The Meniscal Repair Assessment Score (MERAS) – a new MRI scoring tool for evaluation of the healing success after primary meniscus refixation – preliminary results

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Target audience: Radiologists, orthopaedic and trauma surgeons

Purpose of the study: Meniscus refixation should decline the rate of knee osteoarthritis and should therefore be economically profitable regarding cost efficiency. Since the technique of meniscus refixation is increasingly used more often, an appropriate, precise imaging of the results of operations is demanded. **Objectives**: 1. Evaluation of the healing success after primary meniscus refixation: the sutured meniscus will be evaluated with the use of 7 T MRI six and twelve months postoperatively. 2. Differences between clinical and radiological outcome after primary meniscus refixation will be assessed in order to facilitate the decision of returning to sports. 3. Creation of a new assessment tool for evaluation of the healing success after meniscus refixation.

Material and Methods: This prospective study includes ten patients (eight male, two female) with a mean age of 30.1 years (SD 9.3). Patients between 19 and 59 years with a meniscal tear that were treated operatively with meniscus refixation between April 2012 and February 2013 were included. In four patients (2 male, 2 female) an arthroscopic anterior cruciate ligament reconstruction was performed at the same operation. In one male patient an arthroscopic posterior cruciate ligament reconstruction was performed at the same operation. Exclusion criteria were status post partial meniscectomy of the affected knee and contraindications for MRI.
Every patient was examined with a 7 T whole-body system (Magnetom 7 Tesla, Siemens-Healthcare, Erlangen, Germany) using a dedicated 28-channel knee coil (QED, Quality Electrodynamics, Mayfield Village, OH, USA). Morphological assessment was performed with sagittal and coronal PD FSE sequences six and twelve months postoperatively.
The sequence protocol for the PD FSE fat-sat sequences was the following: the repetition time (TR) was 4000 ms, the echo time (TE) was 18 ms, the field of view (FoV) was 160 mm, the pixel matrix was 355x448, the slice thickness was 2.5 mm, the number of slices was 24, the resolution was 0.45x0.36x2.5 mm, the flip angle (FA) 159°, 2 averages, the acquisition time was 4:30 minutes.
The Meniscal Repair Assessment Score (MERAS), a new MRI scoring tool for evaluation of the sutured meniscus was created containing assessment of the femoral and tibial surface, associated meniscal findings and occurrence of other pathologies (see table 1 and figure 1).

Meniscal Repair Assessment Score (MERAS)

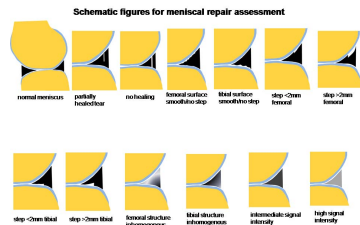| Variables	Grading	Points
tear	healed	25
	partially healed	15
	no healing	0
femoral surface	intact/smooth	20
	fraying or < 2mm step	10
	>2mm step	5
tibial surface	intact/smooth	20
	fraying or < 2mm step	10
	>2mm step	5
associated meniscal findings of the ipsilateral meniscus	none	15
	minor loss of meniscal thickness or shape	10
	degenerative alterations	7
	severe loss of meniscal thickness or shape	4
	tears of adjacent meniscal tissue)	0
other pathologies (e.g. cartilage lesions, ligamental lesions, contralateral meniscal lesions, synovitis)	none	15
	yes	0
effusion	no	5
	yes	0

Table 1

Figure 1

Additionally, a clinical examination as well as an interview with the use of a questionnaire containing the Knee Injury and Osteoarthritis Outcome Score (KOOS), the Tegner-Lysholm Score, the Tegner-Activity-Scale and the IKDC (International Knee Documentation Committee) questionnaire, was performed 6 and 12 months postoperatively to evaluate the clinical outcome. Descriptive statistics are presented.

Preliminary results: According the Meniscal Repair Assessment Score (MERAS) all ten patients showed a mean MERAS Score of 66.6 (SD 12.7) six months postoperatively, indicating good radiological outcome. The four patients who already performed the 12 months follow-up MRI measurement had a mean MERAS score of 68.0 (SD 14.8) six months postoperatively and of 65.0 (SD 12.3) twelve months postoperatively, representing a good radiological outcome at both points of time.
For the four patients who completed two MRI measurements the mean KOOS was 71.4 (SD 15.2) six months postoperatively and 85.2 (SD 8.9) twelve months postoperatively; the mean Tegner-Lysholm Score was 76.0 (SD 12.0) six months postoperatively and 84.3 (SD 7.5) twelve months postoperatively; the mean Tegner-Activity-Scale was 4.0 (SD 0.0) six months postoperatively and 3.7 (SD 0.6) twelve months postoperatively; the mean IKDC was 65.5 (SD 9.0) six months postoperatively and 83.2 (SD 10.4) twelve months postoperatively.

Discussion: Arthroscopy assessment of meniscal repair was advocated in the past. The results focused on clinical outcome using different clinical scores and second look arthroscopy [1-3], representing an invasive technique with all potential operation risks. There is a need for non-invasive assessment. 7 T MRI provides a promising, non-invasive technique for assessment of meniscal healing after meniscal refixation due to its high resolution and fast acquisition time. We developed an MRI assessment tool for a systematic evaluation of postoperative results after meniscal repair. Our preliminary results suggest a good healing response in the short term follow up.

Conclusion: Meniscal refixation offers satisfying clinical and imaging results. The newly developed MERAS-Score allows a systematic analysis of the meniscal structure and is suitable for evaluation of the healing success after meniscal refixation. Further research is required to validate the MERAS Scoring System. Furthermore quantitative MRI at 7 T could improve postoperative meniscal assessment after meniscal repair.
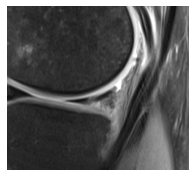

Figure 2: Example for femoral step < 2mm six months postoperatively
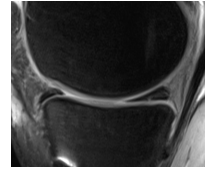

Figure 3: Example for tibial step < 2mm six months postoperatively

References:
[1] Siebold R, et al. Arthroscopy. 2007 Apr;23(4):394-9.
[2] Miao Y, et al. Am J Sports Med. 2011 Apr;39(4):735-42.
[3]. Kim SB, et al. Arthroscopy. 2011 Mar;27(3):346-54.