Arthroscopic Dorsal Capsuloplasty in Scapholunate Tears EWAS 3: Preliminary Results after a Minimum Follow-up of 1 Year
Benjamin Degeorge, Rémy Coulomb, Pascal Kouyoumdjian, Olivier Mares

To cite this version:

Benjamin Degeorge, Rémy Coulomb, Pascal Kouyoumdjian, Olivier Mares. Arthroscopic Dorsal Capsuloplasty in Scapholunate Tears EWAS 3: Preliminary Results after a Minimum Follow-up of 1 Year. Journal of Wrist Surgery, Thieme, 2018, 07 (04), pp.324-330. 10.1055/s-0038-1660446. hal-02142585

HAL Id: hal-02142585
https://hal.archives-ouvertes.fr/hal-02142585
Submitted on 28 May 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
Arthroscopic Dorsal Capsuloplasty in Scapholunate Tears EWAS 3: Preliminary Results after a Minimum Follow-up of 1 Year

Benjamin Degeorge, MD1  Rémy Coulomb, MD, MSc1  Pascal Kouyoumdjian, MD, PhD1  Olivier Mares, MD1

1Département de Chirurgie Orthopédique et Traumatologique, Chirurgie du Rachis, CHU Carémeau, Nîmes, France

Address for correspondence Benjamin Degeorge, MD, Département de Chirurgie Orthopédique et Traumatologique, Chirurgie du Rachis, CHU Carémeau, Place du Pr. Robert Debré, 30029 Nîmes, France (e-mail: degeorge.benjamin@gmail.com).

Abstract

Purpose  We retrospectively evaluated the results of all arthroscopic dorsal scapho-lunate (SL) capsuloplasty without pinning in patients presenting predynamic instability and dorsal capsuloscapholunate septum lesions on arthro-computed tomography scan after failed medical treatment.

Materials and Methods  Fifteen patients, mean age 34.3 years, underwent all arthroscopically assisted dorsal capsuloplasty. Patients were assessed preoperatively and postoperatively by a clinical (pain, Watson’s test, range of motion, and strength), functional (quick disabilities of the arm, shoulder, and hand), patient-rated wrist evaluation, and Mayo wrist score scores), and radiological (SL gap and dorsal inter-caped segmental instability [DISI]) examination. SL tears were evaluated during surgery by European Wrist Arthroscopy Society (EWAS) classification.

Results  The mean follow-up period was 20.2 months (range, 12–41). Preoperatively, positive Watson’s test was noted in all cases. DISI deformity was noted in three cases without any SL gap. The SL instability was graded EWAS IIIB (n = 8) or EWAS IIIC (n = 7). Postoperatively, positive Watson’s test was noted in only one case. Activity pain decreased from 7.8 preoperatively to 2.4 postoperatively. Range of motion in flexion-extension increased from 92.9 degrees preoperatively to 126.2 degrees post-operatively. Grip strength increased from 24.2 preoperatively to 38.2 postoperatively. At final follow-up, range of motion in flexion-extension and grip strength were estimated at 87 and 91% compared with contralateral side, respectively. All functional scores were significantly improved at the last follow-up. No radiographic SL gapping in grip views or DISI deformity was noted.

Discussion  Cadaveric studies demonstrated that the dorsal portion of SL ligament is critical for the stability of the SL complex. The entire arthroscopic SL capsuloplasty technique provides reliable results for pain relief, avoiding postoperative stiffness associated with open procedures. It is an alternative technique for patients with predynamic SL instability after failure of medical management and shall not prelude the resort to any further open procedure.

Level of Evidence  This is a level IV, case series.

Keywords
► scapholunate ligament
► dorsal capsuloplasty
► dorsal capsulodesis
► wrist arthroscopy
Lesions of the scapholunate (SL) complex are the most common causes of intracarpal instability.\(^1\) They induce rotational instability of the scaphoid and a dorsal intercalated segmental instability (DISI) of the lunate, eventually leading to SL advance collapse arthritis.\(^2,3\)

The dynamic stability of the SL complex is ensured mainly by the SL interosseous ligament (SLIL) along with extrinsic stabilizers.\(^4-6\) Recent cadaveric studies have demonstrated the mechanical importance of the dorsal portion of SLIL and the dorsal capsuloscapholunate septum (DCSS), connecting the SLIL to the dorsal capsule.\(^7-9\)

Arthroscopic dorsal SL capsuloplasty\(^10\) is a new, minimally invasive technique allowing the stabilization of the SL complex and pain relief in lower grade SL lesions.\(^10-13\)

The main objective of this study was to analyze preliminary results of SL dorsal capsuloplasty under arthroscopic control in cases of predynamic instabilities\(^14\) in patients with painful SL projection resistant to medical treatment after a minimum follow-up of 1 year.

