TECHNIQUE

Suture-button Fixation and Arthroscopic Dorsal Ligamento-capsulodesis in Chronic Scapholunate Dissociation

Ismail B. Ozcelik, MD and Ali Cavit, MD†*

Abstract: The treatment choice in scapholunate (SL) injury depends on the extent of the SL ligament tear, chronicity of injury, quality of the ligament remnants, reducibility of carpal malalignment, and cartilage status of the radiocarpal and midcarpal joints. In the absence of degenerative changes with chronic reducible dissociation, the optimal treatment would be the reconstruction of the SL interosseous ligament. Various SL reconstruction techniques via open or arthroscopic approaches have been described over the years; they include tendon reconstructions, volar/dorsal capsulodesis, SL allografts, bone-tissue-bone composite grafts, reduction and association of the scaphoid and lunate procedure, SL axis method, and SL internal brace technique. However, all of these techniques have their own shortcomings and disadvantages. The present study demonstrates a new technique using a suture-button device for the reduction and fixation of SL diastasis. The suture-button system is positioned between the scaphoid and the triquetrum, the direction of the system prevents scaphoid flexion and maintains continuity of the reduction. Arthroscopic dorsal ligamento-capsulodesis technique can be added to achieve biological healing during the stabilization process. The major advantages of this technique over others are a straightforward application with shorter operative time and lack of a need for harvesting a tendon graft. The technique is performed through mini-incisions, which enable a shorter postoperative recovery time and rehabilitation period and a quicker restoration of function which decreases the risk of joint stiffness. Furthermore, large bone tunnels which increase the risk of fracture are avoided.

Key Words: suture-button, scapholunate dissociation, carpal instability, arthroscopic dorsal capsulodesis

(*Tech Hand Surg* 2021;00: 000–000)

Scapholunate (SL) instability is the most common form of dissociative carpal instability.[1] If left untreated, it contributes to the development of osteoarthritis, defined as "scapholunate advanced collapse wrist." SL instability can be classified as acute, subacute, or chronic, based on the time elapsed from the injury. Chronic instabilities can be further classified as reducible or nonreducible depending on the persistence of carpal malignment.[2]

Treatment choice in SL injury depends on the extent of the SL ligament tear, chronicity of injury, quality of the ligament remnants, the reducibility of carpal malalignment and cartilage status of the radiocarpal and midcarpal joints.[3] In patients with nonreducible static dissociation or radiocarpal/midcarpal arthritis, treatment options are limited to salvage procedures such as proximal row carpectomy and partial or total arthrodesis. However, the optimal

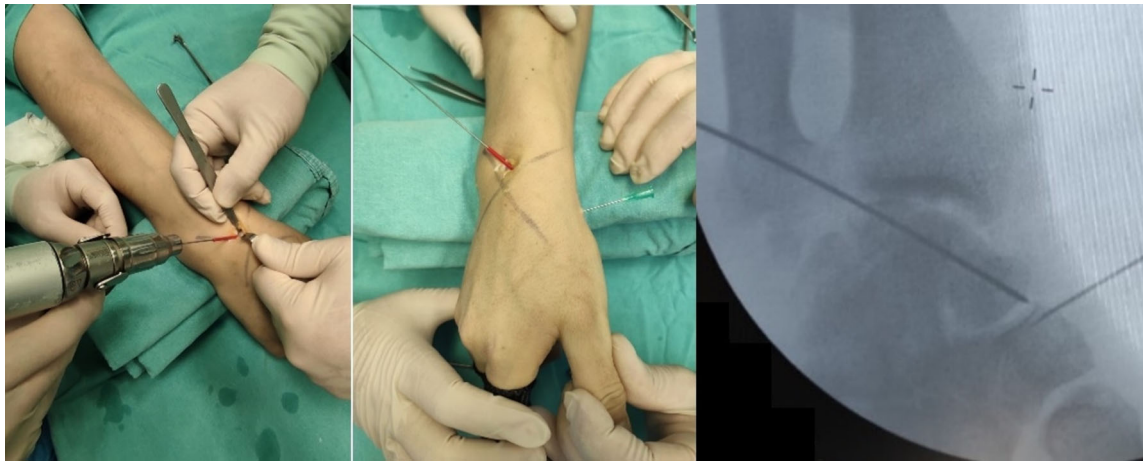

FIGURE 1. The guidewire is directed to the distal scaphoid through the 3-4 portal.

