

## **MR-Assessment of the Temporomandibular Joint - Where to look and what to look for**

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**Authors:** J. M. LIEB; Basel/CH  
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## Learning objectives

MR-imaging of the TMJ with surface coils in a closed and open mouth position as well as dynamic MR-series of joint motion is the method of choice and has become an important part of the workup for TMJ disorders. Radiologists have to be familiar with the anatomy, biomechanics and pathologies of the TMJ prior to reading. Therefore knowing where to look and what to look for in TMJ-MRI is crucial for musculoskeletal, head and neck as well as neuroradiologists. This poster is focused on teaching anatomy, normal and pathologic imaging findings in static as well as dynamic series and the introduction of a simple checklist how to report on a TMJ-MRI.

## Background

Pain related to temporomandibular joint (TMJ) is very common and experienced in up to 20 -30% of the population with a female predominance (f:m = 3:1). Clinical symptoms of TMJ disorder include also decreased mandibular movement and mastication problems. The most common cause and clinical diagnosis for TMJ-symptoms is internal derangement of the articular disc and joint biomechanics. Clinical evaluation of the TMJ can be unreliable due to a huge overlap of internal derangement symptoms with myofascial pain dysfunction, that is often stress related and a psychophysiological disease. Less common causes of TMJ-disorders are related to infection, trauma, neoplasm or inflammatory arthritis.

## Imaging findings OR Procedure Details

Standard MR-protocols for imaging the TMJ consist of PD and/or T2w sagittal oblique slices in closed and maximum open mouth position as well as coronal oblique in closed mouth position (figure 1) for evaluation of the intraarticular structures and disc position. At least one plane in T1 is necessary to fully evaluate the bony structures. T2w with fatsaturation helps in detecting joint effusion and together with T1 in evaluating bone marrow edema. Dynamic TMJ-series can be acquired as fast spinecho PD or T2 in cine mode. Optimal slice orientation is shown in figure 1, sagittal oblique along long axis of condyle, coronal oblique perpendicular to the long axis.

Normal gross anatomy of the TMJ and MR-correlation is presented in figure 2, 3 and 4 for closed and open mouth position. The posterior attachment of the articular disc consists of macroscopically three parts, the bigger temporal and condylar part and the smaller intermediate part. On MR - if the resolution and image quality is superior - we can often see the so called bilaminar zone with superior and inferior (temporal and condylar) part of posterior disc attachment. While opening the mouth, both, the condyle and the intraarticular disc translate together in a forward direction to their anterior position upon the articular eminence.

The most common disorder of the TMJ is "internal derangement" with partial or total displacement of the intraarticular disc. Anterior (sagittal plane) as well as mediolateral (coronal plane) disc displacement in closed mouth position can be categorized into 3 levels, as seen on figure 5 and 6. MR-examples of partial and total anterior and mediolateral disc displacements are given in figures 7 and 8.

