



KSMRM Educational Course 2

교육세션 2-1

## MSK Clinical MRI Essentials (Protocols, Pitfalls, and Technical Pearls)

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**Introduction:**

Musculoskeletal MRI plays a key role in the diagnosis, treatment planning, and follow-up of trauma, bone and soft tissue tumors, and inflammatory disorders such as myositis. The musculoskeletal system covers a wide anatomical range from head to toe and MSK radiologists frequently evaluate short T2 tissues, including tendons, ligaments, and bony cortex. These characteristics necessitate appropriate imaging protocol optimization for each anatomical region to enable accurate assessment of anatomic details.

**Protocols:**

Standardized protocols ensure diagnostic consistency and reproducibility across the institutions. Recommended protocols typically include at least one T1WI and T2WI and usually contain at least one fat-suppressed sequence. The table below summarizes the standard protocols based on the Korean Society of Musculoskeletal Radiology (KSMR) guidelines.

	Essential sequence	Optional sequence
<b>Shoulder</b>	Oblique coronal T2WI*, Oblique coronal or sagittal T1WI, Oblique sagittal T2WI*, Axial T2 or PDWI*	
<b>Elbow</b>	Coronal and axial FS T2WI, Sagittal T2Wi, Axial T1WI	Coronal T1WI, Coronal T2 GRE, Sagittal T2 GRE, 3D FS PD
<b>Wrist</b>	Coronal T2 and T1WI, Coronal FS T2 or PDWI, Axial FS T2 or T2*, Sagittal T2	
<b>Hip</b>	Coronal T1WI, Coronal and axial FS T2WI, Sagittal T1 and T2WI, Oblique axial T2 or PDWI	Radial T2WI, Axial T1WI
<b>Knee</b>	Sagittal, coronal axial T2WI (or PD)*, Sagittal or coronal PDWI (or T2), sagittal T1WI	Oblique sagittal or oblique coronal T2WI
<b>Ankle</b>	Sagittal T1 and T2WI, Coronal and axial T2WI	Coronal FS PD, Coronal T1WI, Oblique axial T2WI

(\*: with or without fat suppression)

**Common Pitfalls:**

1. Inhomogeneous fat suppression – May obscure bone marrow and soft tissue lesions
2. Magic angle effect – Increased signal in tendons oriented at  $\sim 55^\circ$  to B<sub>0</sub> on short TE sequences
3. Artifacts – Metal artifact, motion artifact, and partial volume effects can degrade image quality and mask lesions.



#### Technical Pearls:

Pitfall reduction strategies include careful coil positioning, selection of robust fat suppression techniques (e.g., Dixon or STIR for uniform suppression), and using metal artifact reduction techniques (e.g., SEMAC, MAVRIC, VAT). To optimize visualization of short T2 tissues, ultrashort echo time (UTE) and zero echo time (ZTE) sequences are useful. High-resolution 3D isotropic imaging enables multiplanar reformats without loss of detail. Quantitative

MRI (e.g., T2 mapping, T1 $\rho$ , proton density fat fraction) offers additional value for early disease detection and treatment monitoring.

#### Conclusion:

It is essential to be familiar with the recommended protocols and common pitfalls for each anatomic site. Additional sequences such as 3D isotropic imaging or UTE/ZTE may be incorporated to optimize protocol for enhancing diagnostic performance.

*Keywords: Musculoskeletal, Bone, Tendon, Ligament, Short T2, PD, FS, 3D isotropic, UTE/ZTE*