

Hand and Wrist *Internal/Brace*™ Scientific Update

De Giacomo AF,
Shin SS

Scientific Literature

Repair of the thumb ulnar collateral ligament with suture tape augmentation.

Tech Hand Extrem Surg. 2017;21(4):164-166. doi:10.1097/BTH.0000000000000173

- Surgical technique description of thumb UCL repair with *Internal/Brace*™ ligament augmentation on a professional basketball player. The surgeon used a 2.5 mm PushLock® anchor in the proximal phalanx and a 3.5 mm DX SwiveLock® SL anchor in the metacarpal. SutureTape was used to create the *Internal/Brace* ligament augmentation construct.
- This construct allowed the patient to begin gentle range of motion at day 3 post-op and begin ball-handling exercises at 8 days post-op. At 5 weeks post-op, the patient was cleared to return to full play, and he played his first game at day 37.
- “Under these circumstances, with structural support augmentation, the recovery and rehabilitation process can be expedited for patients to allow an earlier return to activities.”

Shin SS,
van Eck CF,
Uquillas C

Suture tape augmentation of the thumb ulnar collateral ligament repair: a biomechanical study. *J Hand Surg Am.* 2018;43(9):868.e1-868.e6. doi:10.1016/j.jhssa.2018.02.002

- A biomechanical study that compares the maximum load and the load at clinical failure of a repair without *Internal/Brace* augmentation versus repair with a LabralTape™ suture *Internal/Brace* augmentation.
- Repair with *Internal/Brace* augmentation did four to five times better than repair without *Internal/Brace* augmentation.

| Applied Load | UCL Repair Only | UCL Repair With SutureTape Augmentation |
|---|-----------------|---|
| Maximum load (N) with mean SD (N) | 8.02 (SD, 2.24) | 46.56 (SD, 25.56) |
| Load at clinical failure (N) with mean SD (N) | 5.77 (SD, 2.23) | 22.27 (SD, 17.59) |

- “Suture tape augmentation of UCL repair may be valuable in the setting of acute tears by decreasing the time of postoperative cast immobilization and, therefore, allowing for earlier thumb metacarpophalangeal joint motion and overall faster clinical recovery.”



Patel NA,
Lin CC,
Itami Y,
McGarry MH,
Shin SS,
Lee TQ

[Kinematics of thumb ulnar collateral ligament repair with suture tape augmentation.](#)

J Hand Surg Am. 2020;45(2):117-122. doi:10.1016/j.jhsa.2019.09.005

- A biomechanical study that addresses the question of whether the *Internal/Brace*™ augmentation overconstrains the joint, which it did not. The construct was able to restore varus-valgus kinematics after complete UCL tear.
- “In addition, the higher angular stiffness afforded by the suture tape augmentation may allow for earlier rehabilitation after surgery.”

Gibbs DB,
Shin SS

[Return to play in athletes after thumb ulnar collateral ligament repair with suture tape augmentation.](#) *Orthop J Sports Med.* 2020;8(7):2325967120935063.

doi:10.1177/2325967120935063

- A medium-term retrospective review of 18 thumbs in 17 patients who underwent thumb UCL repair with *Internal/Brace* augment with a mean follow-up of 28 months. Patient cohort included 4 collegiate baseball players, 6 professional baseball players, 3 professional basketball players, 1 professional hockey player, 1 amateur-level hockey player, 1 high school basketball player, and 1 high school volleyball player.
- All players returned to same level of play at a mean of just under 5 weeks while in season.
- “Augmenting the repair with anchored suture may prevent prolonged immobilization, expedite thumb motion, and improve postoperative recovery.”

Lee SJ,
Rabinovich RV,
Kim A

[Thumb ulnar collateral ligament repair with suture tape augmentation.](#) *J Hand Surg Asian Pac Vol.* 2020;25(1):32-38. doi:10.1142/S2424835520500046

- 13-patient short-term retrospective study with minimum 1-year follow-up.
- “Three patients in our series with chronic repairs had a markedly less stout ligament than the remainder of the patients in this study. Although a less robust repair was achieved among these patients, similar ROM as well as grip and pinch strength outcomes were noted. This may highlight the applicability of primary repair and suture tape augmentation for chronic repairs with poor ligament substance, whereas reconstruction would be otherwise indicated.”
- Thumb UCL repair with suture tape augmentation demonstrates short-term outcomes comparable to what has been reported for other methods or repair. It may potentially allow for an expedited recovery and rehabilitation process.

