

Growth Factor Functionalized Sutures to Improve Meniscus Repair

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INTRODUCTION: Acute trauma to the meniscus is a common injury among individuals participating in sports-related activities. Meniscus tears disrupt knee joint homeostasis and significantly increase the burden of load upon articular cartilage which causes osteoarthritic changes within the joint. Surgical intervention for these injuries typically involves suturing the meniscus together whenever possible to provide mechanical stability to the tissue. However, these patients may experience continued dysfunction, suffer second meniscus tears, and are likely to progress to osteoarthritis more rapidly. We know from the literature that the administration of growth factors to the site of injury can improve repair, however, localization to the desired site within the knee joint is difficult, growth factors have a shortened half-life, and the costs of such developing such a therapy are exceedingly high. Our group has developed a technology in which we have immobilized binding peptides on sutures to potentially capture endogenously circulating proteins, concentrating, and localizing their regenerative effects. The purpose of this study was to determine (1) if sutures could be functionalized with vascular endothelial growth factor binding peptide (VEGF-BP) and (2) if these functionalized sutures could bind and localize the effects of VEGF on meniscus tissue *in-vitro*.

METHODS: Sutures were functionalized with VEGF-BP according to previously published protocols. Fresh meniscus tissue was obtained from total knee arthroplasties and sectioned into 8 mm biopsy punches. Samples were threaded with functionalized sutures and cultured with or without VEGF for one week. Immunofluorescent staining was used to confirm functionalization and selective binding of VEGF. Safranin-O/Fast Green histology was performed, and VEGF concentrations in the cell culture media was measured using ELISA.

RESULTS SECTION: Immunofluorescent imaging demonstrated high selectivity of functionalized sutures for VEGF in solution (**Figure 1**). Safranin-O staining demonstrated reproducible images with visible suture holes, however, no clear differences were noted between groups with this staining (**Figure 2**). ELISA assays for VEGF demonstrated a decrease in cell media VEGF in samples utilizing VEGF-BP functionalized sutures (**Figure 3**).

DISCUSSION: We successfully functionalized suture material and developed an ex-vivo tissue system to evaluate its effect. Although no differences were found between groups in proteoglycan staining, this technique and culture system has now demonstrated feasibility and may be improved with increased culture times or use of other growth factors binding peptides.

SIGNIFICANCE/CLINICAL RELEVANCE: (1-2 sentences): This study provides a proof-of-concept for functionalizing sutures to use in orthopedic surgeries to provide mechanical stabilization and promote biological healing of the tissue. If future studies are successful, this technology has the potential to revolutionize orthopedic surgeries by functionalizing any piece of surgical tools to promote endogenous repair of tissue.

IMAGES AND TABLES:

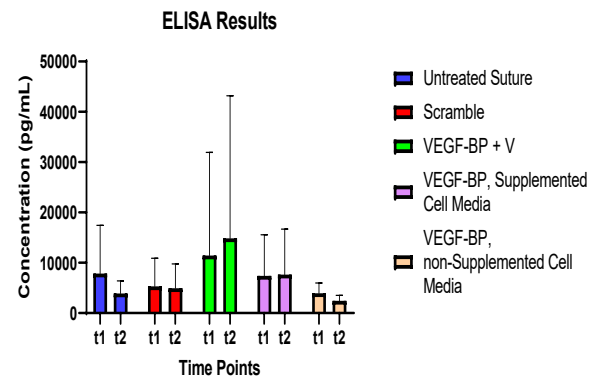
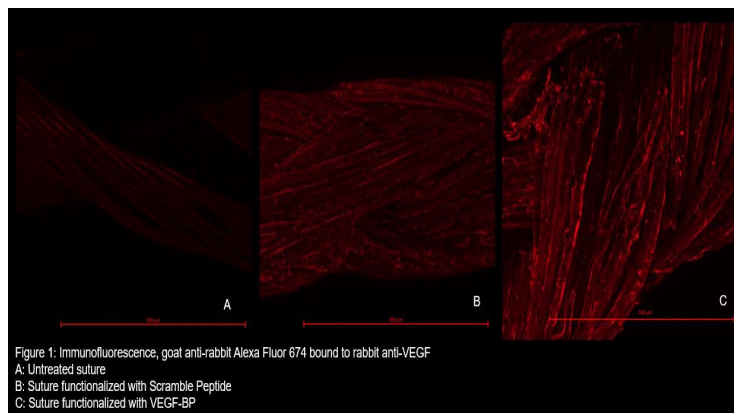


Figure 3: ELISA assays demonstrated low VEGF concentrations in the cell media of menisci threaded with VEGF-BP functionalized sutures.

