Technical Note

How to Perform a Complete Arthroscopic Assessment of the Scapholunate Joint Complex

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Abstract: Scapholunate instability can result in debilitating pain, dysfunction, and secondary arthritis. Diagnosis is primarily based on a combination of clinical and radiological parameters. However, wrist arthroscopy is regarded as the gold standard for definitive confirmation to identify the extent of a scapholunate instability, with specific attention to the integrity of the extrinsic ligamentous system, which is probably more important than the intrinsic ligament. We discuss how to perform a step-by-step, comprehensive, and complete arthroscopic assessment of the entire scapholunate complex.

Diagnosing instability of the scapholunate joint can be a complex task. It is based on clinical examination and radiological measurements. However, wrist arthroscopy is considered the gold standard for assessing the extent of a scapholunate lesion. With the increased anatomic and biomechanical understanding of the scapholunate complex, the arthroscopic evaluation has dramatically evolved from merely scapholunate probing to detailed testing of all individual ligaments.[1-3] This paper aims to guide surgeons through this step-by-step evaluation process of all components of the scapholunate complex, leading to the subgrading according to the European Wrist Arthroscopy Society (EWAS) classification (Table 1).[4]

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Received April 25, 2024; accepted June 8, 2024.

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2212-6287/24676
https://doi.org/10.1016/j.eats.2024.103174

Surgical Technique

Arthroscopic Setup

The patient is positioned supine with the upper extremity placed on a hand table. The arm is positioned in a traction tower (Conmed, Utica, NY) to allow wrist distraction. Chinese finger straps are applied to the second, third, and fourth fingers, and traction is approximately 7 kg. An equal amount of traction throughout the procedure is important to obtain a reproducible assessment: Too little traction may mimic ligamentous attenuation, and too much traction may cause an attenuated ligament to be tensioned. We prefer the dry arthroscopy technique to prevent capsular and ligamentous swelling. The trocar fluid entry port remains open throughout the procedure to avoid capsular collapse. The 30°, 2.7 × 72-mm arthroscope (Arthrex, Naples, FL) is positioned parallel to the articular surface to maintain correct orientation. The triangle on the arthroscopy screen indicates the direction of the arthroscope and its position is described as the hours on a clock. The 1-2, 3-4, and 6R portals are used for radiocarpal assessment, and the midcarpal radial and ulnar portals (MCR and MCU, respectively) are used for midcarpal assessment.

Arthroscopic Assessment

The following description is for a left wrist (Video 1). The evaluation of the scapholunate complex begins in the radiocarpal joint with the arthroscope in the 3-4 portal. Inflammatory synovitis may accompany the

Table 1. European Wrist Arthroscopy Society Classification

Phase	Stage	Testing	Lesion
Predynamic	I	No passage	
Dynamic	II	Tip probe passage	Volar SLIL
Dynamic	IIIa	Volar widening with probe	Volar SLIL, partial RSCL-LRL
Dynamic	IIIb	Dorsal widening with probe	Dorsal SLIL, partial DICL
Dynamic	IIIc	Complete widening with probe	Volar SLIL, dorsal SLIL and complete DICL or RSCL-LRL
Dynamic	IV	Arthroscope passage	Volar and dorsal SLIL, complete DICL and RSCL-LRL
Static	V	Arthroscope passage with radiographic abnormalities	Volar and dorsal SLIL, complete DICL and RSCL-LRL, and THL/STL/DRCL

DICL, dorsal intercarpal ligament; DRCL, dorsal radiocarpal ligament; LRL, long radiolunate ligament; RSCL, radioscaphocapitate ligament; SLIL, scapholunate interosseous ligament; STL, scaphotrapezial ligament; TH, triquetrohamate ligament.

carpal instability but is not always present (Fig 1). The membranous part of the scapholunate interosseous ligament (SLIL) is visualized at 12 o'clock and can be probed from the 1-2 or 6R portal (Fig 2). A defect or detachment of the SLIL at the scaphoid side can be identified with the probe. A degenerative SLIL may appear as a hanging veil and reduces the suspension of the lunate. Both phenomena hinder access to the radiocarpal joint (Fig 3). The radioscaphocapitate (RSCL) and long radiolunate (LRL) ligaments can be visualized at 10 o'clock, and the integrity can be assessed using the probe in the 1-2 portal (Fig 4). The RSC and LRL ligaments are easily probed at the interval between both ligaments and can be graded according to the Van Overstraeten and Camus extrinsic ligament classification (grades E0-E3).[5] The ligaments may appear attenuated in a low-grade scapholunate instability (E1-2) but can be frayed or torn in a high-grade scapholunate instability (E3) (Figs 4 and 5). The RSCL or Testut ligament can be visualized at 10 o'clock. The short radiolunate ligament can be visualized at 2 o'clock by translating the arthroscope from the scaphoid fossa to the lunate fossa and is often covered by synovium (Fig 6).[5] Volar wrist ganglia occur mainly in the radiocarpal joint. They are due to capsular destruction at the volar insertion of the scapholunate ligament and arise mostly from the interval between RSCL and LRL. Highly lesioned radiolunate ligaments will enhance the lunate extension and cause the lunate to drift ulnarly.[1,3]

