Technical Note

Indirect Scapholunate Ligament Repair: All Arthroscopic

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Abstract: The arthroscopic technique most frequently used in acute scapholunate instability is reduction and fixation with Kirschner wires. To repair the injured ligament, open surgery and dorsal capsular plication are recommended, but this procedure has the risk of damaging secondary dorsal stabilizers, the dorsal blood supply, and the proprioceptive innervation of the posterior interosseous nerve. In this report, we present an all-arthroscopic technique of a dorsal reconstruction of the scapholunate interosseous ligament for scapholunate instability using a tape by tethering the scaphoid to the lunate.

Scapholunate interosseous ligament (SLIL) is the primary stabilizer of the scapholunate (SL) articulation. An isolated injury of the SLIL with no lesion of the secondary SL articulation stabilizers may not cause disassociation initially. In these cases, plain radiograph abnormalities will occur over time.

There are a multitude of options and surgical techniques for SLIL injuries. Kitay and Wolfe grouped SL injuries into 6 stages. They proposed an algorithm for the treatment of SL instability. For partial SLIL tears without clinical or intraoperative findings of instability, Kitay and Wolle recommended debridement and thermal shrinkage to help tighten the attenuated ligaments, and for SLIL tear with instability under stress examination, open repair of SLIL with suture anchors or transosseous suture channels and dorsal capsulodesis. Both techniques need temporary K wires placed across the SL joint for 2 to 4 weeks. If the SLIL is not repairable, reconstructive procedures are indicated.

Excellent or good results with SLIL repair and dorsal capsular plication are reported in the literature, but this technique requires a wide dorsal approach, with the risk of damage to the soft tissues and often a reduction in wrist mobility with stiffness. Wrist arthroscopy has evolved in the last decade and allows treatment of these SLIL injuries. It has the advantages of minimizing the damage to the soft tissues, preserving vascular anatomy, and proprioception of the wrist and the secondary dorsal stabilizers.

We present an arthroscopic technique of a dorsal reconstruction of the SLIL for SL instability using a tape by tethering the scaphoid to the lunate.

Indications

The technique is indicated for patients with partial SLIL tears without clinical or intraoperative findings of SL instability or complete SLIL tears but repairable. Other requirements include (1) competent secondary stabilizers, (2) no chondral involvement, (3) absence of degenerative changes, and (4) injury to the SLIL occurring within a 2- to 3-week period. According to the stage-oriented algorithm or the treatment of SL instability by Kitay and Wolle, it is indicated for stages I and II. This technique is also indicated in SLIL tears associated with a distal radius fracture.
Surgical Technique

Position and Portals

The arm is suspended in a wrist traction tower AR-1611S (Arthrex, Naples, FL) under 2.5 kg of traction. Continuous saline irrigation of the joint is achieved with a bag of 3 L of normal saline instilled under gravity. Arthroscopic portals 3-4, 4-5, midcarpal ulnar, and midcarpal radial are performed (Fig 1). We use a 2.5-mm 30° arthroscope (Arthrex).

Arthroscopic SL Instability Diagnosis

SL instability is evaluated and classified from radiocarpal and midcarpal portals (Fig 2). The fibrous and inflammatory tissue from the dorsal portion of the SLIL is cleaned with a shaver. According to where the ligament has been detached, cruentation of the insertion of the SLIL is performed to stimulate healing.

Holes and FiberTape in the Lunate and Scaphoid

With arthroscopic visualization through the 3-4 portal, we introduce a drill guide through the 4-5 portal and place it centered on the lunate. A hole 8 mm depth is created with a 2-mm drill bit (Arthrex; Fig 3). Any soft tissue surrounding and inside the drill hole is cleared. We use a 2-mm FiberTape, each end tapered to no. 2 FiberWire (Arthrex). The FiberWire is pass through the eyelet of a 2.5-mm Pushlock knotless suture anchor (Arthrex) until it reaches the FiberTape (Fig 4). The eyelet tip is pushed to the bottom of the hole in the lunate. The Pushlock is impacted to insert the tak portion of the anchor into the hole and lock the FiberTape (Fig 5). The FiberWire flush is cut.

