Accelerating Pediatric Knee Trauma MRI with Deep Resolve: Clinical Experience from Hebei Children's Hospital

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Meeting the growing demand for pediatric MRI

The Department of Radiology at Hebei Children's Hospital focuses on maintaining high-quality diagnostic imaging, optimizing workflow efficiency, and creating a child-friendly imaging environment.

The department is equipped with advanced MRI systems, including two 3T scanners and one 1.5T scanner. Recently, we added a wide-bore 3T MAGNETOM Vida MRI system.

With the increasing demand for pediatric imaging examinations, our MRI workload has continued to grow. We currently perform more than 100 MRI examinations every day. Improving scanning efficiency and optimizing the patient experience have become important challenges in our daily clinical practice.

Challenges in pediatric knee trauma MRI

MRI plays an important role in evaluating pediatric knee injuries. It provides excellent soft tissue contrast without radiation. MRI allows detailed visualization of the menisci, ligaments, growth plates, articular cartilage, bone marrow changes, and joint effusion.

For pediatric patients with knee trauma, MRI has become an essential diagnostic tool and has largely replaced invasive arthroscopy for evaluating intra-articular injuries. However, conventional pediatric knee MRI protocols require multiple imaging planes and contrasts. The examination usually takes 8–10 minutes. For children with trauma in the emergency setting, long scan times can be challenging. Pain, anxiety, and limited cooperation may lead to motion artifacts, which can affect the detection of subtle injuries. For some young children, sedation may be required, which increases clinical risks and workflow complexity.

Traditional parallel imaging techniques have been applied to accelerate MRI acquisition, but acceleration factors are often limited by reduced signal-to-noise ratio (SNR) and potential image quality degradation. Therefore, we needed a solution that could significantly shorten scan time while preserving imaging quality.

Accelerating MRI scans

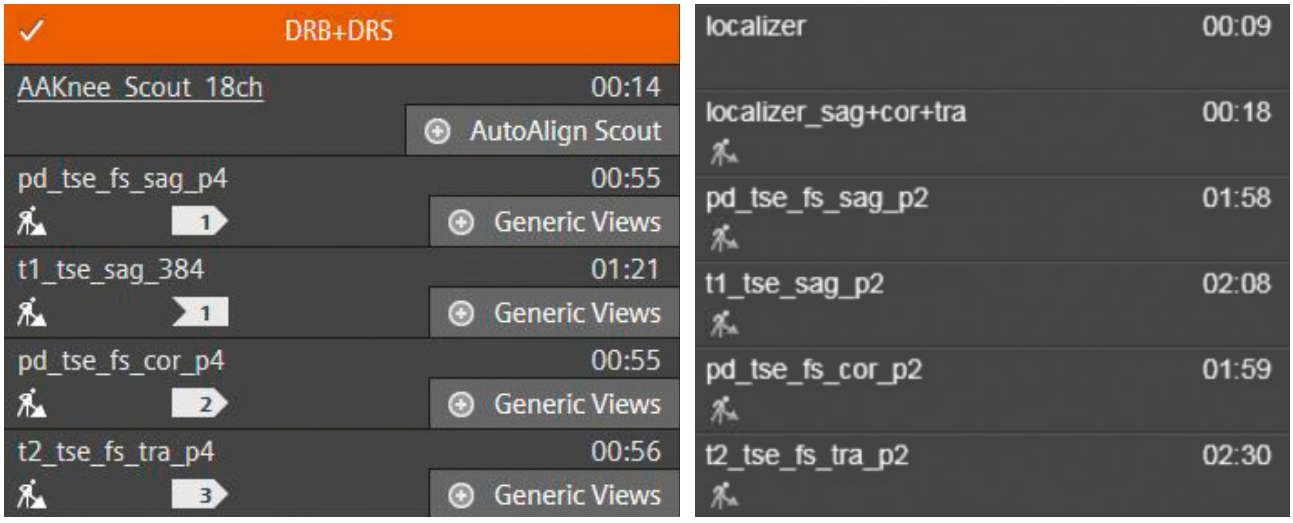
After introducing the MAGNETOM Vida system, we implemented Deep Resolve deep learning reconstruction technology into our routine pediatric knee trauma MRI protocol.

Deep Resolve has significantly improved our MRI workflow. It enables faster acquisition while maintaining excellent image quality. Using this technology, we reduced the total scan time for pediatric knee trauma MRI from approximately 9–10 minutes to around 4 minutes, representing a reduction of more than 50%. By improving acquisition speed without compromising image quality, this

technology helps us deliver faster and more comfortable MRI examinations for children while supporting accurate clinical diagnosis. Furthermore, Deep Resolve enables clear visualization of critical anatomical structures, including meniscal tears, ligament injuries, physeal abnormalities, and subtle bone marrow changes. It also decreases the need for sedation in young children. In our department, faster scanning improves the emergency workflow, increases scanner utilization, and increases daily examination capacity.