The dorso-capsuloligamentous septum (DCSS) is an important stabilizer of the scapholunate joint.[3,6,7] It can be visualized with the arthroscope in either the 1-2 or 6R portal by positioning the arthroscope parallel to the dorsal aspect of the radiocarpal joint after following the dorsal capsule over the SLIL. The DCSS is often covered by synovitis but becomes visible as the dorsal synovitis is shaved from the 3-4 portal. The intact DCSS appears as a septum between the dorsal intercarpal ligament (DICL) and the dorsal side of the scapholunate joint at 12 o'clock and prevents direct access to the midcarpal joint. The integrity of the DCSS can be assessed using the probe (push-up test). If the probe passes into the midcarpal joint, the DCSS is torn (Fig 7).[3,7]

Evaluation of the midcarpal joint starts with the arthroscope in the MCU portal. A high-grade scapholunate instability is characterized by a flexed scaphoid and can impede access through the MCR portal. The volar part of the SLIL and volar extrinsic ligamentous attachments to the scaphoid, lunate, and volar scapholunate joint are visualized at the 2 o'clock position. In acute trauma, the volar ligaments may appear loosened or torn, whereas the dorsal ligaments remain

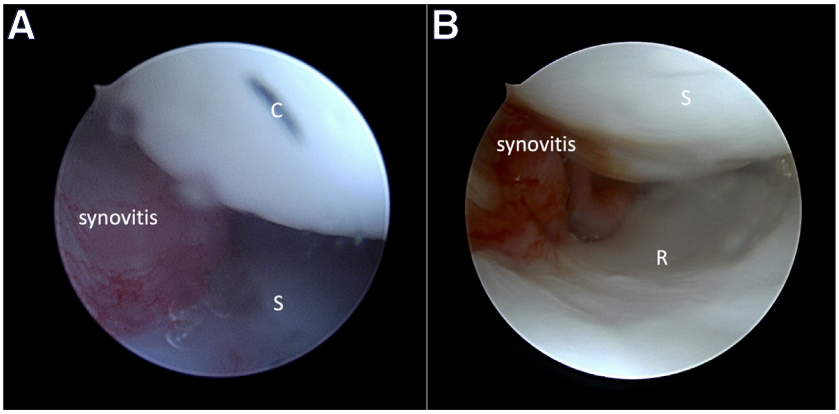

Fig 1. Left wrist, under traction. (A) The presence of dorsal capsular inflammatory synovitis can be visualized in the midcarpal joint from the midcarpal ulnar portal or in the radiocarpal joint from the 6R portal. C, capitate; R, radius; S, scaphoid. (B) Synovitis may point to the localization of the instability.

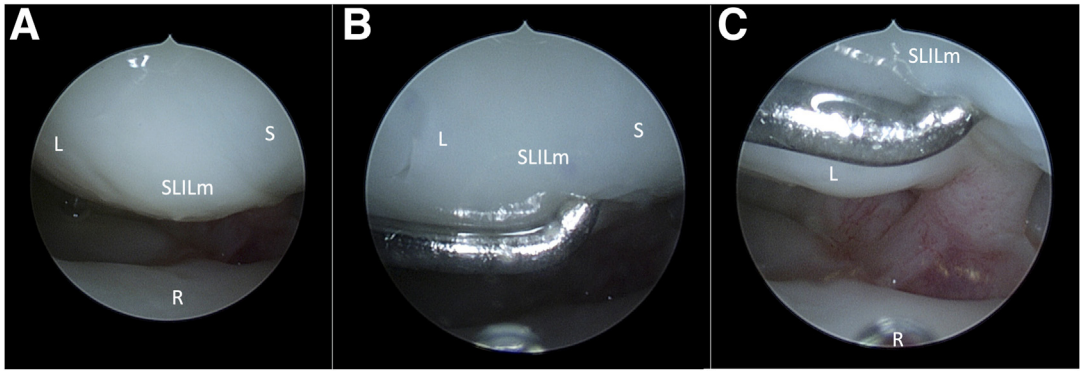

Fig 2. Left wrist, under traction. (A) An intact membranous middle scapholunate interosseous ligament (SLILm) can be visualized from radiocarpal joint from the 3-4 portal. The SLILm and transition to the volar part of the SLIL (SLILv) can be probed with the arthroscope in the 3-4 portal and the probe in the 1-2 portal (B) or the probe in the 6R portal (C). L, lunate; R, radius; S, scaphoid.

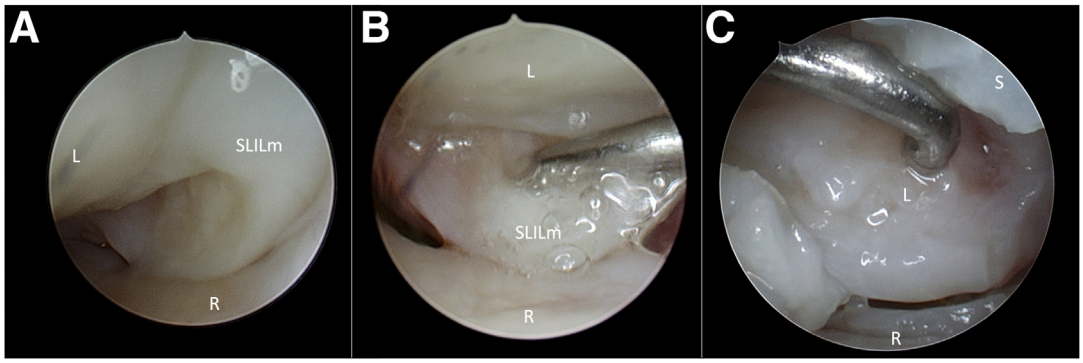

Fig 3. Left wrist, under traction. (A) A large avulsion tear of the membranous middle scapholunate interosseous ligament (SLILm) on the scaphoid side is visualized in the radiocarpal joint from the 3-4 portal. (B) The avulsion tear can be probed from the 6R portal. (C) When the SLIL is highly degenerative as in the case of advanced scapholunate instability, the lunate is no longer suspended. This phenomenon can be visualized from the 1-2 portal. In contrast, visualization of the radioscaphoid joint from the 6R portal may be hindered. L, lunate; R, radius; S, scaphoid.