The portals are switched. With the arthroscope inserted through the 4-5 portal, the FiberTape is retrieved from the 3-4 portal. Then we use the DX SwiveLock SL Disposable Kit 3.5 × 8.5 mm (Arthrex). From the 3-4 portal, we introduce a 1.2-mm K wire into the proximal pole of the scaphoid under arthroscopic control. A 10-mm hole is drilled in the proximal pole of the scaphoid with the 3.5-mm cannulated drill bit (Arthrex). Any soft tissue surrounding and inside the drill hole is cleared (Fig 6).

We load the FiberTape in the forked eyelet of the SwiveLock and insert the SwiveLock into the hole (Fig 7). We hold the square tab steady while turning the knob clockwise until the laser line is just below the level of the scaphoid. When placing the SwiveLock into the scaphoid, resistance is met as the FiberTape slides around the forked eyelet. Slow and constant pressure downward will allow the SwiveLock to insert and autotension the FiberTape (Fig 8). Cut off any excess FiberTape.

SL Joint Stability Test

We check the stability of the SL joint from the midcarpal ulnar and radial portals (Fig 9). Portals are sutured with Safil Quick 4/0 (Aesculap, Center Valley, PA).

A step-by-step summary of this technique is provided in Table 1. Pearls and pitfalls and advantages and disadvantages are presented in Tables 2 and 3, respectively. Key steps of the procedure are shown in Video 1.
Postoperative Management
After surgery, an early mobilization protocol is recommended to achieve full wrist motion. The tape is fixed with anchors, and this enables early mobilization without the use of Kirschner wire or dorsal splint. The stitches are removed 2 weeks after surgery.

Discussion
SLIL is the primary stabilizer of the SL joint. It is anatomically divided into 3 regions: dorsal, proximal, and palmar. The dorsal region is the thickest and strongest part. Berger et al. published a study observing that dorsal SLIL load-to-failure value was twice that of the volar SLIL and that significant
**Fig 6.** Scaphoid step for the left wrist. Arthroscopic visualization through the 4-5 portal. FiberTape is retrieved from the 3-4 portal. A 1.2-mm K-wire is introduced through the 3-4 portal into the proximal pole of the scaphoid (S) under arthroscopic control. A 10-mm hole is drilled in the proximal pole of the scaphoid with the 3.5-mm cannulated drill bit.

**Fig 7.** Scaphoid step for the left wrist. The FiberTape is loaded in the forked eyelet of the SwiveLock. Arthroscopic visualization through the 4-5 portal. SwiveLock is inserted into the hole in the scaphoid (S) through the 3-4 portal.
translation and rotation of the scaphoid occurred after isolated section of dorsal SLIL. Patterson et al.\textsuperscript{10} demonstrated that only section of the dorsal SLIL produces static widening of the SL interval.

Microvascular anatomy of the carpus shows that most of the SLIL receives an abundant blood supply. The study performed by Hixson and Stewart\textsuperscript{11} in 6 fresh cadaver specimens indicates that this vascular supply may be sufficient for ligament healing after injury.

According to these cadaveric studies, surgical reconstructive procedures may center in the SLIL dorsal region, and healing of the ligament may be possible in acute injuries of the SLIL.

Open surgery has been described for direct SLIL repair in acute cases, and good outcomes have been