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Conflicts of Interest and Source of Funding: The authors report no conflicts of interest and no source of funding.

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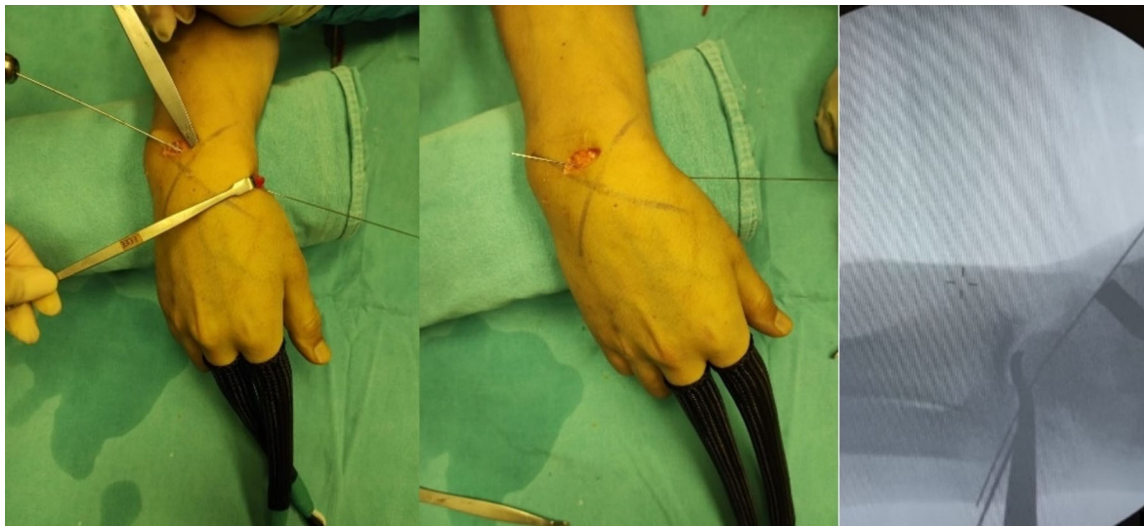

FIGURE 2. The second guidewire of 0.8 mm is introduced in a retrograde fashion through the same hole in the distal scaphoid towards the proximal pole.

treatment would be the reconstruction of the scapholunate interosseous ligament (SLIL), provided that degenerative changes due to chronic reducible dissociation have not yet developed.

Various SL reconstruction techniques using open or arthroscopic approaches have been described previously.[4–26] Tendon reconstructions are the most widely used techniques for chronic SL dissociations.[7–19] Other treatment options include volar/dorsal capsulodesis, SL allografts, bone-tissue-bone composite grafts, reduction and association of the scaphoid and lunate procedure, SL axis method, and the SLIL internal brace technique.[20–26] Although these techniques provide a reliable stabilization, they all have their own disadvantages including joint stiffness, being technically demanding, need for harvesting tendons and large incisions, donor site morbidities, and graft pullout.

We herein would like to present a new technique in the treatment of chronic reducible SL dissociations: Suture-button (SB) fixation and arthroscopic dorsal ligamento-capsulodesis.

ANATOMY

The SL joint is stabilized by intrinsic and extrinsic ligaments. The intrinsic ligament, SLIL, consists of 3 parts; volar, proximal (central), and dorsal.[2] The dorsal part is biomechanically the most important part in scaphoid stability. The extrinsic ligaments (radioscaphocapitate, long and short radiolunate, dorsal radiocarpal, and dorsal intercarpal ligaments) act as secondary stabilizers for SL joint.[2,27,28]

The primary mechanism of SLIL injury is an acute stress load on the wrist in extension, ulnar deviation, and intracarpal supination. The scaphoid extends and supinates, pulled by the trapezium. The lunate, in contrast, stays behind, constrained by the long and short radiolunate ligaments. An increasing SL torque is created, and when this torque reaches a certain level, progressive tearing of SLIL tends to occur. The end stage of injury is a SL dissociation.[29] Secondary stabilizing ligaments must be failing in addition to the SLIL for a complete SL diastasis.