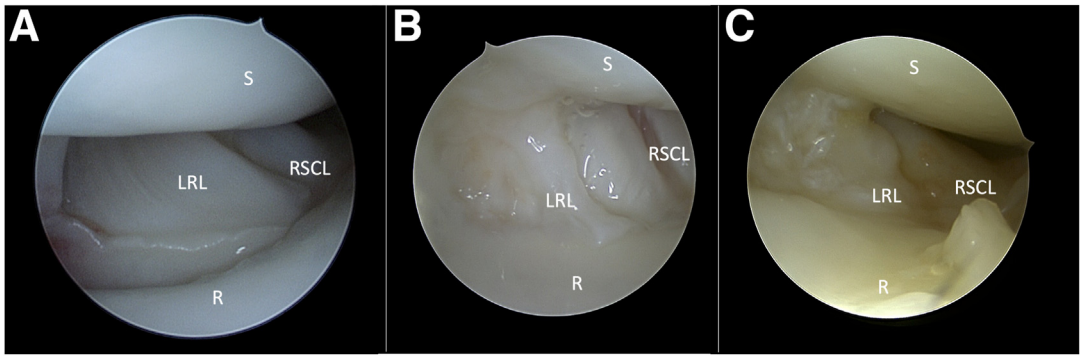

Fig 4. Left wrist, under traction. (A) The radioscaphocapitate ligament (RSCL) and long radiolunate ligament (LRL) can be visualized in the radiocarpal joint from the 3-4 portal. These volar extrinsics are intact when they present as continuous with normal integrity. They are moderately attenuated when they are loosened (B) and highly attenuated when they are frayed or torn (C). R, radius; S, scaphoid.

intact, resulting in a minor scapholunate instability (EWAS stage 2-3A). In chronic setting with a higher grade of scapholunate instability, the volar attachments may not be identifiable (EWAS stage 4-5), and the scaphoid can be separated from the volar capsule without resistance. Volar detachment of the lunate will increase the floating effect of the lunate. The integrity of the DICL insertion to the scaphoid and the DCSS insertion to the dorsal scapholunate joint can be identified at the 9 o'clock position and probed from the

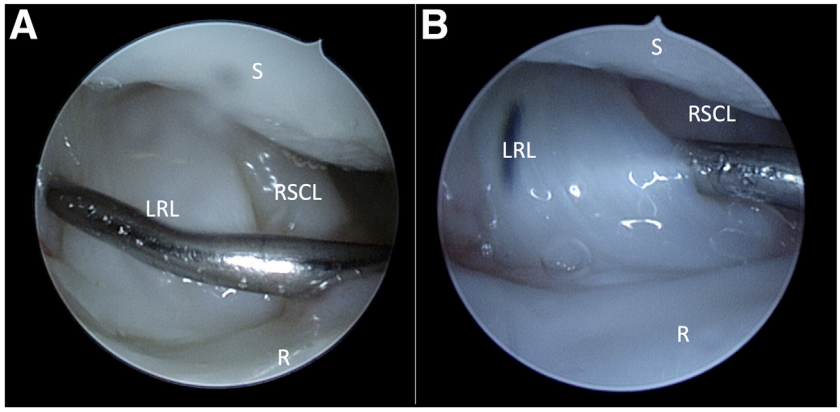

Fig 5. Left wrist, under traction. (A) The radioscaphocapitate ligament (RSCL) and long radiolunate ligament (LRL) can be visualized in the radiocarpal joint from the 3-4 portal. When probing from the 1-2 portal, normal tension corresponds to intact volar extrinsics. (B) If they have a loosened tension when probing from the 1-2 portal, they are moderately attenuated. R, radius; S, scaphoid.

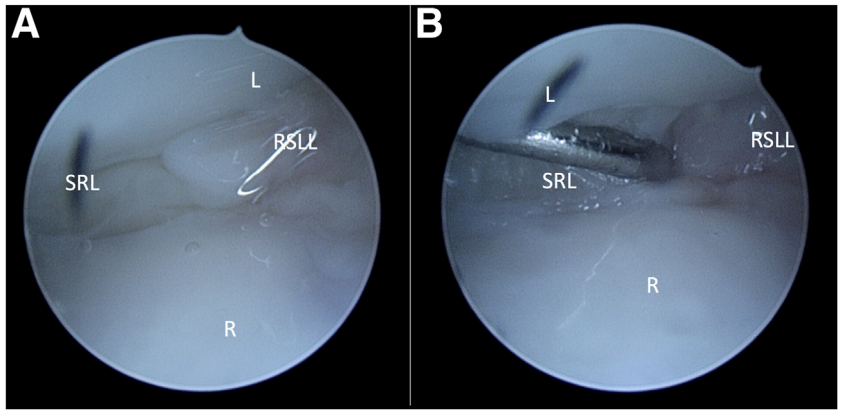

Fig 6. Left wrist, under traction. (A) The short radiolunate ligament (SRL) and radioscapholunate ligament (RSLL) can be visualized in the radiocarpal joint from the 3-4 portal. The SRL is often covered by synovium. (B) After synovial debridement, the SRL can be probed from the 6R portal. L, lunate; R, radius.

