

Scientific Award Winner

In Vivo Response of Human Tenocytes to Extra-Cellular Matrix Patches used for Rotator Cuff Repair

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Introduction: Several allograft and xenograft soft-tissue reinforcement devices have become commercially available to augment rotator cuff repair. There is little research about the interaction of these devices (ECM or extra-cellular matrix patches) with the human rotator cuff tendons.

Purpose: To evaluate the cell adhesion, cell proliferation, extra-cellular matrix production and extent of migration of human tenocytes to six commercially available ECM devices.

Significance: ECM devices need to incorporate into native rotator cuff tissue in order to reinforce the surgical repair. The extent of favorable or unfavorable reaction of human tenocytes to the ECM will be critical in understanding the role of these devices in rotator cuff repair.

Methods: 16 (5mmx5mm)samples from each six commercially available ECM devices (GraftJacket[®], Wright Medical Technologies, Inc., Zimmer Collagen Repair Patch, Zimmer, Inc., Restore[®], Johnson-Johnson-Depuy, OrthADAPT[®], Pegasus Biologics, Fascia lata, Musculoskeletal Transplant Foundation , and Sports Mesh[™], Biomet) were incubated in wells containing human tendon cells that had previously been collected and grown in culture from discarded surgical specimens using standard methods. Cell adhesion to each specimen was measured at 24h (n=4 each patch type) using a Coulter counter technique. Cell proliferation on each sample was measured at 48h using [3H]Thymidine incorporation measures with a scintillation counter.. Extracellular matrix production by the tenocytes on each sample was measured indirectly using quantitative polymerase chain reaction (qPCR) for Type III collagen and decorin at 4 wks (n=4). Histological examination measured the depth of migration of the tenocytes into each material at 4 weeks.

Results: Cells adhered more to GraftJacket[®] and Restore[®] than the other 4 patches. Cellular proliferation was significantly greater on GraftJacket[®] and Zimmer patch, less on OrthADAPT and Fascia lata, and very little on SportsMesh and Restore[®] (p< 0.05). Tenocytes on GraftJacket and Zimmer produced more Type III collagen as measured by qPCR, with lesser amounts on fascia lata, OrthADAPT, and SportsMesh and very little on Restore[®] (p< 0.05). Histological examination identified tenocytes on the surface of each sample. However, the tenocytes were not seen to have migrated into the substance of any of the samples at 4 wks.

Discussion: Tenocytes proliferated and produced more extra-cellular matrix on the dermal based patches (GraftJacket and Zimmer patch) as compared to those with densely arranged collagen (OrthADAPT and human fascia lata). Tenocytes on the Restore patch (submucosal pig intestine) and the SportsMesh (biocompatible poly (urethane urea)) exhibited little proliferation and matrix production. Tenocytes were only seen on the surface of each specimen and had not migrated into any specimen at 4 weeks. In summary, in this cell culture model, tendon cells did not appear to be incorporating into any of the six ECM devices.

The results are preliminary as only tenocyte response was measured. In vivo response and signaling from other cell lines may modify tenocyte response. Further research is necessary to determine the optimal characteristics of a rotator cuff augmentation device.

Clinical Relevance: This information may play a role in a surgeon's decision to use an ECM device for rotator cuff repair augmentation and which device is chosen.