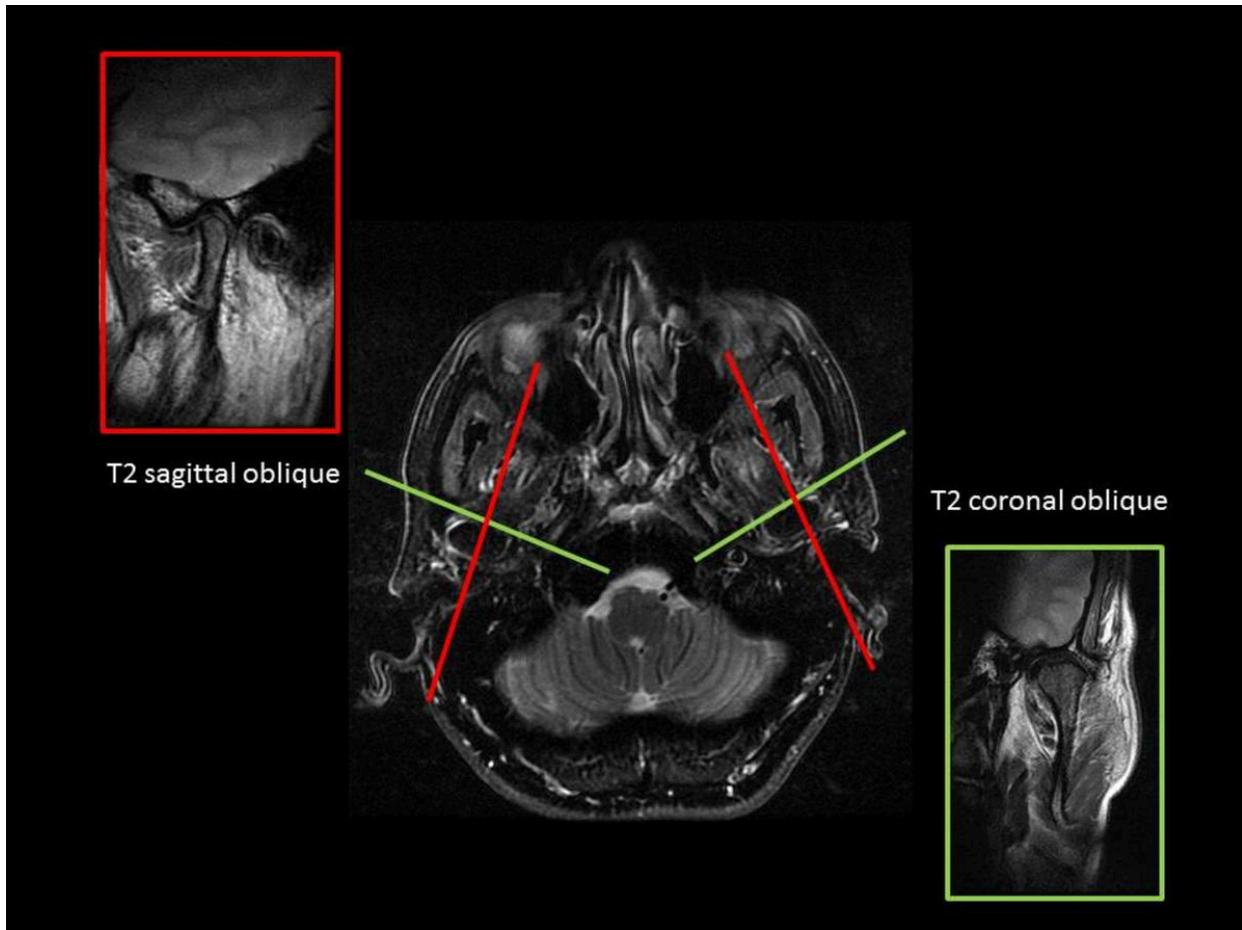
Opening the mouth in a case of disc displacement can result in recapture or no-recapture of the displaced intraarticular disc (figure 7, 8) with a correct or incorrect position of the disc in open mouth position. Advanced internal derangement can lead to degenerative osteoarthritis with typical features as flattening of the condyle (figure 8, closed mouth), osteophytes, joint space narrowing, subchondral cysts, erosions and subchondral edema (figure 9).

Less common disorders of the TMJ include inflammatory changes (rheumatoid or juvenile arthritis), neoplastic lesions (metastasis, primary tumors rare) or traumatic changes. An example of inflammatory osteoarthritis of the TMJ is given in figure 10. MR and CT are complementary modalities in less common TMJ disorders except in trauma, where CT is the modality of choice.