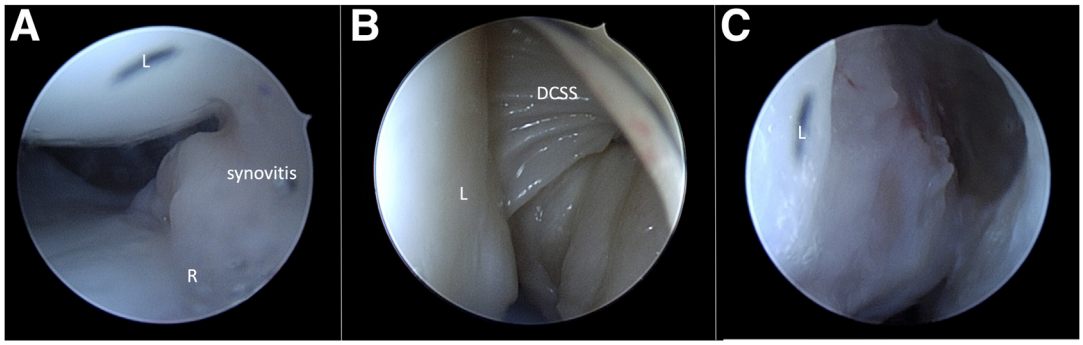

Fig 7. Left wrist, under traction. (A) The dorso-capsuloligamentous scapholunate septum (DCSS) can be visualized in the radiocarpal joint from the 6R portal. It is often covered by synovium. (B) After synovial debridement the septum fibers of the DCSS between the dorsal part of the scapholunate interosseous ligament and the dorsal intercarpal ligament are exposed. (C) These septum fibers are absent when the DCSS is torn, and the arthroscope and probe can pass from the radiocarpal to midcarpal joint. L, lunate; R, radius.

MCR portal (Figs 8 and 9). A limited synovectomy is often necessary to reveal these ligamentous structures. In cases of higher grades of scapholunate instability (EWAS stage 4-5), synovial proliferation may be more abundant, and a fixed scaphoid may be present. The ligamentous insertions can be assessed by pushing the scaphoid away from the dorsal ligaments using the probe (Fig 10). When intact, the scaphoid will be pulled back by the dorsal ligaments or the scaphoid will remain stable when pushing with the probe. In lower grades of scapholunate instability, the DCSS may appear insufficient, but the DICL attachment remains intact (EWAS stage 2-3). However, in higher grades of instability, both the DCSS and the DICL are detached from the scaphoid, resulting in a bare-bone area on the radial edge of the scaphoid (EWAS stage 4-5) (Fig 11).

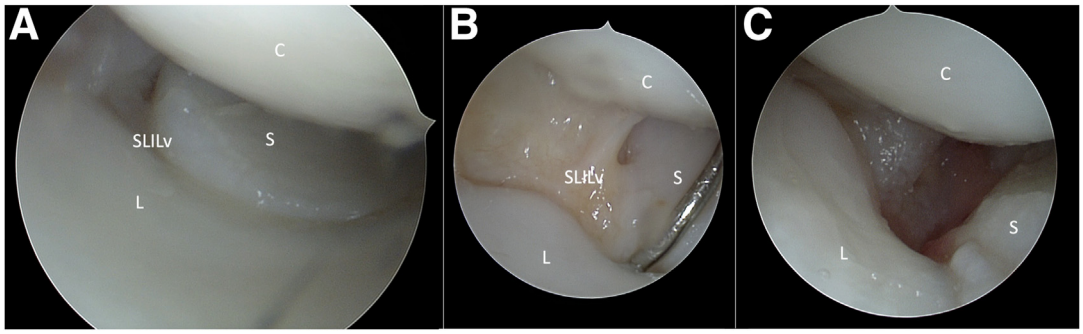

Fig 8. Left wrist, under traction. (A) The volar part of the scapholunate interosseous ligament (SLILv) is visualized in the midcarpal joint view from the midcarpal ulnar portal. (B) This structure is degenerative if it is loosened. (C) In advanced scapholunate instability, the SLILv may be absent. C, capitate; L, lunate; S, scaphoid.

