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Qualitative magnetic resonance imaging of repair cartilage after micro fracturing procedure: Evaluation using dGEMRIC and T2 mappingA. Watanabe¹, C. Boesch², S.E. Anderson³, W. Brehm⁴, Y. Wada⁵, P. Mainil-Varlet⁶;¹Department Of Radiology, Teikyo University Chiba Medical Center, Ichihara, Japan, ²Department Of Clinical Research, Unit For Mr Spectroscopy And Methodology, University of Bern, Bern, Switzerland, ³Department Of Diagnostic, Interventional And Pediatric Radiology, University of Bern, Bern, Switzerland, ⁴University Of Bern, Institute of Pathology, Bern, Switzerland, ⁵Orthopedic Surgery, Teikyo University Chiba Medical Center, Ichihara, Japan, ⁶Cro, Allevia AG, Bern, Switzerland**Purpose:** To investigate the ability of delayed gadolinium-enhanced magnetic resonance imaging of cartilage (dGEMRIC) and T2 mapping to evaluate the quality of repair cartilage after micro fracturing procedure.**Methods and Materials:** Five knees from 5 goats (5 females; aged 2-3 years) were studied. An osteochondral defect (6mm in diameter) was created at both medial femoral condyle and lateral femoral condyle of the left hinder leg. Six months after the surgery, MR imaging was performed using a 3 Tesla magnet. dGEMRIC was performed to evaluate glycosaminoglycan (GAG) distribution, and T2 mapping was performed to evaluate collagen arrangement and hydroxyproline (HP) concentration in cartilage. Immediately after MR imaging, the goats were euthanized and the repair cartilage and adjacent native cartilage were extracted. The cartilage samples were assessed for general histology using modified O'driscoll score including assessment of collagen orientation by means of polarized light microscopy (PLM). The concentration of GAG as well as HP was also studied.**Results:** Repair cartilage was classified as mixed cartilage or fibrocartilage. Concentration of GAG and HP in repair cartilage was significantly lower than that in native cartilage. A significant correlation was observed between GAG concentration and T1 value as well as HP concentration and T2 value in repair cartilage ($p < 0.05$). However, no significant correlation was observed between histological grading and T1 value as well as T2 value in repair cartilage. There was no significant correlation between T2 and collagen orientation assessed by PLM.**Conclusions:** dGEMRIC and T2 mapping might correlate closely with macromolecular concentration, but not with comprehensive histological grading.

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Examiner repeatability of patellar cartilage T2 valuesM.F. Koff¹, S. Parratte², K.K. Amrami³, K.R. Kaufman²;¹Department Of Orthopedic Surgery, Mayo Clinic, Rochester, United States of America, ²Department Of Orthopedic Surgery, Mayo Clinic, Rochester, MN, United States of America, ³Department Of Radiology, Mayo Clinic, Rochester, MN, United States of America**Purpose:** To evaluate inter-examiner and intra-examiner repeatability of patellar cartilage T₂ values**Methods and Materials:** Following IRB approval with informed consent, three subjects were scanned to acquire axial MRI T₂-weighted images across 10 slices spanning the length of the patella. Eight echo images were acquired at each slice location: TR/TE = 1000ms/(8-76)ms, slice thickness = 2mm, slice spacing = 4mm, FOV=12cm². Two examiners independently processed each image on two different days. Custom software was used to calculate patellar cartilage T₂ values. An average T₂ value generated from all analyzed pixels in each slice was used for intra- and inter-examiner repeatability analysis using the methods of Bland and Altman. Repeatability of T₂ measurements was evaluated as the root mean square of the T₂ differences.**Results:** Intra-examiner reliability was high, with a mean (\pm st.dev.) T₂ difference of only 0.2 ± 0.8 ms. Similarly, the inter-examiner reliability was high, with a mean T₂ difference of 0.6 ± 1.4 ms. The inter-examiner limits of agreement (LOA) were -2.1 ms to 3.3 ms. The repeatability of T₂ evaluation was 1.5 ms.**Conclusions:** Excellent repeatability of T₂ measurements between examiners was found, with an average T₂ difference below 0.7 ms. Furthermore, the repeatability and range of LOA of the T₂ values are less than the changes of T₂ values reported in previous studies which have examined changes of T₂ using a scan/re-scan protocol. The results of this study emphasize the reliability of detecting degenerative changes of cartilage by T₂-mapping.