Structured reporting of a TMJ-scan includes statements abouts:

1. Condylus: position, morphology (normal, flattened, erosions, osteophytes), bone marrow
3. Disc morphology and signal: normal bow tie, thinning, signal changes
2. Disc position: normal, anterior displacement (sagittal plane), medial or lateral displacement (coronal plane)
4. Joint and disc motion: normal, reduced or no anteriortranslation of condyle, recapture or no-recapture of disc (open mouth sagittal plane, dynamic series)
5. Joint Effusion
6. Masticator space and surrounding tissue: incidental findings or other nearby causes for TMJ-discomfort

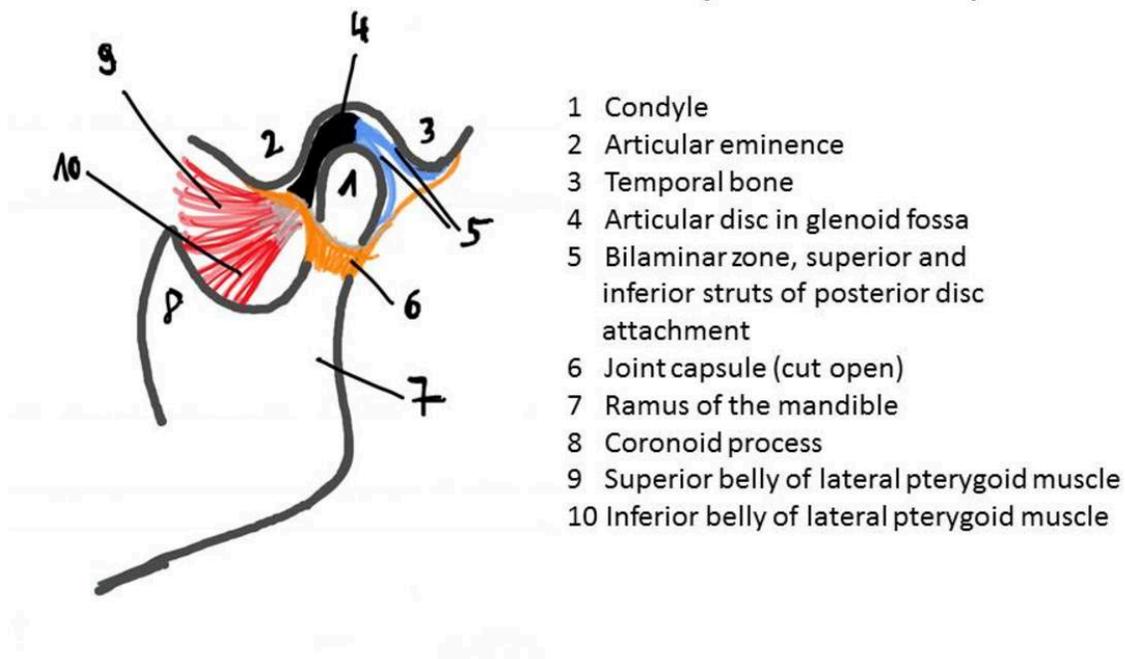
Images for this section:



**Fig. 1:** MRI planning of sagittal and coronal oblique slides

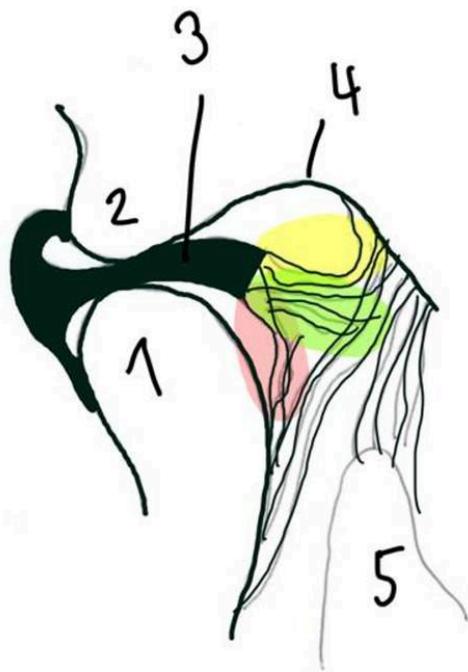
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### Anatomy TMJ: closed mouth position



**Fig. 2:** Anatomy of the TMJ, closed mouth position

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**Anatomy TMJ: intermedium open mouth position**

- 1 Condyle
- 2 Articular eminence
- 3 Articular disc
- 4 Glenoid fossa
- 5 Parotid gland

Posterior attachment:

- Yellow: temporal part
- Green: intermediate part
- Red: condylar part

**Fig. 3:** Anatomy of the TMJ in intermediate open mouth position, posterior attachment of intraarticular disc in detail

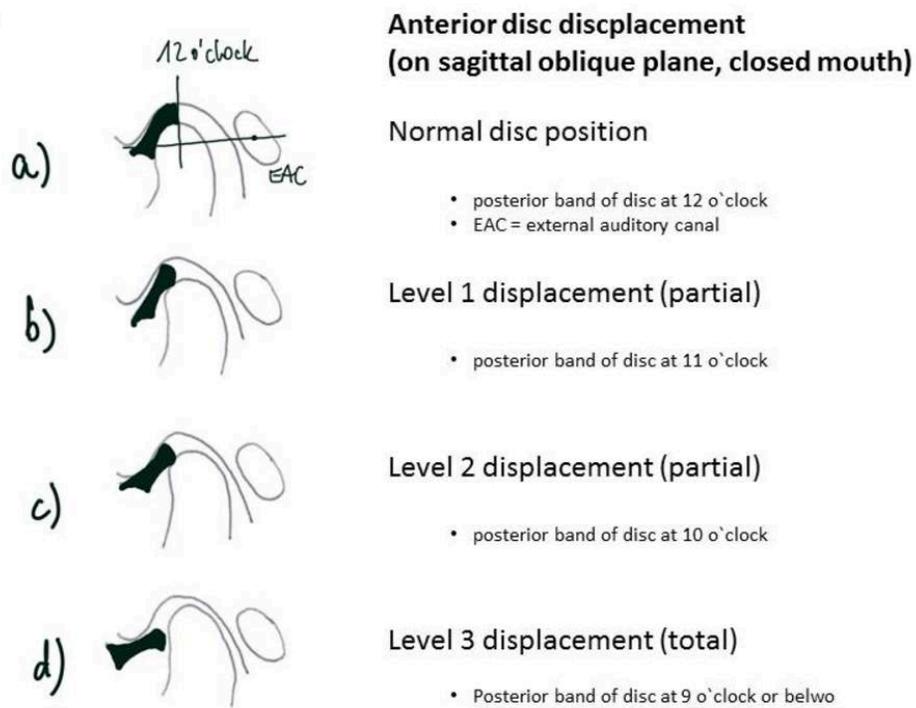
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## Normal anatomy of the TMJ and normal disc position



**Fig. 4:** Anatomy and normal findings of TMJ on MRI in closed and open mouth position

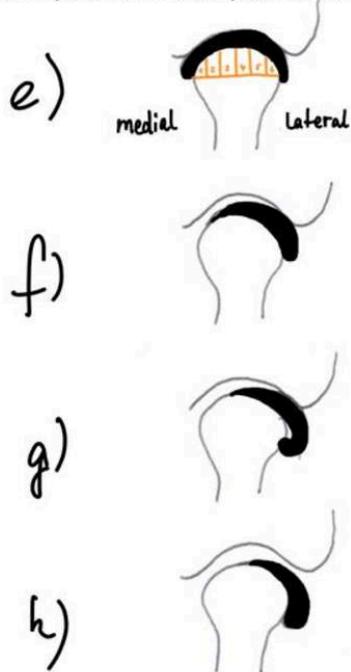
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**Fig. 5:** Levels of anterior disc displacement

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Example: lateral displacement



### Mediolateral disc displacement (on coronal oblique plane, closed mouth)

#### Normal disc position

- disc centered between poles of glenoid fossa

#### Level 1 lateral displacement

- marked thickening of disc on side of displacement
- or displacement of up to 1/6 of width of condyle