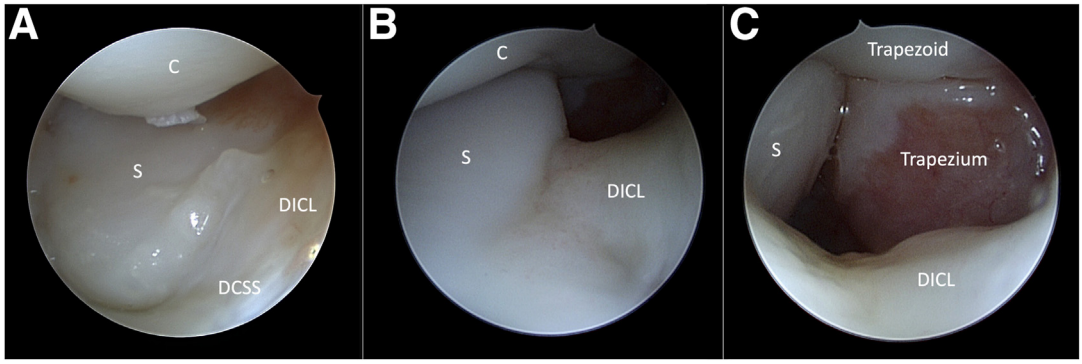

Fig 9. Left wrist, under traction. (A) The dorsoradial aspect of the scaphoid is visualized in the midcarpal joint from the midcarpal ulnar portal. The dorso-capsuloligamentous scapholunate septum (DCSS) and dorsal intercarpal ligament (DICL) attachment on the scaphoid can be assessed. They may be covered with synovium. (B) When following the radial border of the scaphoid with the arthroscope in the midcarpal ulnar portal, the insertion of the dorsal intercarpal ligament (DICL) on the scaphoid can be assessed. (C) When pushing the arthroscope deeper, the scaphotrapezialtrapezoid (STT) joint can also be visualized. C, capitate; S, scaphoid.

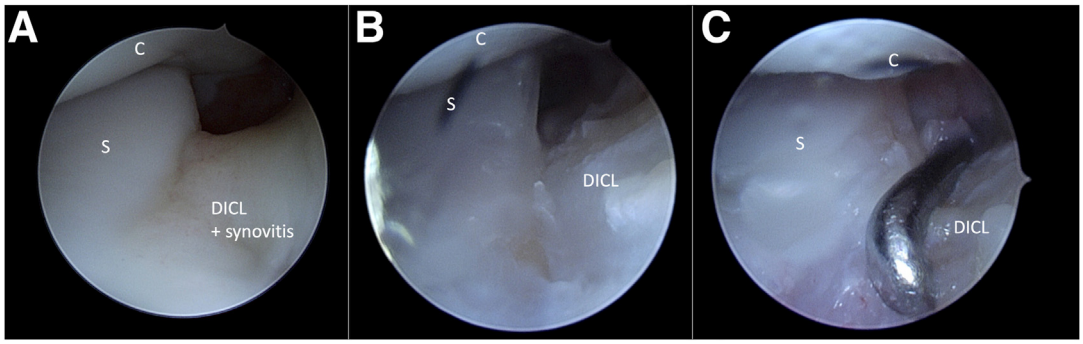

Fig 10. Left wrist, under traction. (A) The dorsal intercarpal ligament (DICL) attachment on the scaphoid in the midcarpal joint can be visualized from the midcarpal ulnar portal. (B) The DICL attachment may be covered with synovium. The integrity of the DICL attachment is exposed after synovial debridement. (C) It can be tested by the "hook-sweep" test, which involves sweeping the dorsal surface of the bony insertion point and hooking the DICL dorsally with a probe. C, capitate; S, scaphoid.

Recently, Merlini et al.[8] published their "hook-sweep" test, indicating an avulsed DICL. This procedure involves sweeping the dorsal surface of the bony insertion point and hooking the DICL dorsally with a probe. If the DICL is intact, it should be impossible to sweep and hook it away from its insertion. This test is also positive in chronically attenuated DICL with poor tissue quality. Sometimes, a bony avulsion accompanies a DICL.[8] A detachment of the DICL induces scaphoid flexion.[1] The scapholunate joint is visualized from 10 to 5 o'clock. The stability of the scapholunate joint should be assessed by probing the joint from the MCR portal. The probe is thus parallel to the scapholunate interval. Once the hook is deeply introduced in the scapholunate

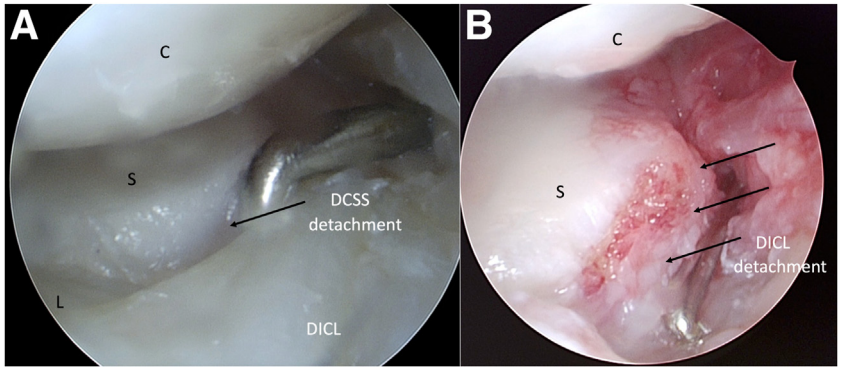

Fig 11. Left wrist, under traction. (A) The dorsoradial aspect of the scaphoid is visualized in the midcarpal joint from the midcarpal ulnar portal. Dorso-capsuloligamentous scapholunate septum (DCSS) detachment from the scaphoid induces scapholunate instability. (B) The instability is increased when the dorsal intercarpal ligament (DICL) is also detached from the scaphoid. C, capitate; L, lunate; S, scaphoid.