\begin{table}
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\caption{Step-by-Step Summary of Arthroscopic Dorsal Reconstruction for Scapholunate Instability}
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1. & Position the arm in a wrist traction tower under 2.5 kg of traction. \\
2. & Establish arthroscopic portals 3-4, 4-5, midcarpal ulnar, and midcarpal radial. \\
3. & Use a 2.5-mm 30° arthroscope and wrist arthroscopy set as instrumentation. \\
4. & Continuous saline irrigation of the joint is achieved with a bag of 3 L of normal saline instilled under gravity. \\
5. & Evaluate and classify scapholunate instability from radiocarpal and midcarpal portals. \\
6. & Use 3-4 portal as the viewing portal and 4-5 portal as the working portal. \\
7. & Clean inflammatory tissue from the dorsal portion of the scapholunate interosseous ligament. \\
8. & Perform cruentation of the insertion of the scapholunate interosseous ligament. \\
9. & Introduce a drill guide through the 4-5 portal and place it central on the lunate. \\
10. & Perform a hole with a 2-mm drill bit. \\
11. & Pass the FiberWire through the eyelet of the Pushlock knotless suture anchor until it reaches the FiberTape. \\
12. & Impact the Pushlock into the lunate hole and lock the FiberTape. \\
13. & Cut the FiberWire flush. \\
14. & Switch the portals. \\
15. & Use 4-5 portal as the viewing portal and 3-4 portal as the working portal. \\
16. & Retrieve the FiberTape from the 3-4 portal. \\
17. & Introduce a K-wire through the 3-4 portal into the proximal pole of the scaphoid under arthroscopic control. \\
18. & Perform a hole with the 3.5-mm cannulated drill. \\
19. & Load the FiberTape in the SwiveLock. \\
20. & Insert the SwiveLock in the scaphoid hole. \\
21. & Check the stability of the scapholunate joint from the midcarpal ulnar and radial portals. \\
22. & Suture the portals.
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\begin{table}
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\caption{Pearls and Pitfalls}
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Pearls & Pitfalls \\
\hline
Acute injury is ideal (2-3 weeks). & Chronic injury. \\
Achieve a stable environment. & Incorrect portal placement. \\
Evaluate and identify scapholunate instability. & No identification of scapholunate instability. \\
Cleaning and cruentation. & No stimulation of ligament healing. \\
Perform the hole central on the lunate. & Break out the lunate cortex. \\
Impact the Pushlock properly. & Break the implant. \\
Introduce the K-wire in the proximal pole of the scaphoid. & Malposition of the K-wire. \\
Perform the hole in the proximal pole of the scaphoid. & Break out the scaphoid cortex. \\
Insert the SwiveLock properly. & Do not countersink it. \\
Check the stability of the scapholunate joint. & No clinical results improvement. \\
\end{tabular}
\end{table}
The objective of this arthroscopic technique is to stabilize the SL joint and prevent the SL diastasis. We perform holes and no tunnels, and these minimize the risk of perioperative fracture and avascular necrosis. The damage to delicate structures is low through these conventional arthroscopic wrist portals. Neither pinning nor immobilization are necessary. Additionally, it is a simple technique in wrist arthroscopy. The expectations allow us to be optimistic for the future, especially for the SLIL injuries associated with intra-articular distal radial fractures.

### Table 3. Advantages and Disadvantages

| Advantages                                      | Disadvantages                                      |
|------------------------------------------------|----------------------------------------------------|
| Minimally invasive procedure.                  | Small incisions are required.                      |
| Allows verification of the scapholunate instability | Specific materials are requested.                   |
| Avoids damage to the soft tissues: interosseous posterior nerve, vascular supply, and secondary stabilizers. | Knowledge of the regional anatomy is necessary. |
| Allows correct placement of the implants.      | Demands precision in the placement and drilling of the holes. |
| Simple arthroscopic wrist procedure.           | Requires wrist arthroscopic skills.                |

published. Bickert et al.\(^1\) reported excellent or good results in 8 of 12 patients after a mean follow-up of 19 months, and Rosati et al.\(^2\) in 16 of 18 patients after a mean follow-up of 32 months. In both studies, Mitek anchors to repair the SLIL were used, and dorsal capsular plication was performed. Dorsal capsulodesis limits abnormal scaphoid flexion and stabilizes rotary subluxation of the scaphoid,\(^2\) but this technique predicts a loss of 15° of wrist flexion.\(^9\)

Arthroscopy allows surgeons to respect the soft tissues, neurovascular structures, and the secondary dorsal stabilizers. Good results have been published in acute SL instability with reconstruction of the dorsal SL, but 3 major risks are mentioned with these techniques: (1) the perioperative fracture during tunneling in the bones; (2) the damage to delicate structures, especially during the volar reconstruction; (3) the avascular necrosis of the bones. On the other hand, pinning is sometimes necessary, and after surgery patients need to be immobilized between 2 and 8 weeks. Despite a strong reconstruction with dorsal and volar portion, tendon and ligament compliance is different, and it is possible that the graft will stretch out over time. And finally, to perform these procedures, previous wrist arthroscopic skills and specific materials are required.\(^6,12\)

FiberTape is a 2-mm width tape with ultrahigh strength that provides broad compression, making it an excellent choice for knotless repair techniques. This combination withstood the highest load at clinical failure in rotator cuff tears.\(^13\)

Our technique uses a nonbiological band in the dorsal portion of the SL ligament. It is indicated in an acute injury, with partial or complete tear of the SLIL, and without misalignment of the carpus (stages I and II).\(^2\)

### References

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