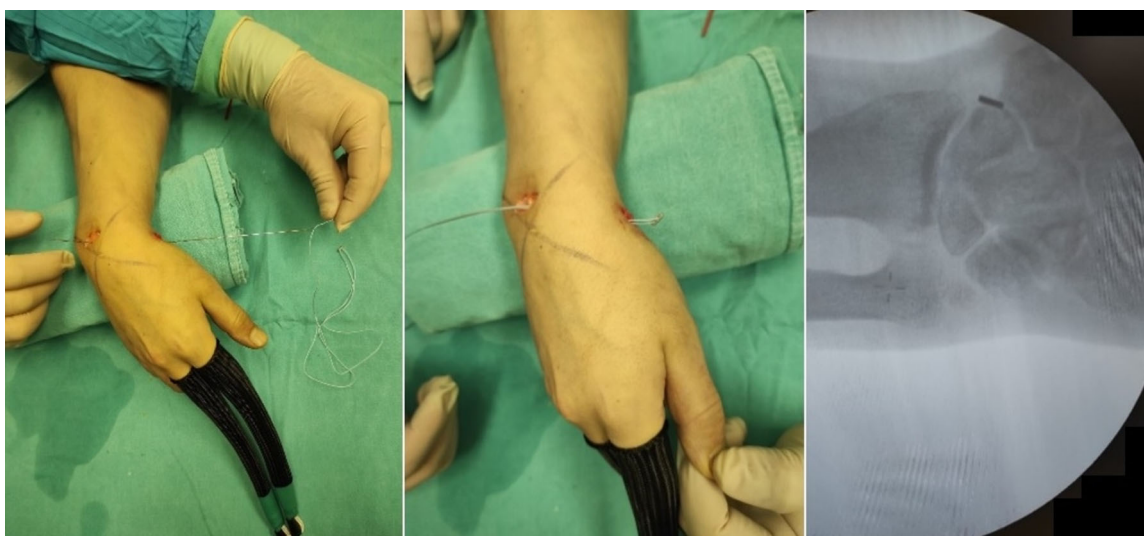

FIGURE 3. The guidewire is then pulled through towards the 3-4 portal, taking the suture-button device through the tunnel along the scaphoid. The first button is anchored on the distal pole of the scaphoid.

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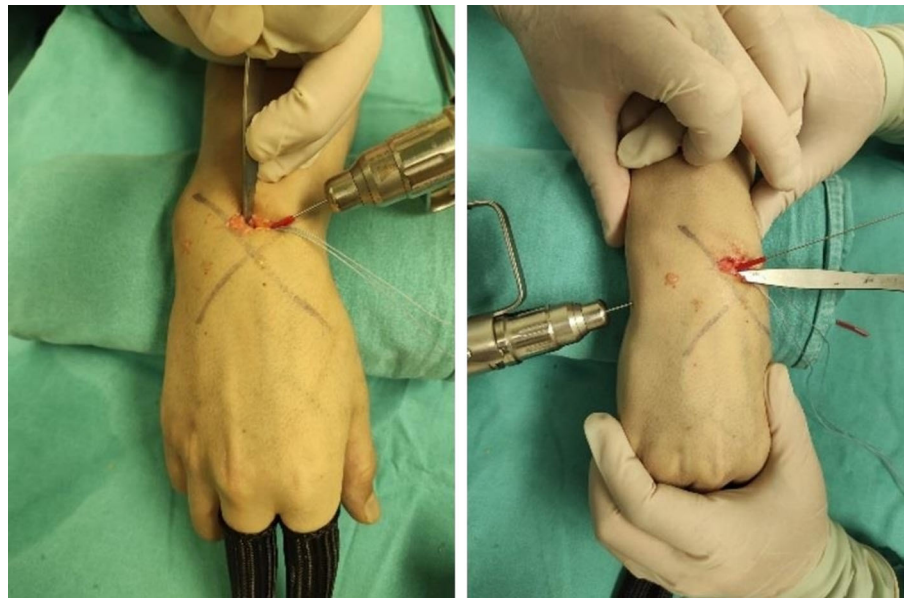

FIGURE 4. The guidewire is reintroduced through the 3-4 portal, from the lunate towards the triquetrum.