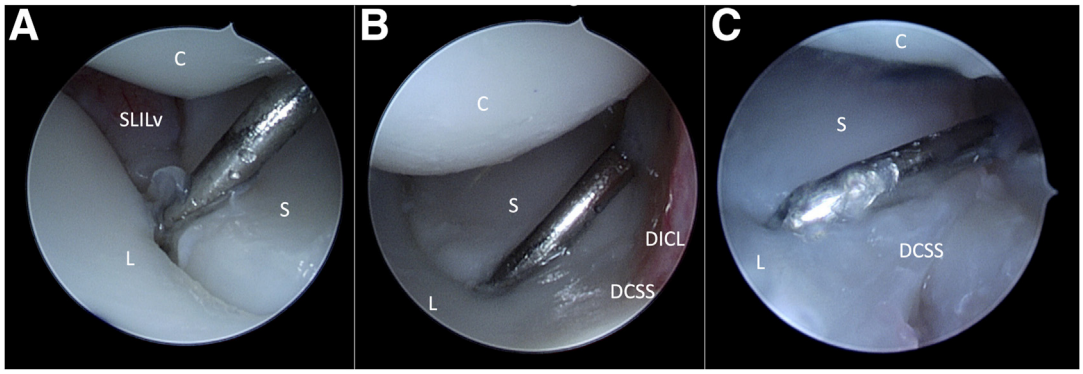

Fig 12. Left wrist, under traction. Systematic scapholunate stability probe testing should be performed on the entire length of the scapholunate joint in the midcarpal joint with arthroscope in the midcarpal ulnar portal and probe in the midcarpal radial portal. The stability is tested on the volar side (A), in the middle (B), and on the dorsal side (C). C, capitate; L, lunate; S, scaphoid.

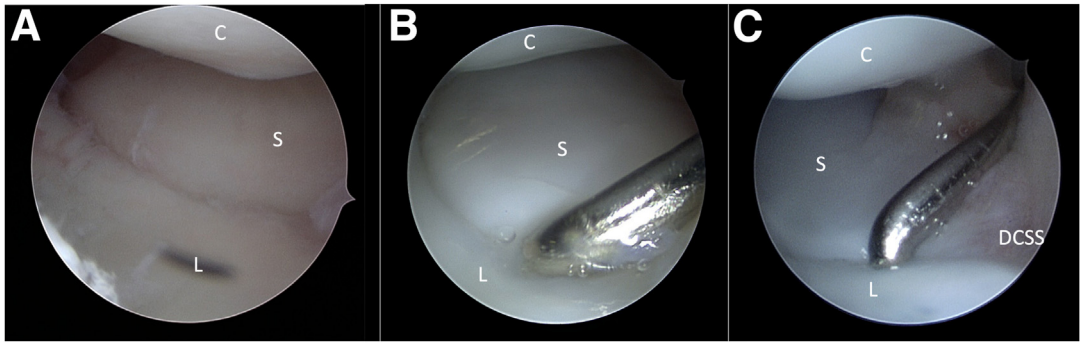

Fig 13. Left wrist, under traction. (A) Scapholunate stability probe testing should be performed in the midcarpal joint with arthroscope in the midcarpal ulnar portal and probe in the midcarpal radial portal. European Wrist Arthroscopy Society stage 1 corresponds to no gap or step-off in the scapholunate joint. The probe tip cannot pass in the middle (B) or on the dorsal side (C). C, capitate; L, lunate; S, scaphoid.

space, a strong and progressive twisting motion is axially applied to the hook. Following the EWAS classification, the testing should be performed on the volar, middle, and dorsal side to differentiate the EWAS stage 3A, 3B, and 3C subtypes (Fig 12). Increased instability probing leads to a higher EWAS stage (Figs 13-16) (Table 1). When present, a dorsal wrist ganglion stalk can be assessed in the midcarpal or radiocarpal joint in the vicinity of the DCSS.[3]

The scaphotrapeziotrapezoid (STT) joint is accessible with the arthroscope in the MCU portal, so the MCR portal can be used as the working portal. The arthroscope is directed to the DCSS area and should then follow the radial border of the scaphoid. Deeper access is possible when a synovectomy is performed. After passing the radial border of the scaphoid, the arthroscope must be rotated to the 2 o'clock position to visualize the STT joint (Fig 9). An additional STT portal

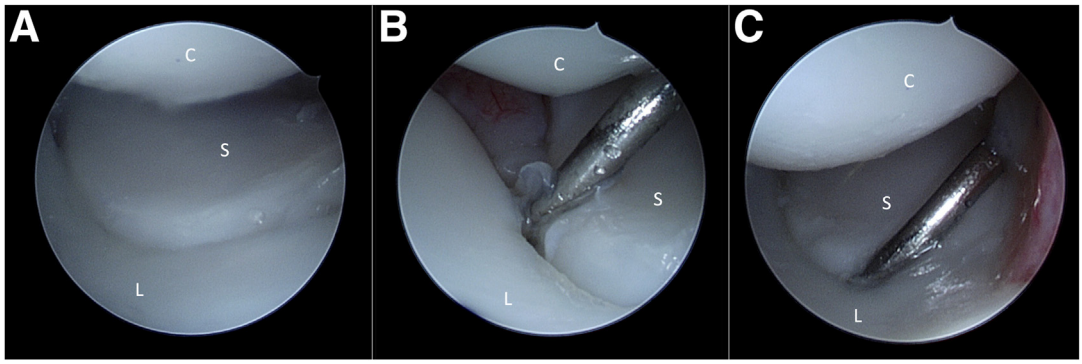

Fig 14. Left wrist, under traction. (A) Scapholunate stability probe testing should be performed in the midcarpal joint with arthroscope in the midcarpal ulnar portal and probe in the midcarpal radial portal. European Wrist Arthroscopy Society stage 2 corresponds to a minor scapholunate gap and step-off. Probe tip passes on the volar side (B) and in the middle of the of the scapholunate joint (C). C, capitate; L, lunate; S, scaphoid.

