Tissue engineering of the anterior cruciate ligament-sodium dodecyl sulfate-acellularized and revitalized tendons are inferior to native tendons.

Abstract:
The acellularization of tendons using detergents (sodium dodecyl sulfate, Triton-X, tri-nitro-butyl-phosphate) is a new source of scaffolds for tissue engineering in anterior cruciate ligament (ACL) repair. In vitro testing demonstrated that acellular tendon scaffolds are biocompatible and show good biomechanical properties, but in vivo confirmation of these results is not yet available. Therefore, the aim of this study was to see in vivo if an acellular allogenic construct colonized with autologous fibroblasts improves the quality of ACL reconstruction. ACL replacement was performed in 31 New Zealand White rabbits using a standardized model. Fifteen animals received autologous semitendinosus tendon, whereas 16 animals were treated with a tissue-engineered construct. This construct was made by acellularization of allogenic semitendinosus tendons using sodium dodecyl sulfate and subsequent in vitro colonization with autologous fibroblasts. Eight weeks postoperatively, macroscopic, biomechanical (ultimate load to failure, elongation, stiffness; n = 8/9), and histological (n = 5) examinations were performed. Biomechanical testing showed decreasing strength of the constructs at 8 weeks after implantation compared with the direct postsurgical strength. However, tissue-engineered constructs (F = 19.7 +/- 20.3 N) were significantly weaker.
than autologous tendons (F = 61.2 +/- 31.2 N). Histologically, the autologous tendons showed signs of partial necrosis and tissue remodeling. The tissue-engineered constructs exhibited an inflammatory reaction and showed both repopulated and acellular regions. In conclusion, in vivo results were much more unfavorable than in vitro results had suggested. Further studies have to be performed to test if modifications of the acellularization process yield better results in vivo.