Efficacy of various stabilizing techniques to protect the ulnar collateral ligament of the thumb: a cadaveric study

Morgan Turnow[1], Warren Lee[2], Laura C. Boucher[3]

[1]Division of Anatomy, The Ohio State University College of Medicine
[2]Department of Biomedical Engineering, The Ohio State University
[3]Injury Biomechanics Research Center, The Ohio State University College of Medicine

Athletic injuries to the hand are common, especially to the ligamentous structures, primarily the collateral ligaments of the thumb. Rupture to the ulnar collateral ligament of the thumb (UCLt) accounts for approximately 86% of all injuries occurring at the base of the thumb. Laxity of the UCLt can occur due to repetitive valgus stress; however instantaneous mechanisms are more likely to result in injury. The objective of this study was to evaluate the effectiveness of common stabilization devices for the UCLt in both embalmed and fresh cadaveric specimens.

Methods: Basic anthropometry measurements were initially taken and included hand length, palm length, hand breadth, thumb length (from the MCP joint), thumb circumference, and range of motion at the MCP joint. Next, four conditions were assigned in random order for each specimen. The conditions included three common stabilization techniques; a thumb spica tape job, a thumb abduction tape job, and an over-the-counter spica splint. The fourth condition was a no-stabilization device condition. The pilot tests were conducted on 5 embalmed cadaveric specimens. A custom drop tower, measuring 6 feet tall and 13 inches wide, was built. The cadavers were lying supine with the left arm abducted approximately 20 degrees. The forearm was stabilized with a custom-made splint apparatus, which aligned the thumb in a neutral position. A hose clamp was secured 15 mm from the MCP joint of the thumb and was attached to a cable pulley latch system. One hundred-fifty Newton of force was applied through an impact load transfer system, resulting in a high rate of forced thumb abduction. High speed video cameras were used to capture the movement of the thumb from a superior view and TEMA motion analysis software (Adept Turnkey, Australia) was used to calculate the maximum abduction angles at impact. An analysis of variance (ANOVA) will be used to compare each stabilization condition on the fresh cadaver tests.

Results: Analysis thus far includes pilot testing data performed with 5 embalmed cadavers (2 female, 3 male; mean age=77±21). Mean thumb abduction range of

motion before splinting was 30.73°±12.27. A total of twenty tests were conducted, but only seventeen tests could be analyzed due to data errors in the collection process. Results demonstrate mean abduction angles of with no stabilization device = 18.60°, thumb spica tape job = 18.34°, thumb abduction tape job = 19.07°, and with the over-the-counter spica splint = 14.01°. An additional eight PMHS tests are scheduled for testing in the next month using the same methodology and analysis as above.

Discussion: The data thus far suggest that the over-the-counter spica splint is the most effective stabilizing device followed by the thumb spica tape job. This is the first study to assess the efficacy of these commonly used stabilization devices. Whether being used following injury or preventatively, understanding the most effective stabilizing method is important for an athlete's safety during competition.