#### Level 2 lateral displacement

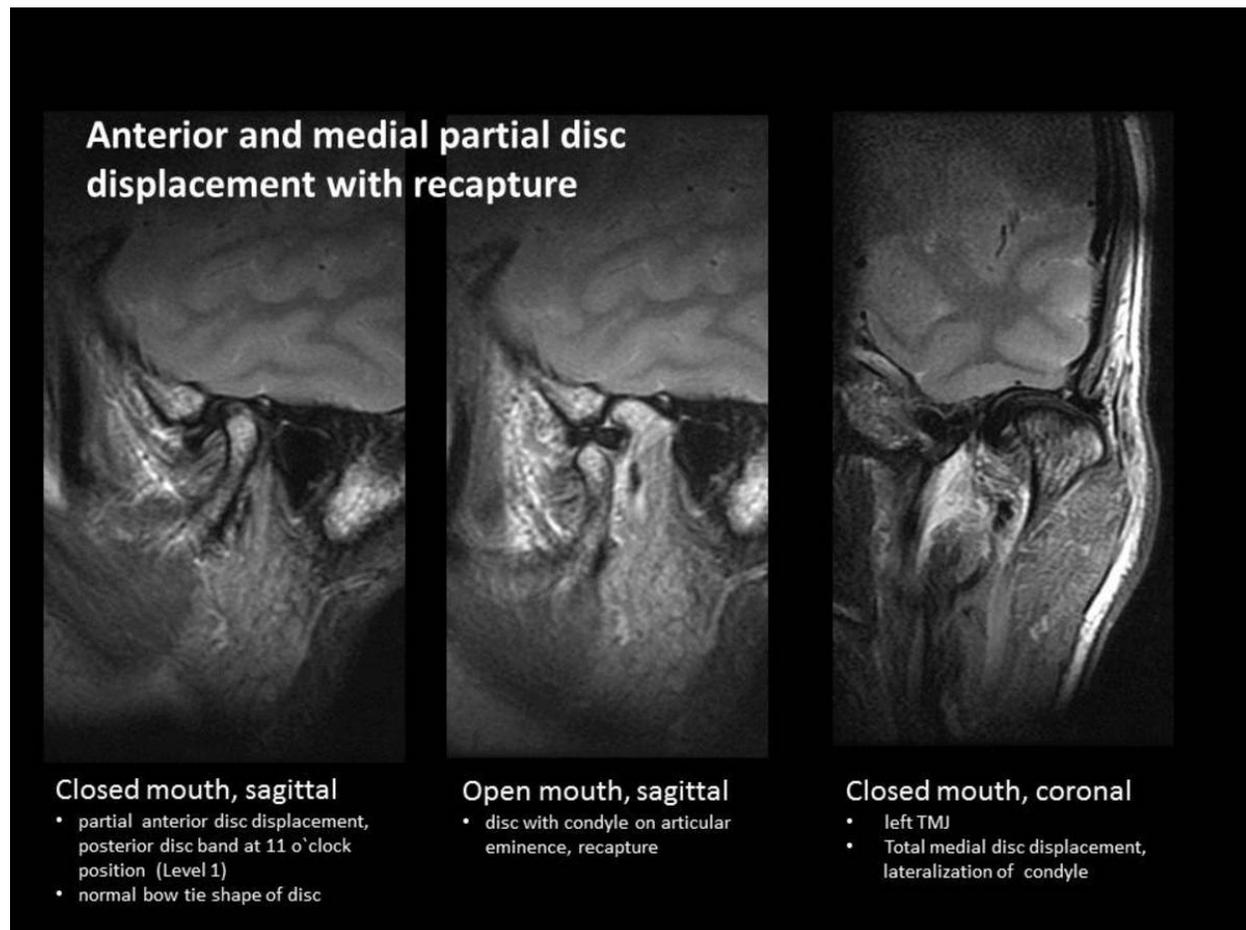
- displacement up to 1/3 of width of condyle and
- drooping look of disc on side of displacement