Deep Resolve-based rapid knee trauma protocol

The detailed imaging parameters of the Deep Resolve-based rapid knee trauma MRI protocol are summarized in Table 1. In this protocol, acceleration factors of 3–4 were applied to improve acquisition speed. Deep Resolve technology helps maintain high SNR and image quality despite the acceleration factors, enabling rapid MRI examinations without compromising image quality.



	PDw	T1w	PDw	T2w
TR (ms)	2600	500	2600	3500
TE (ms)	38	8.6	38	63
FOV (mm^2)	170 × 170	170 × 170	170 × 170	180 × 180
Matrix	256 × 205	384 × 269	256 × 205	352 × 218
Voxel size (mm^3)	0.3 × 0.3 × 3.0	0.2 × 0.2 × 3.0	0.3 × 0.3 × 3.5	0.3 × 0.3 × 3.5
Slices	24	24	24	24
Acceleration factor	4	3	4	4
Fat suppression	Fat saturation	–	Fat saturation	Fat saturation
Planes	Sag	Sag	Cor	Tra
Acquisition time (min:sec)	0:55	1:21	0:55	0:56

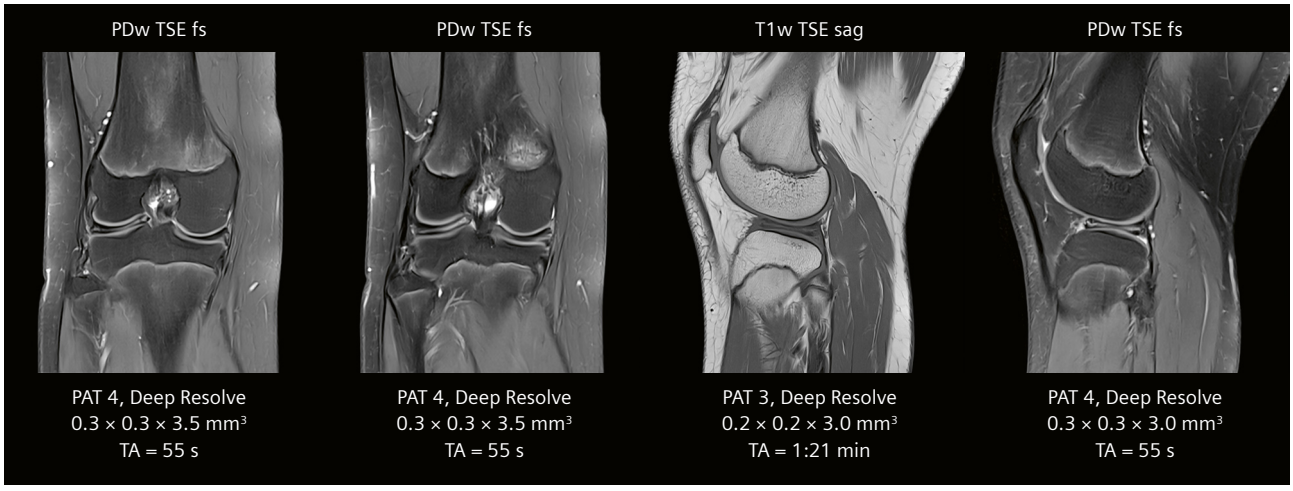
Table 1: Rapid MRI protocol parameters for pediatric knee trauma using Deep Resolve technology.
DRB = Deep Resolve Boost; DRS = Deep Resolve Sharp

Clinical cases

Case 1

A 12-year-old girl with meniscal injury and persistent right knee pain.

