InternalBrace™ Augmentation of the Thumb Ulnar Collateral Ligament Repair: A Biomechanical Study

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Introduction

The ulnar collateral ligament (UCL) is the primary stabilizer of the thumb metacarpophalangeal (MCP) joint to radial stress. Excessive radial deviation of the thumb is a common cause of injury to the UCL. Treatment of these injuries depends on the degree of ligamentous injury, chronicity of the tear, and physical demands of the patient. Operative treatment is indicated for tears where there is greater than 30 deg opening of the MCP joint with radial stress or a relative opening of 15 deg compared to the contralateral side. Numerous methods to repair the UCL have been described. Suture anchor repair has become more popular due to shorter surgical times, fewer soft-tissue complications, and lower cost. Internal bracing is a new augmentation method using suture tape recently applied to a myriad of other orthopaedic applications.

Objective

This purpose of this study was to evaluate and compare the biomechanical strength of the thumb UCL repair alone to repair augmented with an InternalBrace™ (Arthrex Inc, Naples, FL).

Methods

Twelve fresh frozen cadaveric specimens (six matched pairs) had the UCL divided at its attachment on the base of the proximal phalanx and repaired with (Figure 1) or (Figure 2) InternalBrace™ augmentation. The repair in each specimen was performed with FiberWire® suture and one SwiveLock® (Arthrex Inc., Naples, FL) anchor. InternalBrace™ augmentation consisted of adding a synthetic tape [in this case, LabralTape® (Arthrex Inc., Naples, FL)] to the ligament repair and secured by a second SwiveLock® anchor. A material testing machine was used to provide valgus stress. Prior to testing, a preload of 0.2 N was applied to each specimen. A valgus load was then applied at a rate of 0.1 mm/s until failure was achieved. The maximum load and load at clinical failure were recorded. Clinical failure was defined as the load corresponding to a valgus deflection of more than 30º or approximately 12.81 mm of vertical displacement. A paired sample t-test was used to determine if there was a difference in maximum load and load to failure between the repair only and the repair with InternalBrace™ augmentation group. The α level for statistical significance was set at 0.05.

Results

In the specimens with UCL repair augmented with an InternalBrace™, the maximum load (46.56 SD 25.56 N) and load at failure (25.31 SD 18.34 N) were significantly higher than in the repair alone group (8.02 SD 2.24 N and 6.00 SD 2.39 N, respectively) (Figure 3).

Discussion

The most important finding of the present study was that adding InternalBrace™ augmentation to the repaired thumb UCL results in an increased maximum load as well as increased load to failure.

The present study does have limitations. First, only 12 specimens were used in this study. However, pre-hoc sample size calculation indicated only 8 specimens were needed to ensure sufficient statistical power. Secondly, the loads applied may not have simulated the precise stresses on the first MCP joint during normal daily activities or traumatic incidents. Lastly, the strength of the repair technique was tested at time zero as it was not possible to reproduce the effect of biologic healing. Perhaps in vivo, the strength of the repair would increase with time as biologic healing occurs.

InternalBrace™ augmentation may be valuable in the setting of acute tears, obviating the need for post-operative cast immobilization and therefore allowing for earlier thumb MCP joint motion and overall faster clinical recovery. The importance of InternalBrace™ augmentation may be even more profound for chronic UCL tears, where the intrinsic ligament quality is less than optimal but stout enough for augmented repair, as well as to reinforce UCL reconstruction using palmaris longus autograft.

Conclusion

In conclusion, thumb UCL repair with InternalBrace™ augmentation is biomechanically superior to non-augmented repair.

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