Background: Postoperative bone marrow edema (BME) in the control MRI is a consequence of the trauma and is observed as a result of ACLR surgery. The applied technique of surgery, especially drilling bone tunnels to fix the graft, temporarily disrupts the structure of the bone tissue, which may affect the blood supply to the subcartilage layer and thus accelerate the process of articular cartilage degeneration. The aim of this study was to determine at which stage of postoperative rehabilitation there is a significant reduction in BME.

Methods: A total of 40 patients (22 males and 18 females) participated in the study group (SG) after ACLR surgery using the rectus femoris tendon as a graft. The control group (CG) consisted of 20 patients (9 males and 11 females) without episodes of knee trauma and surger. BME was assessed by 3-T MRI in coronal STIR sections measuring the signal intensity in five areas (ROI – region of interest): four key points (KP key points: fem_MC, tib_MC, tib_MC) and as a reference point the proximal part of the tibia bone (BCGR).

The area of each point was 1.4 cm². The MRI measurement has been performed in the milestones of postoperative rehabilitation, i.e. in 3 (40 prt), 6 (30 prt), 9 (25 prt) months. The ratio of the key point signal with the reference point (KP/BCGR) and the ratio of the key point signal with the values of the control group were compared. Results: The signal ratio (KP/BCGR) from all reference points is significantly higher (p < 0.05) compared to the control group at the 3rd month after surgery. In the 6th month, a significant difference (p < 0.05) persists in the fem_MC, tib_MC and tib_MC MC areas, while in the 9th month after the procedure, all areas showed an improvement in the signal to a statistically insignificant level compared to the control group. The reduction of BME in the lateral compartment of the knee joint occurs faster than in the medial compartment in which on the tibial surface of the tib_MC still in the 6th month we observe a significantly higher (p < 0.05) signal intensity (BME) compared to the points in the lateral compartment of the knee joint. Conclusion: MRI analysis showing the long-term process of reducing BME after ACLR may be a valuable additional criterion for assessing return to sport. Prolonged BME, especially in the medial part of the knee, which is particularly sensitive to accelerated degeneration of the cartilage and reduced blood supply to the subcartilage layer, may suggest the necessity to delay the implementation of intensive strength and dynamic training, especially within 6 months, and to return to sport before 9 months after ACLR.

The influence of BME in the period of intensive rehabilitation on the process of cartilage degeneration is still not widely studied and requires longer observation and possibly additional research methods. Our research will continue in this direction.