**Materials and Methods**

**Study Outline**

Fifteen patients (9 men and 6 women), operated by a single trained senior operator between December 2013 and October 2015 for arthroscopic dorsal SL capsuloplasty, were reviewed.

Patients mean age was 34.3 years (range, 19–51). All patients had a wrist trauma during the months prior to the surgical intervention. The reparation of traumas was as follows: sport accident in nine cases (60%), road traffic accident in three cases (20%), and accident at work in three cases (20%). The average time between trauma and surgery was 9 months (2–20). Dominant side was involved in 11 patients (73%).

**Table 1** Arthroscopic EWAS classification and corresponding AP findings in cadaver specimens\(^9\)

<table>
<thead>
<tr>
<th>Arthroscopic stage (EWAS)</th>
<th>Arthroscopic testing of SLIOL from MC joint</th>
<th>AP findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No passage of the probe</td>
<td></td>
</tr>
<tr>
<td>II: lesion of membranous SLIOL</td>
<td>Passage of the tip of the probe in the SL space without widening (stable)</td>
<td>Lesion of proximal/membranous part of SLIOL</td>
</tr>
<tr>
<td>IIIA: partial lesion involving the volar SLIOL</td>
<td>Volar widening on dynamic testing from MC joint (anterior laxity)</td>
<td>Lesion of anterior and proximal part of SLIOL with or without lesion of RSC-LRL</td>
</tr>
<tr>
<td>IIIIB: partial lesion involving the dorsal SLIOL</td>
<td>Dorsal SL widening on dynamic testing (posterior laxity)</td>
<td>Lesion of proximal and posterior part of SLIOL with partial lesion of DIC</td>
</tr>
<tr>
<td>IIIC: complete SLIOL tear, joint is reducible</td>
<td>Complete widening of SL space on dynamic testing, reducible with removal of probe</td>
<td>Complete lesion of SLIOL (anterior, proximal, and posterior), complete lesion of one extrinsic ligament (DIC lesion or RSC/LRL)</td>
</tr>
<tr>
<td>IV: complete SLIOL with SL gap</td>
<td>SL gap with passage of the arthroscope from MC to RC joint. No radiographics abnormalities such as increased SL gap, DISI deformity</td>
<td>Complete lesion of SLIOL (anterior, proximal, and posterior), lesion of extrinsic ligaments (DIC and RSC/LRL)</td>
</tr>
<tr>
<td>V</td>
<td>Wide SL gap with passage of the arthroscope through SL joint. Frequent X ray abnormalities</td>
<td>Complete lesion of SLIOL, DIC, LRL, RSC, involvement of one or more ligament (TH, ST, and DRC)</td>
</tr>
</tbody>
</table>

Abbreviations: AP, anatomopathological; DIC, dorsal intercarpal ligament; DISI, dorsal intercalated segmental instability; DRC, dorsoradiocarpal; EWAS, European Wrist Arthroscopy Society; MC, midcarpal; RC, radiocarpal; RCS, radioscapohamate; RLR, long radiolunate; SL, scapholunate; SLIOL, scapholunate interosseous ligament; ST, scaphotrapezial; TH, triquetromhamate.
into the open part of the capsule. Two PDS 3/0 suture threads were introduced in the needles and pulled out through the MCR portal using forceps. The two suture threads were then knotted together. The knot was reintroduced into the midcarpal joint through the MCR portal under visual control from MCU portal. After releasing the traction, a second knot is then tied between the two proximal suture threads into the 3/4 portal performing the capsuloligamentous suture. A final arthroscopic control was performed to test the SL interval in the midcarpal joint. No SL or scaphocapitate pinning was performed.

**Postoperative Protocol**

A strict immobilization of the wrist using removable splint was prescribed for 21 days. Soft physiotherapy aimed at muscular reinforcement insisting on radial muscles, insisting on the flexor carpi radialis (FCR) and extensor carpi radialis longus (ECRL).15,16 was performed after the immobilization phase. Return to sports was authorized 3 months after surgery.

**Clinical Assessment**

Pre- and postoperative data were collected. Rest and activity pain were evaluated by the visual analog scale (VAS). Subjective and objective SL shifts using Watson's test17 were searched. Range of motion (in degrees) for wrist flexion, extension, radial, and ulnar deviation was measured. Grip strength (in kg/F) using a Jamar hand dynamometer (Kit Baseline, Arex, Palaiseau, France) was measured.

Evaluation of functional outcomes was undertaken with the patient-rated wrist evaluation,18 quick disabilities of the arm, shoulder, and hand,19 and Mayo wrist score20 standardized questionnaires.

At last follow-up, patients were asked to evaluate their general satisfaction regarding the surgical procedure by a five-level scale: “unsatisfied,” “somewhat satisfied,” “moderately satisfied,” “satisfied,” and “very satisfied.”