Thompson RG,
Dustin JA,
Roper DK,
Kane SM,
Lourie GM

[Suture tape augmentation for scapholunate ligament repair: a biomechanical study.](#)

J Hand Surg Am. 2020;S0363-5023(20)30376-2. doi:10.1016/j.jhsa.2020.06.017

- This study compared an all-dorsal scapholunate repair with and without SutureTape augmentation.
- Specimens that received an *Internal/Brace* augment had a max load to failure twice that of the specimens without an augment (135 N vs 68 N, respectively).
- “Acute SL ligament injuries may benefit from suture tape augmentation by increasing the stability of the primary repair. This may prove beneficial in higher-demand patients.”



Park IJ,
Maniglio M,
Shin SS,
Lim D,
McGarry MH,
Lee TQ

[Internal bracing augmentation for scapholunate interosseous ligament repair: a cadaveric biomechanical study.](#) *J Hand Surg Am.* 2020;45(10):985.e1-985.e9. doi:10.1016/j.jhssa.2020.03.017

- This study compares an all-dorsal repair with and without *InternalBrace*™ augmentation to the native ligament.
- The repair with *InternalBrace* augmentation performed significantly better than the repair without *InternalBrace* augmentation in all testing parameters.
- “Repair with *InternalBrace* augmentation could serve as a novel surgical technique that enhances SLIL direct repair through biomechanical support.”

Poster and Podium Presentations

Lee SJ,
Coyle R,
Porter DA,
Kremenik I

[Biomechanical testing of scapholunate reconstruction with internal brace versus scapholunate repair.](#) Presented at FESSH 2017.

- This abstract presents the all-dorsal scapholunate reconstruction with *InternalBrace* ligament augmentation technique. The biomechanical properties of this technique were compared to a simple scapholunate repair with two anchors.
- The ultimate strength of the augmented ligament reconstruction averaged 82.0 N, while the ultimate strength of the ligament repair averaged 41.7 N.

Lee SJ,
Choinski RJ,
Freigang A,
Papangelou C,
Riano R

[Scapholunate reconstruction: a biomechanical analysis of a novel technique.](#) Presented at FESSH 2017.

- This presentation looked at the strength of the native scapholunate ligament and that of an all-dorsal scapholunate ligament repair with LabralTape™ suture *InternalBrace* augment.
- The load to failure of native dorsal ligaments and repair with the *InternalBrace* construct were 137±43 N and 90±42 N, respectively, with no statistically significant difference between the two groups ($P = .1$). The force to 3 mm gap formation was not significantly different ($P = .06$).

Schwartzberger JJ,
Clark C,
Santoni BG,
Garcia M,
Stone JD,
Nydick J

[Scapholunate ligament reconstruction using tendon autograft and 3.5 mm fork-tip interference anchors.](#) Poster 146 presented at ASSH 2018.

- This abstract presents the all-dorsal scapholunate reconstruction with *InternalBrace* ligament augmentation technique and compares early clinical and radiographic outcomes to the 3-ligament tenodesis. Average follow-up was 9.9 months.
- The dorsal reconstruction group demonstrated significant correction of scapholunate and radioscapoid angle from preoperative (76.2° and 65.5°, respectively) to immediate postoperative radiographs (52.5° and 47.8°, $P = .04$ and $.029$, respectively). Early follow-up of the all-dorsal reconstruction with *InternalBrace* construct compares favorably to the 3-ligament tenodesis procedure and has a low incidence of complications.



Orr S,
Morse K,
Meyers K,
Weiland A

Scapholunate ligament reconstruction with *Internal/Brace*[™] technique provides biomechanically equivalent fixation compared to the percutaneous pin fixation in a cadaveric model. Presented at IFSSH/FESSH 2019 Congress; June 13-16, 2018. Berlin, Germany.

- This poster compared fixation of the scapholunate repair with K-wires versus with a LabralTape[™] suture *Internal/Brace* augment. For the K-wire group, two K-wires were placed percutaneously between the scaphoid and lunate and the third K-wire was placed through the scaphoid and capitate. The wrists were then cycled 300 times.
- There was no difference in the increase of the scapholunate gap (0.51 ± 0.14 vs 0.26 ± 0.18 , $P > .05$) or angle (0.97 ± 0.23 vs 1.12 ± 0.33 , $P > .05$) between repair techniques. The use of an internal brace technique is biomechanically comparable to K-wire fixation in a cadaveric model.

