Rotator cuff changes in a full thickness tear rat model: verification of the optimal time interval until reconstruction for comparison to the healing process of chronic lesions in humans.

The aim of the study was to develop a standardized rat model for chronic rotator cuff tears. Therefore, a time point of degenerative changes that shows comparable histological changes to the chronic tendon tears in humans had to be determined. The rat shoulder has already been described as a standardized model for investigation of the healing behavior in acute supraspinatus lesions. Little data exist about the possibility of generating a chronic rotator cuff lesion. We performed a complete detachment of the supraspinatus tendon in 45 Sprague-Dawley rats. After an interval of 3, 6 and 9 weeks (15 rats in each group), the macroscopic and histological changes were analyzed. The histological investigation included atrophy and fatty muscle degeneration, tendon degeneration and the grade of inflammatory changes. For evaluation of tendon degeneration, a modified MOVIN-Score was used. The contralateral shoulder provided as control group. Macroscopically the defect showed an increasing coverage with scar tissue over time with a complete closure in 73% after 9 weeks. The 3 week group showed the highest rate of persisting defects (80%). The atrophy of the supraspinatus muscle decreased from initial slight atrophy to a nearly normal...
muscle status in the 9 week group. Fatty infiltration was found in three animals per group regardless of the time interval after detachment. Tendon degeneration (modified MOVIN-Score) showed no significant difference between 3 and 6 weeks (p = 0.93) whereas after 9 weeks a significant increased degeneration was found (p< 0.01). In the early phase (3 and 6 weeks), inflammatory cells could be detected more frequently. The results show that a chronic tear of the human rotator cuff can be imitated in the rat model with some exclusion. The rapid self-healing response in the rat and the fatty infiltration of the human muscle are the main differences. However, tendon degeneration, inflammation and muscle atrophy combined with a persisting defect at 3 weeks after detachment are comparable to the chronic tendon tears in humans. This model can serve as a basis for further research in the field of rotator cuff repair for chronic lesions.