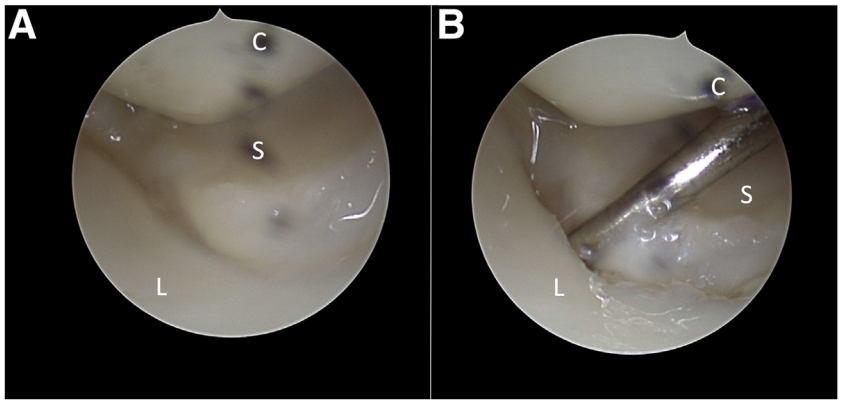

Fig 15. Left wrist, under traction. (A) Scapholunate stability probe testing should be performed in the midcarpal joint with arthroscope in the midcarpal ulnar portal and probe in the midcarpal radial portal. European Wrist Arthroscopy Society stage 3 corresponds to a moderate scapholunate gap and step-off. (B) The probe passes through and can be twisted inside the scapholunate joint. C, capitate; L, lunate; S, scaphoid.

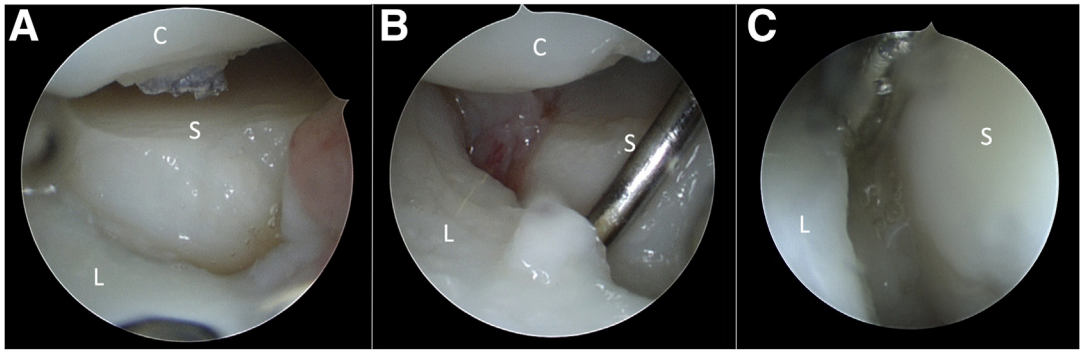

Fig 16. Left wrist, under traction. (A) Scapholunate stability probe testing should be performed in the midcarpal joint with arthroscope in the midcarpal ulnar portal and probe in the midcarpal radial portal. European Wrist Arthroscopy Society stage 4 corresponds to a large gap and step-off. The probe passes easily through the scapholunate joint (B); it also passes through the scapholunate joint (C). C, capitate; L, lunate; S, scaphoid.

may provide a more direct access to the joint to evaluate the volar STT ligaments.[1,9]

By switching the arthroscope to the MCR portal and the probe to the MCU portal, the stability of the lunotriquetral joint can be assessed at 10 o'clock and the insertion of the DICL to the lunate and triquetrum can be assessed at 3 to 5 o'clock (Figs 17 and 18). When both the scapholunate and lunotriquetral joints are highly unstable, the lunate appears to be floating. A characteristic sign of the floating lunate is the rocking

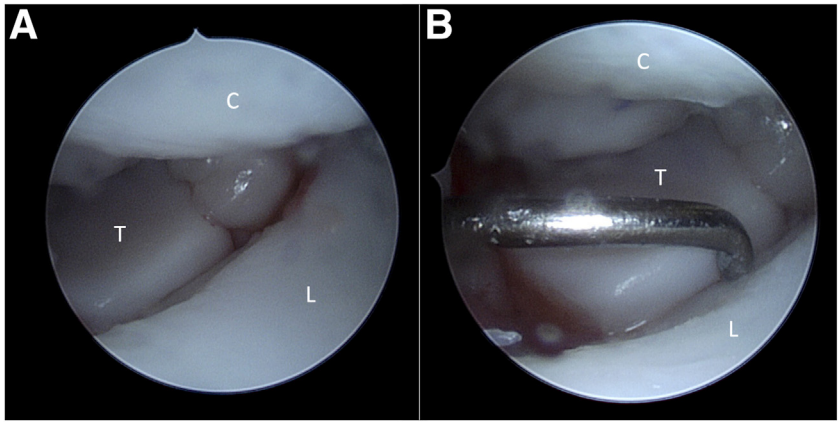

Fig 17. Left wrist, under traction. (A) The lunotriquetral joint is visualized in the midcarpal joint from the midcarpal radial portal. (B) There is no probe tip passage in an intact lunotriquetral joint. C, capitate; L, lunate; T, triquetrum.

