The Effect of Radial Collateral Ligament Plication on Varus Stability in a Sequential Injury Model of the Lateral Elbow: A Biomechanical Study

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INTRODUCTION:
Radial collateral ligament (RCL) insufficiency can lead to symptomatic minor instability of the lateral elbow (SMILE). While RCL plication has favorable clinical outcomes in treating SMILE, its biomechanical impact on varus stability remains unclear, particularly regarding how effectively RCL plication restores stability compared to an intact elbow across various degrees of lateral elbow injury. This study was to evaluate impact of RCL plication on varus stability within a sequential lateral elbow injury model under controlled varus loading.

METHODS: A custom-made device was used to test fresh-frozen cadaveric specimens (60o degrees of elbow flexion) under a controlled varus load. We examined seven conditions: intact elbow, three sequential injury scenarios (anterior half of the common extensor origin [CEO] release, partial RCL release, and complete RCL release), and three corresponding conditions following RCL plication. Each specimen was tested under three varus loads (gravity alone, additional 0.5 and 1 kg applied to the hand). True anteroposterior radiographs of the elbow were taken in each condition to measure varus angle and assess varus stability.

RESULTS: RCL plication significantly reduced varus angle in cases of anterior half of the CEO and partial RCL release across all tested loads compared to their respective pre-plication states, while a significant reduction was not observed after RCL plication in the condition involving complete RCL release. At all load levels, varus angles in cases of RCL plication for anterior half of the CEO and partial RCL release showed no significant difference from intact elbow. However, RCL plication following complete RCL release exhibited a significantly larger varus angle than the intact elbow.

DISCUSSION AND CONCLUSION: RCL plication in both anterior half of the CEO and partial RCL releases demonstrated significant improvements in varus stability compared to their respective injury conditions and achieved varus stability comparable to that of the intact elbow, whereas RCL plication following complete RCL release did not significantly improve varus stability and exhibited inferior varus stability compared to the intact elbow.