#### Level 3 lateral displacement

- displacement of at least 1/2 of width of condyle

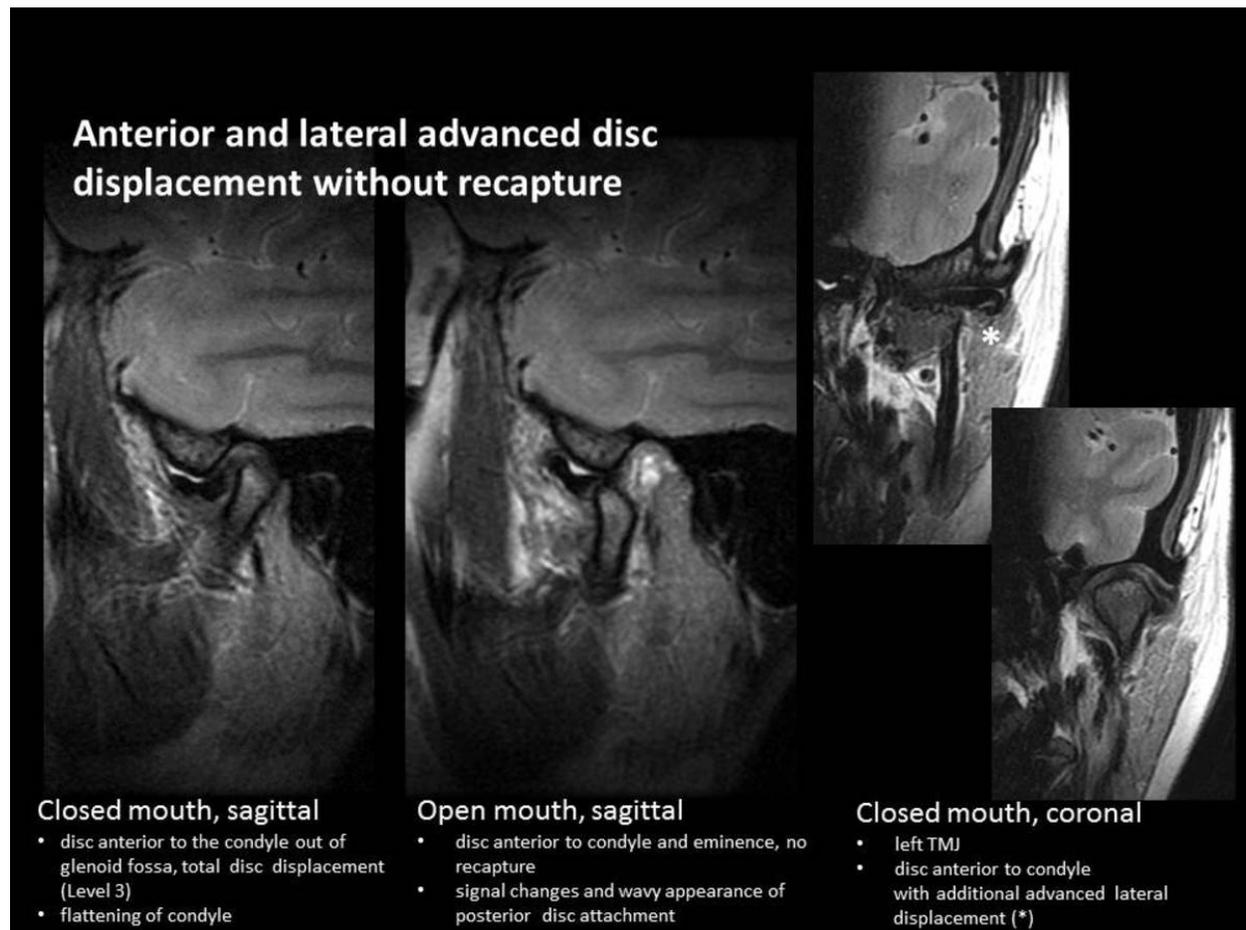
**Fig. 6:** Levels of mediolateral disc displacement