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Bone contusion distribution in a cohort of patients with acute ACL disruption: location based on gender, activity, and mechanism.K. Knilsson¹, K. Shea², R. Pfeiffer³, D. Isackson⁴;¹Orthopedics, Intermountain Orthopaedics, Idaho, ID, United States of America, ²Intermountain Orthopaedics, 83702, United States of America, ³Kinesiology, Boise State University, Boise, ID, United States of America, ⁴Biomechanical Engineering, University of Utah, Salt Lake, UT, United States of America**Purpose:** To describe bone contusion patterns associated with ACL tears and evaluate their relationship to gender, activity, and mechanism of injury.**Methods and Materials:** 219 Patients (117 Males, 102 females) with an acute ACL disruption were identified. MRI sequences were analyzed for bone contusion location. Chi square analysis was used to assess differences in bone contusion distribution between genders, skiing and all other sports, and contact vs. non-contact mechanism.**Results:** Contusions were identified on medial femoral condyle (MFC) in 14%, on lateral femoral condyle (LFC) in 45%, on medial tibial plateau (MTP) in 24%, and lateral tibial plateau (LTP) in 60%. Contact mechanism was responsible for 9% of injuries, noncontact for 88%. Skiing accounted for 27% of injuries. There was no difference in occurrence of bone contusions between males and females for MFC, LFC, MTP, or LTP (all $p > 0.05$). There was no difference in occurrence of bone contusions between skiing and other activities for MFC, LFC, MTP (all $p > 0.4$); there was a higher occurrence of LTP contusions in skiers than other sports ($\chi^2 = 3.475$, $p = 0.043$), but this was not confirmed by phi coefficient and Cramer's V (all $p = 0.062$). There was no difference in location of bone contusions between contact and noncontact mechanism.**Conclusions:** For acute ACL injury, there is no significant difference in distribution of contusions based upon gender or mechanism. There is a trend toward higher numbers of LTP contusions in skiers, suggesting that skiing induced ACL injury is caused by higher energy or a different mechanism.

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Autologous chondrocyte implantation to repair knee cartilage injury: Ultrastructural evaluation at 2 years and long term follow up including muscle strength measurementsS. Løken¹, T.C. Ludvigsen¹, L. Engebretsen¹, T. Høysveen², F.P. Reinholt³;¹Orthopaedic Centre, Ullevål University Hospital, Oslo, Norway, ²Physiotherapy, Norwegian Institute for Sports Medicine, Oslo, Norway, ³Institute And Department Of Pathology, Rikshospitalet University Hospital, Oslo, Norway**Purpose:** To obtain more detailed information about the repair tissue after ACL by detailed morphological studies at 2 years, and to evaluate long term function of the knee with the use of isokinetic muscle strength measurements.**Methods and Materials:** 21 patients were treated with autologous cartilage implantations (ACI) in the knee. Mean size of the lesions was 5.2 cm². Follow up arthroscopy with biopsy was performed at 2 years. The biopsies were examined with both light microscopy (LM) and electron microscopy (EM) including immunogold techniques. Modified 10 point scales of the Cincinnati knee rating system were obtained preoperatively and at 1 and 8 years. Isokinetic muscle strength testing was performed at 1, 2 and 7.4 years.**Results:** LM and EM both showed predominately fibrous cartilage with a high percentage of collagen I as confirmed by the immunogold technique. Muscle strength was significantly reduced in the operated leg at all time points (22% lower than non-operated leg at one year, 16% at two years and 15% at 7.4 years). Mean pain score improved from 4.3 preoperatively to 6.3 at one year ($p = 0.03$) and to 6.6 ($p = 0.01$) at 8 years. Overall condition score improved from 4.1 preoperatively to 6.1 at one year ($p = 0.004$) and to 6.5 at 8 years ($p = 0.008$). Four patients have later been revised with other resurfacing techniques.**Conclusions:** The morphological analyses confirm that ACL results in mainly fibrous cartilage. Patients remain markedly weaker in the operated leg. However, the improvement in functional score does not deteriorate over time.