IN VIVO HEALING RESPONSE AFTER CAPSULAR PICATION IN AN OVINE SHOULDER MODEL

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INTRODUCTION: Shoulder stabilization has historically been performed via open surgical procedures. Development of arthroscopic techniques over the last two decades has provided a less invasive and potentially more efficacious means of addressing glenohumeral instability. Capsular plication is currently being performed arthroscopically in an increasing number of patients. Preliminary clinical results of this procedure indicate that arthroscopic plication is an effective method of eliminating or significantly reducing symptomatic posteroinferior instability (Antoniou et al, JBJS, 2000). However, there are no animal studies evaluating the healing potential of capsular plication and/or capsulo-labral repair. Histologic evaluation of capsular healing has not been well documented after any type of shoulder stabilization surgery, thus, scientific evaluation and comparison of open capsular shift and arthroscopic plication has not been possible.

The purpose of this project was to evaluate the healing potential of side to side capsular plication simulating arthroscopic capsular plication compared to the healing potential of the more traditional open capsular shift involving cutting and advancing the capsule. Our primary hypothesis was that the capsular plication procedure would demonstrate similar histologic properties compared to the traditional open capsular shift. Thus our first specific aim was to demonstrate that capsular plication is a viable surgical alternative for addressing redundant capsular tissue in the clinical arena. Our secondary hypothesis was that a sham operation group consisting of surgical exposure of the capsule without manipulation of the tissue, would demonstrate no significant differences in histology compared to non-operated limbs. Thus our second specific aim was to demonstrate that the surgical approach and associated inflammatory mediators would, in and of themselves, have little effect on the capsular tissue.

METHODS: After IACUC approval was obtained, thirty skeletally mature Columbian X Rambouillet ewes were allocated for use. The animals were placed into three groups. Twenty-six animals were randomized to either the capsular plication group (13) or the open shift group (13). The remaining four animals underwent a sham operation.

After standard prepping and draping procedures each of the shoulders was approached through a posterior incision with the animal in the lateral recumbency. The incision was made over the spine of the scapula and taken down to the level of the infraspinatus muscle tendon junction. The plane between the upper and lower portions of the infraspinatus was then developed to fully expose the posterior capsule of the shoulder joint. For the capsule plication group, three interrupted horizontal mattress sutures were placed without disruption of the capsule, resulting in plication of the capsule (Fig. 1). For the open shift surgeries, a transverse incision was made in the posterior capsule and the inferior capsule was shifted superiorly and sutured with three interrupted figure-of-eight sutures (Fig. 2).

RESULTS: There were no gross failures from either surgical procedure. There was one infection in the plication group. This animal was eliminated from any statistical analyses. Both the capsular plication group (Fig. 3) and the open shift group (Fig. 4) demonstrated healing by fibrosis at the site of surgical manipulation. There were no statistical differences in the capsular healing responses between groups using the histologic criteria of: fibrosis (p = 0.13); granuloma formation (p approx 1.0); and vascularity (p = 0.1). Both groups demonstrated disorganized collagen formation under polarized light microscopy.

DISCUSSION: The findings in this study confirmed our hypothesis that capsular healing was equivalent between the plication group and the open shift group. In addition, the open shift group demonstrated significantly more changes indicative of tissue damage. Longer term studies will be required to further evaluate the maturation of fibrotic scar into organized collagen. The previously reported inferior clinical results seen after arthroscopic plication relative to open shift for shoulder instability may be improved with current arthroscopic techniques. This basic science evaluation confirms the capsular healing potential after arthroscopic plication and supports its use in clinical practice.