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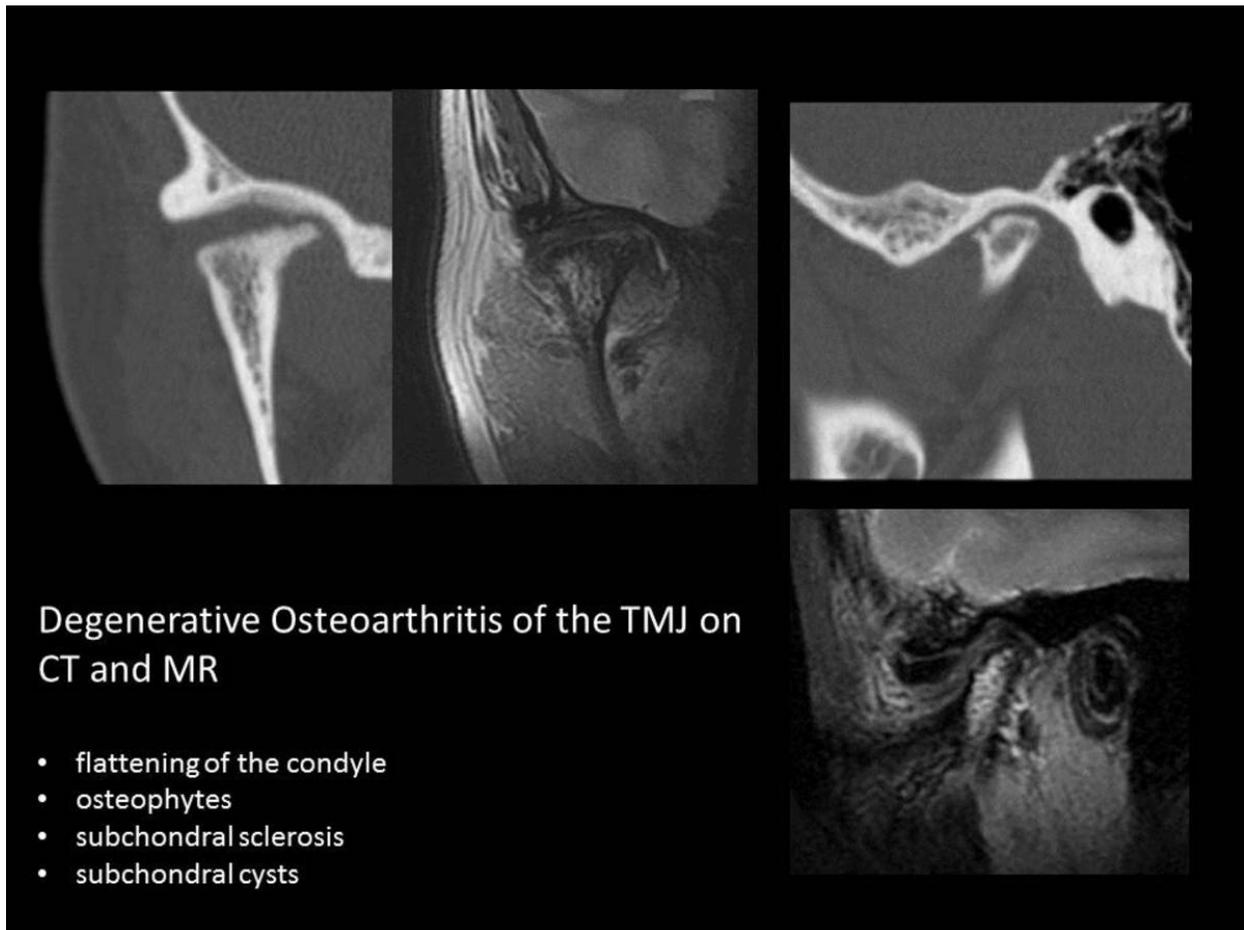
**Fig. 7:** Anterior partial disc displacement with recapture on MRI