Van Eck C,
Papaliadis D,
Shin SS

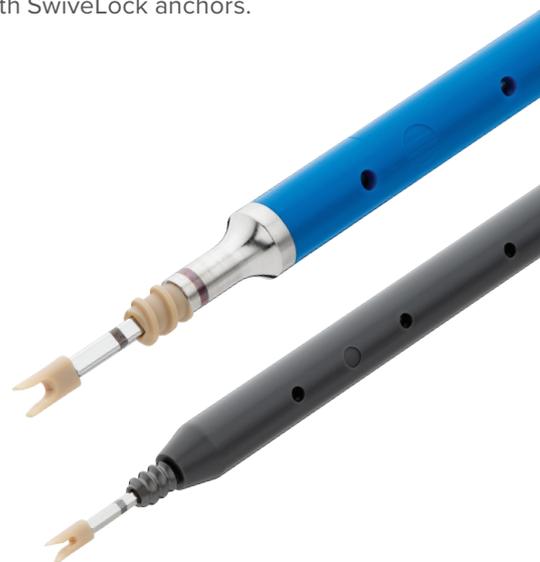
Suture tape stabilization of the fifth carpometacarpal joint in the elite athlete. Presented at IFSSH/FESSH 2019 Congress; June 13-16, 2018. Berlin, Germany.

- This poster describes a case study of a fourth metacarpal fracture replaced with a plate and screw and a subsequent 5th CMCJ dislocation that was reduced and secured with an *Internal/Brace* augment versus K-wire fixation.
- The elite athlete was able to move more quickly, cutting down on his immobilization post-op, and he returned to his sport more quickly.

Rabinovich RV,
Lee SJ,
Aguilar MB,
Kim A

Management of CMC joint arthritis with an internal brace and tendon interposition: a prospective case series. Presented at 74th Meeting of the ASSH 2019; September; Las Vegas, NV.

- This poster is a retrospective review of the results of a CMC *Internal/Brace* procedure using graft and another group with a SwiveLock[®] suspensionplasty without graft.
- The average follow-up for the 21 patients undergoing the procedure was 2.6 years. The authors looked at pinch and grip strength, ROM, and metacarpal height at a minimum of 1 year post-op.
- No significant difference was seen in any of the measures other than MP ROM in the sagittal plane. Excellent clinical and radiographic results can be achieved with or without graft while performing a SutureTape suspensionplasty with SwiveLock anchors.



Doering T,
Greenberg A,
Tuckman DV

Patel SS,
Hachdorian M,
Nydick J,
Garcia M

Neustein TM,
Bellamy T,
Thompson JD,
Gottschalk MB,
Wagner ER,
Daly CA

Avoricani A,
Dar Q-A,
Levy KH,
Hayes W,
Shah NV,
Koehler SM

[Prospective analysis of knotless suture anchor suspensionplasty for treatment of basal joint arthritis.](#) Presented at 74th Meeting of the ASSH 2019; September; Las Vegas, NV.

[Thumb metacarpophalangeal joint ulnar collateral ligament: early outcomes of suture anchor repair with suture tape augmentation.](#) Poster Presented at AAHS Annual Meeting 2020, Ft. Lauderdale, FL.

- This poster looks at thumb UCL with *Internal/Brace*™ ligament augmentation in 6 patients at an average follow-up of 14 months. The authors looked at ROM, DASH score, and complications.
- No complications or MCP instability were reported at final follow-up.

[Biomechanical evaluation of scapholunate reconstruction techniques.](#) Poster SPP0354 presented at ASSH Annual Meeting, 2020, virtual.

This poster compares modified Brunelli, all-dorsal reconstruction with LabralTape™ suture *Internal/Brace* augmentation, and the intact S-L ligament during 500 cycles of axial and torsional loading.

Table 1. Summary of Results

| Population | 1. Final Range of Rotation | | 2. Torsional Stiffness (N-mm/deg) | 3. Range of Rotation Delta (degrees) | 4. Final Range of Axial Motion (mm) |
|-------------------|----------------------------|-------------------|--------------------------------------|---|--|
| | Angle (degrees) | Effectiveness (%) | | | |
| Intact | 34.04 ± 4.28 | N/A | 6.95 ± 4.20 | 1.83 ± 0.95 | 0.91 ± 0.58 |
| All-Dorsal | 22.78 ± 7.07 ^a | 94.4 | 15.34 ± 9.23 | 2.04 ± 1.44 | 0.63 ± 0.58 |
| Modified Brunelli | 26.34 ± 10.89 | 76.0 | 15.88 ± 15.46 | 2.74 ± 1.75 | 1.61 ± 0.91 |
| Capsulodesis | 32.71 ± 22.62 | 52.4 | 26.65 ± 34.63 | 3.24 ± 3.61 | 1.47 ± 0.71 |
| Repair ANOVA | <i>P</i> = | .587 | .678 | .749 | .272 |

- “The all-dorsal reconstruction most effectively recreated the torsional function of an intact SL ligament and displayed the greatest restraint to gap formation throughout axial loading.”

