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Experimental tendon regeneration of rotator cuff tears with autologous tenocytes and a biodegradable collagen-based scaffold in sheep model – First results

B. P. Roßbach [1,*], L. Kempfert [1], M. F. Pietschmann [1], T. Ullamann [1], B. Schmitt [1], A. Ficklscherer [1], M. F. Gülecyüz [1], P. E. Müller [1]

[1]Department of Orthopaedic Surgery, University Hospital of Munich (LMU) - Campus Grosshadern, Munich, Germany

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[1-3]. 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