DISTRIBUTION OF LUBRICIN IN POST-TRAUMATIC FLEXION CONTRACTURES OF THE ELBOW AND IN NORMAL HUMAN ELBOW JOINT CAPSULES

INTRODUCTION
The cellular basis of the pathophysiology of post-traumatic joint contractures is only now becoming established. Cells expressing a contractile actin isoform, α-smooth muscle actin (α-SMA) have been identified in contractures of the elbow capsules. While the cause of these contractures has now become clearer, questions remain about the other features of the make-up of the tissue that may explain its mechanical behavior (viz., tribology) and resistance to remodeling.

The hypothesis of this study was that a mucinous glycoprotein, lubricin, which is known to facilitate joint lubrication and prevent adhesion is distributed in the fibrotic lesion in post-traumatic elbow contractures. The potential importance of identifying lubricin in this tissue is that it may interfere with cell adhesion and integrative repair processes required for the remodeling and ultimate resorption of contracted fibrotic tissue. The rationale for investigation of lubricin in the fibrotic tissue is based in part on its recent finding within tendons, with the suppositions that it may be facilitating the relative movement of collagen bundles and playing a role in interfascicular lubrication.

Moreover, fistulas in the fibrotic capsule in the post-traumatic elbow may allow access of lubricin-bearing joint fluid to interior regions of the lesion.

MATERIALS AND METHOD
As controls, nine specimens of human elbow capsule were excised from six cadavers (4 males and 2 females) with no signs of trauma or previous operations. Histological sections of the antero-lateral elbow capsule around radial head were taken in the sagittal plane. Eight specimens were resected during elbow capsule release procedures for post-traumatic flexion contractures of the elbow (7 males and 1 female; average age of 33 years). After fixation in formalin, specimens were processed for paraffin embedment. Immunohistochemical staining of lubricin was performed using a purified monoclonal antibody (from T.M. Schmid; #S6.79; Rush University Medical Center, Chicago, IL).

Sections were evaluated for the presence of lubricin 1) as a discrete surface layer, 2) in the extracellular matrix, 3) and in cells, based on the sample area displaying immuno-positive staining on a scale of 0-++; 0, no staining; +, ≤50%; ++, 51-100%.

RESULTS
In the cadaveric elbow capsules lubricin was identified most prominently on the synovial surface (Fig. 1a). Lubricin could, however, also be seen in the extracellular matrix (Fig. 1b and c) and intracellularly (Fig. 1c), and it could also be found concentrated in planes through the tissue (Fig. 1b). Occasional separations occurred through lubricin-containing seams in the tissue (Fig. 1b). Of note was the finding of lubricin in the cytoplasm of cells of fibroblastic morphology sectioned in cross-section and longitudinally (Fig. 1c). Also of interest was the finding of lubricin in planes defining the edges of fascicle-like fiber bundles displaying crimp (Fig. 1d).

Lubricin appeared prominently as a discrete surface layer on tissue folds within the resected samples from post-traumatic elbow contractures (Fig. 2a). Many of these surfaces did not display the typical cell array found in synovium, and in many cases the fibrocollagenous matrix extended to the lubricin-coated surface (Fig. 2b). Cells could occasionally be found distributed within the lubricin surface layer (Fig. 2b). There were regions of the tissue in which no lubricin was seen as a surface layer despite the fact that lubricin-bearing cells were in close proximity (Fig. 2c). While none of the control samples displayed a grade of +++ for matrix and cellular staining, 3/8 contracted samples had a grade of +++ for matrix staining and 4/8 contracted samples had a grade of +++ for cellular staining.

DISCUSSION
In the cadaveric elbow capsules, a distinct lubricin layer was found on the most of the surfaces on the joint side of the tissue. Most of these surfaces did not have the typical appearance of synovium. Lubricin was also found in planes within the fibrous tissue, occasionally appearing to separate fascicular like fibrous bundles. This suggests a possible role for lubricin as lubricant to facilitate interfascicular or interlamellar sliding as has been proposed for the rotator cuff.

A notable finding of this study was the presence of lubricin on the surfaces of tissue folds and within the fibrotic tissue resected from post-traumatic elbow contractures. The presence of lubricin in this tissue may provide insights into why it is so persistent. Lubricin is an essential boundary lubricant for normal articulating tissues such as articular cartilage and an important anti-adhesion molecule on the surface of other tissues such as tendon. However, when it occurs on the edges of torn tissues or on tissue folds it may prevent a binding repair (integrative binding) of the apposed surfaces, which may be necessary for remodeling. The source of lubricin may be the joint fluid or cells in the joint capsule. Future work needs to investigate the source of the lubricin, and determine if contracture stimulates the production of lubricin by cells in the joint capsule. This evidence that surface layers of lubricin may interfere with reparative processes in torn or folded tissues, directs attention toward therapeutic strategies for its degradation.

REFERENCES

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