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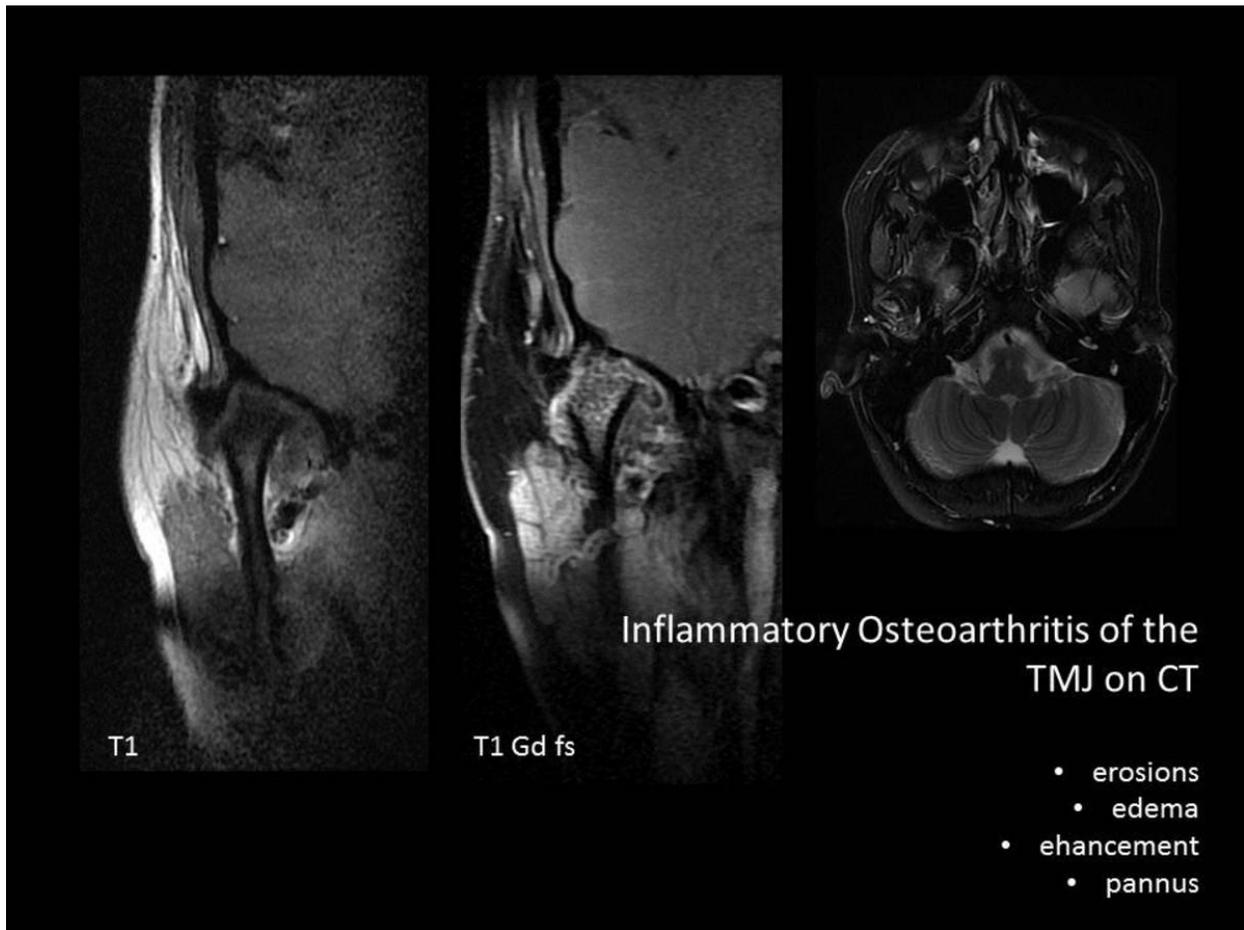
**Fig. 8:** Anterior and lateral total disc displacement without recapture on MRI

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**Fig. 9:** Degenerative Osteoarthritis of the TMJ on CT and MR

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**Fig. 10:** Inflammatory Osteoarthritis of the TMJ

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## Conclusion

For the interpretation of an static and dynamic MRI of the TMJ with a good level of confidence radiologists have to be familiar with the anatomy of the joint, the dynamic biomechanics and motion of joint-structures as well as the normal and pathologic imaging findings in common and rare TMJ disorders. The most common cause of TMJ pain is internal derangement, which we introduced in detail with a step by step instruction for reporting on TMJ-scans in clinical routine.

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