INTRODUCTION

Optimal healing of rotator cuff injuries involves reinsertion of the tendon into bone at the original site of attachment. Studies have reported a relatively high incidence of failure regarding rotator cuff repair [1,2], which has been suggested to result from poor tendon tissue quality and tendon-to-bone healing. Addition of growth factors at the time of surgery may augment tendon to bone healing of these injuries, thereby reducing the incidence of re-tears. Platelet-derived growth factor-BB (PDGF-BB) is well characterized wound healing protein known to be chemoattractive and mitogenic for cells of mesenchymal origin, including osteoblasts and tenocytes, and has been shown to improve healing when applied to animal models of tendon injury [3-5]. We hypothesized that the application of rhPDGF-BB, combined with a type I bovine collagen matrix as an interpositional graft at the site of tendon repair, would improve rotator cuff repair in an ovine model.

METHODS

Treatment Groups: 60 skeletal mature ewes (3.5± years) were distributed among five treatment groups (n=12/group);

- Group 1: Suture only repair (No test article)
- Group 2: Collagen 0 µg rhPDGF-BB (sodium acetate buffer)
- Group 3: Collagen 75 µg rhPDGF-BB
- Group 4: Collagen 150 µg rhPDGF-BB
- Group 5: Collagen 500 µg rhPDGF-BB

Surgical Procedure: The infraspinatus tendon was surgically exposed and sharply detached from the humeral head [5,6]. The tendon footprint was decorticated and three perforations were made into the bone to induce bleeding. The test articles were placed as an interpositional graft between the tendon and the bone. Two sutures were passed through the tendon using a Mason-Allen technique and the tendon was secured to the humeral head through a single-row repair consisting of three bone tunnels. The surgical site was closed using standard procedure and the sheep were allowed to ambulate normally. Animals were sacrificed 12 weeks post-surgery.

Outcome Measures:

- **Histologic:** Decalcified specimens (n=3/group) were embedded in paraffin, with sections taken from the central region of the infraspinatus-humerosus repair site. Sections were stained with hematoxylin and eosin.
- **Histophotology:** Sections were evaluated using a semi-quantitative scoring system (Table 1) assessing the quality of the reparative/healing tissue at the tendon-bone interface, including vascularity, presence of inflammatory cells, collagen orientation/fiber density, and presence of Sharpey’s fibers at the insertion site.

RESULTS

- **Biomechanical Testing:** Specimens (n=9/group) were pulled at an approximate angle of 135° relative to the long axis of the humerus (Figure 1). Specimens underwent preconditioning (10-50 N, 0.25 Hz, 60 cycles) followed by a load-to-failure ramp (1 mm/s). Displacement was tracked using three reflective markers. Quasi-static stiffness, ultimate load at failure, elongation, energy to failure, and the failure mode were determined.

Statistical Analysis: A one-way ANOVA and post-hoc Fisher’s LSD test were performed to identify significant differences in continuous biomechanical parameters among treatment groups. No statistics were performed on the histophotophological scores due to the small sample size. Significance was set at p≤0.05. Biomechanical data are shown as mean ± SEM, histophotophological scores are shown as median (range) of the average of 5 sections/animal.

DISCUSSION

- **Biomechanical Results:** Ultimate load at failure (Table 3) was significantly increased in the 75 µg and 150 µg rhPDGF-BB groups relative to the suture only control (64% and 63%, respectively) and the 500 µg rhPDGF-BB group (128% and 119%, respectively).
- **Energy to failure (Table 3) was significantly increased in the 75 and 150 µg rhPDGF-BB groups compared to the suture only groups and 500 µg rhPDGF-BB groups. Additionally, the 75 µg group was significantly increased relative to the 0 µg rhPDGF-BB group.
- Peak elongation (Table 3) was significantly increased in the 75 and 150 µg rhPDGF-BB and 150 µg rhPDGF-BB groups relative to the suture only control (69% and 71%, respectively) and the 0 µg rhPDGF-BB group (49% and 51%, respectively).
- All specimens in the Suture control, 0 µg rhPDGF-BB group and 500 µg rhPDGF-BB group failed in the repair tissue (Table 4). The 75 µg rhPDGF-BB (66.7%) and 150 µg rhPDGF-BB (55.6%) each had specimens that failed with some bony avulsion.

REFERENCES