

Differential Collagen Isoform Expression in Post-Traumatic Stiff Elbow Anterior Capsules

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Introduction:

Posttraumatic elbow joint contracture results in severe functional limitations with daily living after elbow injuries such as fractures and/or dislocations. Very little is known about the structural properties of the posttraumatic elbow joint contracture capsule. The type of collagen (notably I and III, as well as II, V, VI and X) and its organization in extracellular matrices play a critical role in determining the mechanical properties of biological structures. In order to determine whether the collagen types of contracted post-traumatic EJ capsules change over time from the initial elbow trauma, we performed western blot analysis and hypothesized that several collagens are expressed in response to capsular injury and change over time, in addition to the previously published changing ratio of collagen types I and III in contracted joint capsules [1].

Methods:

We surgically excised the anterior capsules of 7 post-traumatically injured and contracted patients' elbow joints, recalcitrant to conservative management, in order to improve their range of motion. These excised capsules were immediately preserved in dry ice and underwent basic histological and more detailed western blot analysis for collagen sub-type analysis. We observationally reported our data due to sample size. Our study received IRB approval and informed consent was obtained.

Results:

The results indicated that type I and type III collagen levels, as well as lesser collagens II, V, VI and X, were detected at differing levels in all patients throughout time from the initial elbow trauma (Figure 1). The amalgamated data of all the specimens showed a maximum expression of all of the collagens cumulatively between 3 and 7 months from the traumatic event. After 4 months post-trauma, the levels of collagen type II, V and X were consistently less than collagen VI. Collagen VI showed consistent expression throughout the time from elbow trauma from 1 to 18 months. The results demonstrate a relative downregulation of collagen II, V, and X, which continues to downregulate as the time from elbow trauma increases.

Discussion:

In our study, the expression of collagen types I, II, III, V, VI and X was increased up to 4 months contracture time. Our results revealed that elevated collagen expression is observed in human elbow capsules and that there may be a temporal relationship between collagen content and contracture time. This collagen content change may also reflect on the physical and mechanical properties of contracted capsules through time, particularly in terms of fibril diameter and tensile strength. Our study is limited by a small sample size, which only allowed us to report our data observationally. Also, there was no control group due to ethical reasons as we did not perform surgery on uninjured patients without contracture.

Significance/Clinical Relevance:

Our data is useful in furthering the understanding of the molecular and cellular level of elbow contraction and if there is a temporal relationship between collagen capsule content and contracture time clinically.

References:

- [1] Matsumoto F, Trudel G, Uthoff HK. High collagen type I and low collagen type III levels in knee joint contracture. *Acta Orthopaedica Scandinavica* 73 (2002): 335-43.

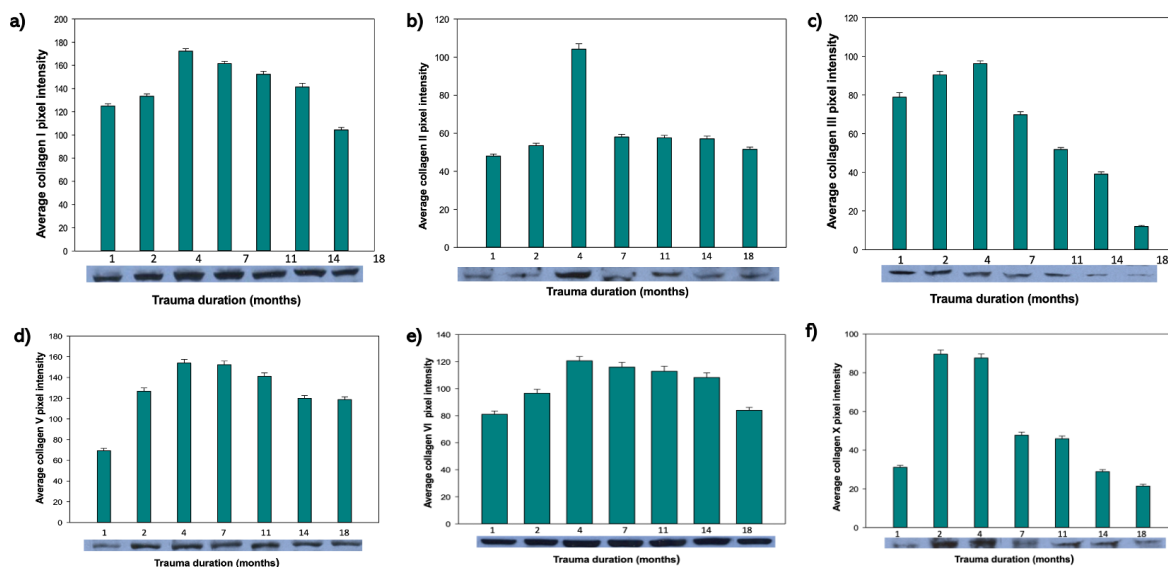


Figure 2. Semi-quantification of collagen subtypes using western blotting. The Y-axis corresponds to signal intensities (pixels): (a) collagen I (129 kDa), (b) collagen II (140 kDa), (c) collagen III (138 kDa), (d) collagen V (180 kDa), (e) collagen VI (140 kDa) and (f) collagen X (66 kDa).