INDICATIONS/CONTRAINDICATIONS

The surgical indication for the present technique is a chronic, reducible, Geissler grade 4 SL ligament injury with an accompanying >2 mm SL dissociation.[30] The reducibility can be assessed by performing dynamic maneuvers under fluoroscopy or during arthroscopy, or by taking dynamic radiographic views in ulnar and radial deviations. Also, 4-dimensional kinematic computed tomography assessment can be performed preoperatively to check the reducibility of malaligment and diastasis (Supplemental Video Files: Videos 1, 2, Supplemental Digital Contents 1, http://links.lww.com/BTH/A134, 2, http://links.lww.com/BTH/A135). Before deciding on the treatment, radiocarpal and midcarpal joints are evaluated arthroscopically for any chondral lesions and the SLIL remnants are assessed to determine whether they are suitable for repair. This technique is contraindicated in cases of irreducible carpal malignment or presence of degenerative changes in the midcarpal/radiocarpal joints.

TECHNIQUE

Setup

The patient is positioned in supine position under general or regional anesthesia. The arm is fixed on the table under nonsterile upper arm tourniquet and placed in the traction tower through Chinese finger traps on the index and long fingers.

FIGURE 5. The guidewire is pulled from the ulnar side together with the suture.

FIGURE 6. The second button is anchored on the triquetrum. The suture-button system is tensioned, and reduction is achieved by tensioning the system and checked under fluoroscopy.

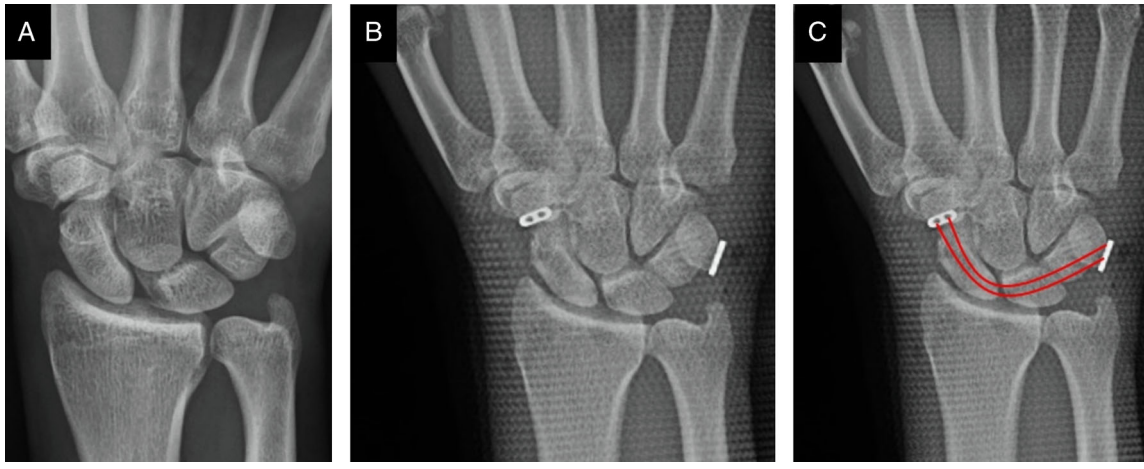

FIGURE 7. A, Preoperative x-ray showing complete scapholunate diastasis. B, Reduction of scapholunate diastasis with the suture-button system. C, Red lines represent the direction of the sutures.

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Exposure and Reconstruction

A diagnostic arthroscopy is performed. We start with the 3-4 portal for visualization, then a second portal, 6R portal, is opened for instrumentation. Careful inspection of the entire radiocarpal joint is performed with visualization of chondral tissue for any signs of arthritis. SLIL is visualized to confirm complete tear and checked to see if the remnants of the ligament are available for repair. The midcarpal portals are used for assessment of the midcarpal joint.

Synovial debridement is performed through the 3-4 portal with a shaver. SL ligament and capsule are also debrided for preparation of arthroscopic dorsal capsulodesis. Next, traction is released and the hand is placed on the operating table. The 3-4 portal incision is extended. Extensor tendons are retracted. Then, the wrist is flexed, and the proximal pole of the scaphoid is seen. We use the second generation SB system (Mini TightRope; Arthrex, Naples, FL). A 1.1 mm guidewire is introduced through the 3-4 portal incision, just distal to the attachment of the SL ligament to the scaphoid in the radiocarpal joint. The proposed exit point of the wire on the scapho-trapeziotrapezoidal joint is determined with a needle under fluoroscopy control (Fig. 1). The guidewire is then directed to the anterolateral aspect of the scaphoid distal pole under fluoroscopic control so that the button does not impinge upon the trapezium (Fig. 1). At this stage, if available, the direction of the guidewire is determined with a jig system.