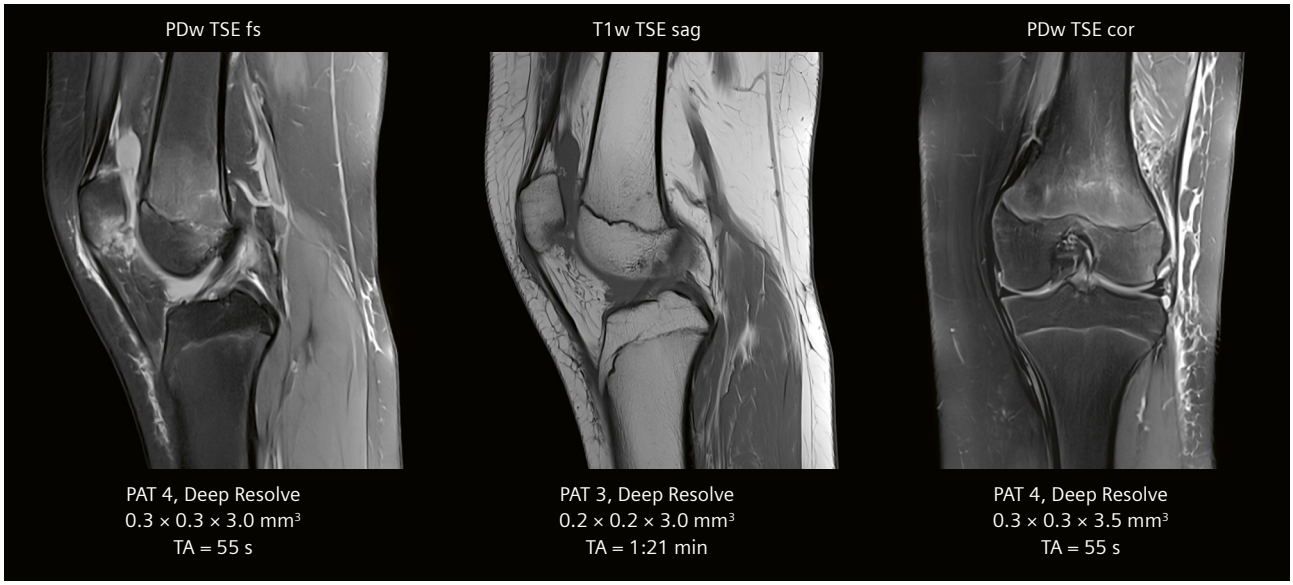
MRI revealed a discoid lateral meniscus with tear in the right knee, tear of the posterior horn of the medial meniscus, anterior cruciate ligament injury, and right knee joint effusion.



Case 2

A 12-year-old girl with left knee trauma during physical education class and left knee pain for five days.

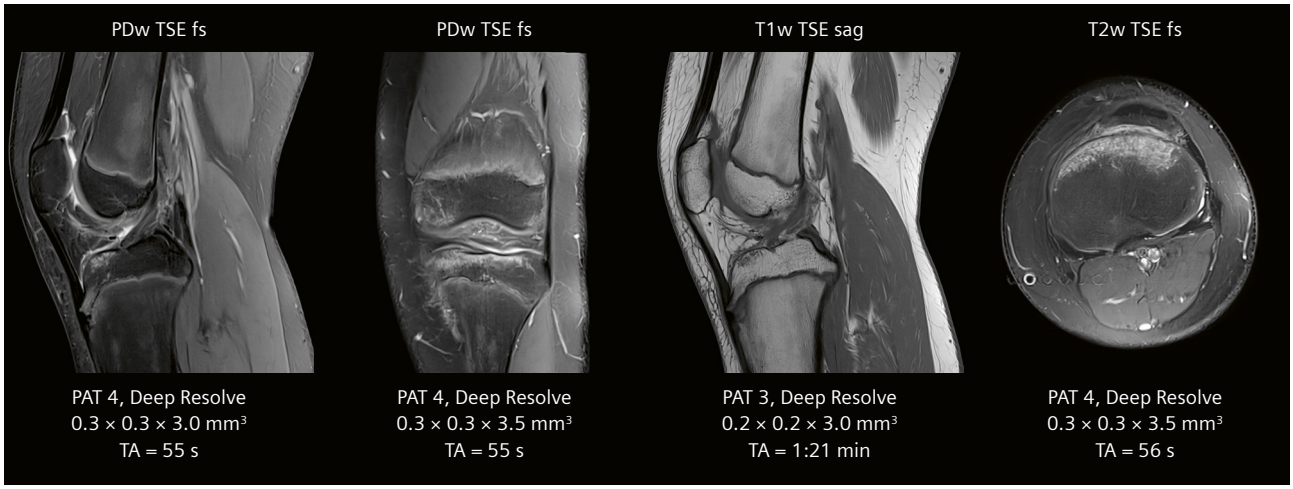
MRI revealed patellar fracture with dislocation, bone marrow edema of the distal femur, local avulsion fracture, medial patellofemoral retinaculum injury, partial injuries of the quadriceps tendon and patellar ligament, hemarthrosis/joint effusion in the suprapatellar recess and left knee joint cavity, and surrounding soft tissue swelling.



Case 3

A 13-year-old girl with left lower extremity trauma for one day and limited mobility.

MRI revealed bone marrow edema involving the distal femur and distal femoral physis, proximal tibial physis, left knee joint effusion, left knee soft tissue swelling, and prominence with abnormal signal intensity of the tibial tubercle.





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Representative procols **(.nii and PDF)** from Hebei Children's Hospital can be downloaded at

www.magnetomworld.siemens-healthineers.com/clinical-corner/protocols