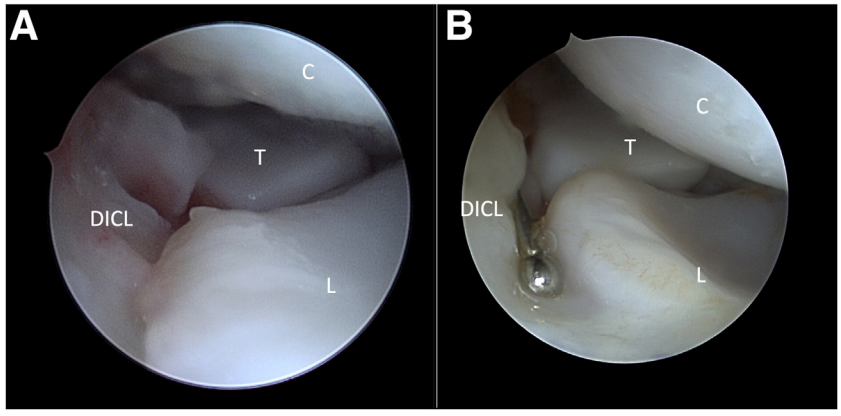

Fig 18. Left wrist, under traction. (A) The dorsal intercarpal ligament (DICL) attachment to the lunate and triquetrum is visualized in the midcarpal joint from the midcarpal radial portal. (B) Probing of the DICL attachment can be performed from the midcarpal ulnar portal. C, capitate; L, lunate; T, triquetrum.

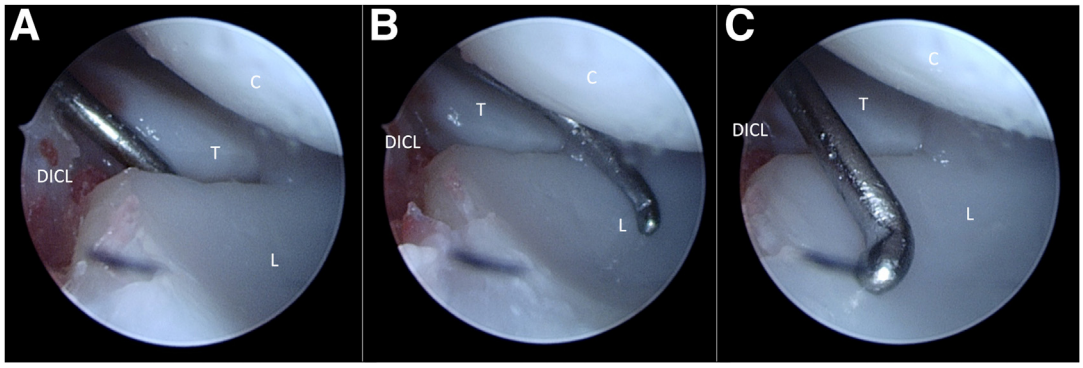

Fig 19. Left wrist, under traction. The lunate becomes highly unstable when scapholunate and lunotriquetral pathology occur together. The instability of scapholunate joint should be diagnosed using the probe in the midcarpal radial portal and the arthroscope in the midcarpal ulnar (MCU) portal. (A) When switching the arthroscope and probe in the portals, instability of the lunotriquetral joint is assessed if there is easy probe passage through the lunotriquetral joint. When pushing the lunate with the probe from the MCU portal in the volar aspect (A) and the dorsal aspect (B) of the lunate, the lunate acts like a rocking chair (rocking-chair sign). This instability of the lunate is referred to as a floating lunate. C, capitate; L, lunate; T, triquetrum.

chair sign, which can be observed with the probe in the MCR portal and the arthroscope in the MCU portal: when pushing the lunate on its dorsal and volar articular surfaces, it will swing like a rocking chair (Fig 19, Video 1).[10] See Table 2 for pearls and pitfalls of this technique.

Table 2. Pearls and Pitfalls

Pearls
• Dry arthroscopy is preferable to reveal the inflammatory synovitis and the actual structure integrity of the ligaments.
• Assessment should be performed in a systematic manner.
• The nick and spread method is used to avoid damage to tendons, the radial artery, the superficial radial nerve around the 1-2 portal, the dorsal cutaneous branch of ulnar nerve, and the extensor digiti minimi tendon around the 6R portal.
• Portals are created under direct vision using a needle, and a blunt trocar is used to avoid damage to the articular cartilage.
• Assessment is performed in the radiocarpal and midcarpal joint.
Pitfalls
• An equal, continuous level of traction is necessary to obtain a reproducible assessment.
• Arthroscope, shaver, and probe should be adapted for wrist arthroscopy.
• The extrinsic ligamentous evaluation is probably of more importance than the intrinsic scapholunate ligament.
• Synovial shaving is often necessary to reveal the actual ligamentous structure.

Discussion

The arthroscopic assessment of the entire scapholunate complex should be performed in an accurate and systematic manner to guide the surgeon in choosing the most appropriate treatment option. Current knowledge suggests that the stability of the scapholunate joint is more related to the integrity of the extrinsic ligaments than intrinsic ligaments.[1,3] Therefore, the importance of assessment of the extrinsic ligamentous attachments to the scapholunate joint exceeds the assessment of the intrinsic scapholunate ligament, which was the main focus in the past. The arthroscopic assessment with EWAS subgrading precedes the surgical repair or reconstruction, which could be tailored to the assessed EWAS subtype.

Disclosures

The authors (C.K.G., K.V.R., T.S., J.D., C.M.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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