblast-like cells
- Chondrocyte-like cells
- Type 1 collagen: (90% dry weight)
- Elastin: 5% dry weight
- Proteoglycans (enhance compressive properties)

ARTICULAR DISC COLLAGEN ARRANGEMENT
Anterior band:
- Collagen fibers transversely oriented

Intermediate zone:
- Collagen fibers are anteroposteriorly oriented

Posterior band:
- Transverse and vertical collagen fibers
ARTICULAR DISC CELLS

Anterior band:
- Fibroblast-like cells

Intermediate zone:
- Chondrocyte-like cells

Posterior band:
- Fibroblast-like cells.

CBCT ANATOMY

Signal intensity

Normal: Superior > Anterior

NORMAL
POSTERIOR ATTACHMENT

- Temporal (TPA) / Superior Lamina
- Condylar (CPA) / Inferior Lamina
- Intermediate (IPA)
SYNOVIAL MEMBRANE LINED CAPSULE

Anterior and posterior recesses

T2

ALL DONE!