[Biomechanical comparison of three thumb ulnar collateral ligament reconstruction methods.](#) Poster SPP0801 presented at ASSH Annual Meeting, 2020, Virtual.

- This won “Best Tip e-Poster” at ASSH 2020 and compares joint congruity and load-to-failure for the following three groups: UCL repair with anchors, UCL repair with anchors and *Internal/Brace* augmentation, and UCL reconstruction with palmaris longus allograft.
- Repair with SutureTape reached higher load to failure and all three groups demonstrated different congruities from native joints.
- “In the setting of complete, acute tears of the thumb UCL, we found suture tape to be significantly more effective in maintaining MCP joint congruity and strength over both suture anchors and palmaris longus allografts.”



Zeiderman MR,
Sonoda LA,
McNary SM,
Boutin RD,
Bayne CO,
Szabo RM Zeiderman,
et al.

[The biomechanical effects of SutureTape augmentation of dorsal intercarpal ligament capsulodesis for scapholunate instability.](#) Poster RF19 presented at ASSH Annual Meeting, 2020, Virtual.

- CT scans were used to analyze carpal aligned after 500 cycles for the following three groups: all-dorsal reconstruction with *InternalBrace*™ augmentation (IB), dorsal intercarpal ligament capsulodesis (DIC) without IB, and DIC with IB.
- DIC with IB demonstrated better SL interval reduction before and after cycling compared to both DIC without IB and DIC alone.
- “Scapholunate ligament reconstruction with dorsal intercarpal ligament capsulodesis augmented with SutureTape (DIC+IB) maintains SL interval reduction better than SL ligament reconstruction with tendon autograft with SutureTape augmentation (IB+T) or dorsal intercarpal ligament capsulodesis alone (DIC). SutureTape augmentation of SL ligament reconstruction may provide more durable repair by providing bone-ligament fixation and preventing viscoelastic stretch of ligament or tendon graft.”

White Papers

Arthrex Research
and Development

[Biomechanical testing of an ulnar collateral ligament repair: SwiveLock® anchor with *InternalBrace* ligament augmentation vs SwiveLock anchor alone.](#) LA1-00046-EN. Naples, FL; 2018

- The purpose of this study was to compare the maximum load and load at clinical failure of an ulnar collateral ligament (UCL) suture anchor repair using one SwiveLock® anchor vs two SwiveLock anchors with *InternalBrace* ligament augmentation.
- The UCL repair performed with SwiveLock anchors and an *InternalBrace* ligament augmentation significantly increased the maximum load as well as load observed at clinical failure compared to the repair with only a SwiveLock suture anchor. Additionally, repairs that included the *InternalBrace* ligament augmentation demonstrated superior maximum loads to previously studied repairs involving either a figure-of-8 tendon weave or Bio-Tenodesis™ screw construct (23.5 N and 24.3 N, respectively).

Arthrex Research
and Development

[Scapholunate reconstruction: a biomechanical analysis of a novel technique.](#) LA1-00053-EN. Naples, FL; 2017

- The biomechanical properties of the native dorsal portion of the scapholunate (SL) ligament were compared to the properties all-dorsal scapholunate *InternalBrace* ligament augmentation repair technique.
- The loads to failure of native dorsal ligaments and repair constructs were 137±43 N and 90±42 N, respectively, with no statistically significant difference between the two groups ($P = .1$). The force to 3 mm gap formation was not significantly different ($P = .06$).

Arthrex Research
and Development

[Fatigue loading of SutureTape for use as an *InternalBrace* ligament augmentation as part of an ulnar collateral ligament repair.](#) LA1-00101-EN_A. Naples, FL; 2018

- SutureTape suture was fixated into 20/40 foam block with two 3.5 mm DX SwiveLock SL anchors. Samples were cycled 50,000 cycles at a rate of 2 Hz and load and displacement data were recorded.
- All samples of SutureTape survived the 50,000 cycles, demonstrating the durability of the construct over significant repetitive loading.