A small skin incision is made at the level of the volar-radial aspect of scaphotrapeziotrapezoidal joint to allow exit of the guidewire and for passage of the button. The superficial branches of the radial nerve are identified and protected. The 1.1 mm guidewire is moved back and forth several times to determine the exit point. Several back and forth maneuvers make this hole distinct and easily accessible. Soft tissues are debrided to reveal the exit point. Next, a second 0.8 mm guidewire is introduced in a retrograde fashion through the same hole in the distal scaphoid (Fig. 2). The guidewire is then pulled from the 3-4 portal, taking the SB device through the tunnel along the scaphoid (Fig. 3). The first button is anchored on the distal pole of the scaphoid (Fig. 3).

Next, a second guidewire is reintroduced through the dorsal incision, just distal to the lunate attachment of the SL ligament and directed towards the triquetrum. Its position is confirmed under fluoroscopy control (Fig. 4). It is then advanced through the skin on the ulnar side of the triquetrum. A second incision is made at the exit site. The guidewire is pulled from the exit site together with the suture (Fig. 5). The second button is anchored on the triquetrum. The SB system is tensioned; traction is applied by an assistant at this stage. Reduction is achieved by tensioning the system and checked under fluoroscopy after the first knot is tied (Fig. 6). Then, multiple knots are securely tied and suture ends are cut. Tying 7 to 8 knots at this stage will prevent knot loosening. Knots should be buried under soft tissue to prevent irritation. Next, the reduction is checked arthroscopically whether there is any dissociation or step. Finally, arthroscopic dorsal capsuloplasty is performed according to the technique described by Mathoulin et al.[31]

Rehabilitation

Postoperatively, the patient is placed in a short-arm cast, and control wrist radiographs are taken (Fig. 7). The cast is applied for 3 weeks and then replaced by a removable thermoplastic orthosis worn for another 3 weeks. Rehabilitation is initiated under the supervision of a hand therapist at the sixth week. During the postoperative rehabilitation phase, the goal is to maximize the patient's wrist range of motion and functional capacity, including all activities of daily living.[32] The dart-throwing movement should be included in the initial phase of rehabilitation to preserve healing structures in the early phase.[33] Proprioception training is started to maintain wrist neuromuscular control. After the ligament has healed sufficiently, treatment is advanced to strengthen certain muscles with isokinetic, isometric, and eccentric exercises to increase joint stability. Isometric muscle and joint stabilization exercises are initiated (Supplemental Video Files: Videos 3 and 4, Supplemental Digital Contents 3, http://links.lww.com/BTH/A136, 4, http://links.lww.com/BTH/A137).

EXPECTED OUTCOMES

The present study demonstrates a new technique using SB device for reduction and fixation of SL diastasis combined with arthroscopic dorsal ligamento-capsulodesis. The SB system is positioned between the scaphoid and the triquetrum. The direction of the system prevents scaphoid flexion and maintains the continuity of the reduction. By combining arthroscopic dorsal ligamento-capsulodesis technique, the aim is to achieve biological healing during the stabilization process and thus to prevent SB system failures by reducing load transfer to the SB system. The major advantages of this technique over others are straightforward technical application and a shorter operation time without a need for harvesting a tendon graft. The technique is performed through mini-incisions which reduce postoperative recovery time and rehabilitation period and leads to faster restoration of function, overall decreasing the risk of joint stiffness. Furthermore, large bone tunnels which can lead to possible fractures are avoided.

COMPLICATIONS

The suture and buttons may cause irritation to the dorsal sensory branches of radial and ulnar nerves or soft tissues. Incorrect placement of the button in the distal scaphoid may cause pain due to irritation on the trapezium. Chondral damage may occur during arthroscopy. A jig may be used to assist in directing the guidewires. This is more efficient and prevents frequent fluoroscopy use, and avoids chondral damage due to the incorrect axis of the guidewires. Infection, loosening of the system, and loss of reduction could be other possible complications of this procedure.

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