Imaging of the Pediatric Temporomandibular Joint

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KEYWORDS

• Temporomandibular joint • Juvenile idiopathic arthritis • Imaging • Radiology • MRI
• Ultrasound scan • Computed tomography • Radiography

KEY POINTS

- Imaging of the temporomandibular joint in pediatric patients is a critical component in the evaluation and treatment of children with temporomandibular joint symptoms.
- MRI can detect subclinical inflammation within the temporomandibular joint and direct early treatment to prevent future joint destruction.
- In certain situations, ultrasound scan is a convenient modality to evaluate joint anatomy and the presence of inflammation as well as guide therapeutic injections.
- Radiography and computed tomography provide excellent evaluation of the osseous structures to recognize subtle morphologic changes of the mandibular condyle and provide operative planning.

INTRODUCTION

Imaging is an important component in the evaluation of temporomandibular joint (TMJ) symptoms. Sometimes, children do not exhibit TMJ symptoms (ie, in the setting of juvenile idiopathic arthritis, JIA). This lack of symptoms causes the clinical history and examination to be less reliable indicators of disease status.[1,2] Identifying pathologic conditions of the TMJ is particularly important during development of the mandible. The mandibular condyle is in close proximity to the joint. Therefore, inflammation and synovitis could alter growth, resulting in worsening mechanical abnormalities over time.[3,4] Imaging is also critical for monitoring response to therapy over time.[5]

This review begins with a basic summary of TMJ anatomy as it is visualized on radiographs. It then discusses the various imaging modalities and explains specific techniques. MRI is emphasized because of its current role as the gold standard for identifying pathologic conditions in many cases. Other modalities including ultrasound scan, computed tomography (CT), and radiography will be discussed (**Box 1**). The use of ultrasound scan to guide interventions of the TMJ is also illustrated. Next, specific examples of disease entities including JIA, condylar hypoplasia, disc injury, and posttraumatic arthropathy are illustrated.

The basic anatomy of the TMJ, particularly at the age when most children undergo imaging, is similar to that expected in the adult population. This glide and hinge (ginglymoarthrodial) joint allows for both rotational and translational motions.[2] The articular disc, or meniscus, is a biconcave fibrocartilaginous structure normally located within the central aspect of the TMJ.[6] There is a central thin intermediate zone and triangular anterior and posterior bands (**Fig. 1**). The disc is supported posteriorly by connected superior and inferior retrodiscal layers and a vascular region called the *retrodiscal space* or *bilaminar zone*. Anterior support of the disc is in part provided by the superior head

Disclosure Statement: The authors have nothing to disclose.
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Oral Maxillofacial Surg Clin N Am 30 (2018) 25–34
http://dx.doi.org/10.1016/j.coms.2017.08.008

Box 1
TMJ imaging modalities

- MRI
- CT
  - Conventional CT
  - Cone beam CT
- Radiography
  - Orthopantogram (panorex)
  - Mandible radiographs, including oblique views
- Ultrasound—diagnostic
- Ultrasound—procedure guidance

of the lateral pterygoid muscle. The disc separates the joint into superior and inferior spaces with minimal if any joint fluid visualized on imaging. With the mouth closed, mandibular condyle and temporal fossa articulate with the posterior band near the 12 o'clock position in the sagittal plane as seen on MRI (less than 10° anterior to a vertical line through the condyle) with the intermediate zone centrally interposed between the 2 bones (see Fig. 1).[7–10] With mouth opening, rotation and anterior translation occurs and places the condyle subjacent to the articular eminence of the temporal bone with the disc centered between (Fig. 2).

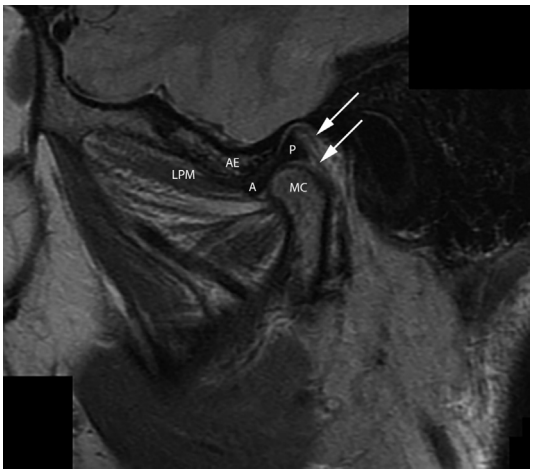

Fig. 1. Sagittal PD-W image of TMJ with mouth closed. Arrows points to the superior and inferior layers of retrodiscal space. A, anterior band of disc; AE, articular eminence; LPM, lateral pterygoid muscle; MC, mandibular condyle head; P, posterior band of disc.

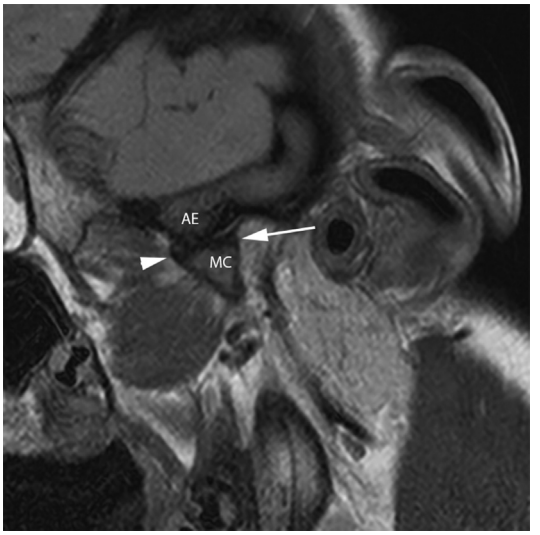

Fig. 2. Sagittal PD-W image of TMJ with mouth open. Slight irregularity of the condyle in 11-year-old female with JIA and intact disc. Arrow points to the posterior band and the arrowhead points to the anterior band. AE, articular eminence; MC, mandibular condyle head.

TECHNIQUES

MRI

MRI has become the primary imaging modality of the TMJ because of its superior soft tissue differentiation, high resolution, and lack of ionizing radiation while visualizing the entire joint bilaterally in open- and closed-mouth positions. Excellent evaluation of the disc and its supporting structures, joint fluid, synovial thickening and hyperenhancement, and bone changes (including edema, erosions, mandibular morphology) can be achieved. Subtle osseous changes, particularly small erosions, are sometimes difficult to identify in the absence of active inflammation and are better seen with CT. The typical limitations of MRI apply, including relatively long scan times, noise of the machine, and discomfort holding the mouth open for sequences.

Identifying abnormal synovial enhancement is an important aspect of interpreting TMJ MRI studies. Because treatment decisions could depend on this finding, there is a desire to develop standard methods to quantitatively characterize abnormal enhancement.[11] Various methods including studying enhancement curves, using subtraction sequences from postcontrast and precontrast data, and comparing enhancement of synovium to a separate neck muscle reference has been described with various and conflicting results.[12–14] This finding is complicated by the