INTRODUCTION: High rerupture rate and non-closable massive rotator cuff tears still represent an unsolved problem in shoulder surgery. Therefore, autografts, allografts, absorbable xenografts and synthetic biomaterials, partially in combination with growth factors, are experimental used. But none of these methods has been shown long-term success. One underlying difficulty may possibly be represented by ingrowth of cells to the subacromial space. For this purpose colonization of a scaffold with cultivated cells potentially leads to an improvement.

OBJECTIVES: Biodegradable collagen-based scaffolds were seeded with autologous tenocytes. By using a sheep model the improved ability for biomechanical regeneration in massive rotator cuff tears was examined.

METHODS: A critical-size defect in the tendon-bone junction of right infraspinatus tendon of 24 sheep (3 groups with each 8 animals) was created. Group A served as defect group. Animals in group B received the implantation of a biodegradable collagen-based scaffold. In Group C a collagen-based scaffold colonized with autologous tenocytes wasimplanted. Tenocytes have previously been harvested by a tissue biopsy of the patellar tendon and cultivated for 2 weeks before depositing onto the collagen scaffold. 12 weeks postoperatively the regenerated tendons were examined by histological and biomechanical methods. Contralateral shoulders served as controls.

RESULTS: In macroscopic assessment only in Group C with colonized scaffold new tendon tissue was generated, meanwhile in groups A with defect and B with non-colonized scaffold hypertrophic tissue was formed. In biomechanical testing each specimen was loaded to failure with a preload of 10 N and at a rate of 500 mm/min under displacement control. Healthy control tendons showed an average tensile strength of 2995 N. With a mean value of 2516 N for group C with colonized scaffold a clear biomechanical superiority was seen in comparison to groups A with defect and B with non-colonized scaffold with 2004 N respectively 2088 N.

CONCLUSION: Implantation of a biodegradable collagen-based scaffold seeded with autologous tenocytes in large animal model results in superior biomechanical outcome compared to unsupplied defect and defect coverage with non-colonized scaffold. Here, the biomechanical results are very close to those of healthy tendons. This could be a promising approach for the repair of tendon defects that cannot be closed.

Disclosure of Interest: None Declared

Keywords: autologous tenocytes, collagen-based scaffold, rotator cuff tear, sheep model, tendon healing