**Radiographic Assessment**

Anteroposterior and strict lateral X-rays of the wrist and clenched fist21 were performed pre- and postoperatively to detect a SL gap over 3 mm22 and a DISI of the lunate, defined as an SL angle superior or equal to 70 degrees.23

**Statistical Analysis**

Statistical evaluations were performed using the SPSS software (IBM, Armonk, North Castle, NY). We applied Student's t test for data of paired group to compare continuous variables, and Fisher's exact test for comparison of nominal variables. Statistical significance threshold was set at p < 0.05.

**Results**

**Preoperative Arthroscopic Staging**

On dynamic testing, dorsal SL widening was described in eight patients (53%) and complete SL widening was described in seven patients (47%). According to EWAS staging system, eight patients were classified at stage IIIB and seven at stage IIIC (Table 1).

<table>
<thead>
<tr>
<th>Pain</th>
<th>Preoperative scores</th>
<th>Postoperative scores</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest pain</td>
<td>5.8 (2–8)</td>
<td>0.9 (0–5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Activity pain</td>
<td>7.8 (5–10)</td>
<td>2.4 (0–6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Range of motion</td>
<td>Flexion</td>
<td>47.5 (30–60)</td>
<td>62.9 (4–75)</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
<td>45.4 (30–60)</td>
<td>63.3 (30–75)</td>
</tr>
<tr>
<td></td>
<td>Radial deviation</td>
<td>18.3 (5–30)</td>
<td>22.9 (10–30)</td>
</tr>
<tr>
<td></td>
<td>Ulnar deviation</td>
<td>27.9 (20–40)</td>
<td>39.6 (20–55)</td>
</tr>
</tbody>
</table>

**Clinical Evaluation**

The mean follow-up was 20.2 months (range, 12–41). Preoperatively, all patients presented a painful SL shift and a positive Watson's test. At follow-up, one patient presented a painless SL shift with a positive Watson's test (67%) (p < 0.001) (Table 2).

Pain was significantly improved (p < 0.001) with a mean decrease of 4.9 (range, 2–8) and 5.3 (range, 2–9) points on VAS at rest and activity, respectively.

Postoperative mean ranges of motion were 125 degrees (range, 70–140) in flexion–extension motion, and 61 degrees (range, 30–85) in radio–ulnar deviation. Postoperative ranges of motion and grip strength were significantly improved compared with preoperative values (p < 0.001) (Fig. 1). At last follow-up, ranges of motion in flexion–extension and in radio–ulnar deviation were evaluated at, respectively, 87 and 89% compared with the contralateral side (Fig. 2). Grip strength was evaluated at 91% compared with the contralateral side.

All functional scores were significantly improved in postoperative time (p < 0.001) (Table 3). Eleven patients (73%) were very satisfied with the surgical procedure. All patients were either satisfied or very satisfied with the surgical procedure.

**Radiographic Assessment**

Preoperatively, no patients presented a SL gap >3 mm on clenched fist X-rays. Three patients (20%) presented a DISI of the lunate with a mean SL angle of 55 degrees (range, 40–75). At the follow-up, neither SL gap nor DISI was noted. The mean SL angle was 49 degrees (range, 40–60) with a mean decrease of 6.6 degrees (range, 0–15) (p = 0.03).

**Complications**

Two patients (13%) developed a type 1 complex regional pain syndrome. They were treated for an accident at work.


**Discussion**

Tears of the SL complex involve changes in the normal intracarpal kinetics. Iterative movements of the wrist implicate acute flexion of the scaphoid with posterior rotational subluxation of its proximal pole and extension of the lunate leading to DISI under the traction of lunotriquetral fibers. Those iterative pathological displacements are, as demonstrated by Watson et al, responsible for styloscaphoid arthrosis primarily followed then by radiocarpal and intracarpal arthrosis. Thus, treatment for the initial SL tear appears essential to avoid this arthritic progression.

**Two Types of Stabilizers Compose the Scapholunate Complex**

An intrinsic stabilizer: The SLIL is composed of three portions: palmar, proximal, and dorsal. Cadaveric studies report that the dorsal portion is the most important in terms of biomechanics. Its integrity is critical and its lesion necessary though insufficient to induce a SL instability. Salva-Coll et al found that proprioceptive innervation of the SLIL represents a protective factor against the degenerative process of arthrosis. According to the authors, proprioception resulting from this innervation would prevent excessive intracarpal mobility, hence decreasing the occurrence of cartilage degradation.

---

**Fig. 1** Comparisons of pre- and postoperative ranges of motion and grip strength. Range of motion values correspond to the sum of active radiocarpal motion in flexion–extension and radio–ulnar deviation. All postoperative ranges of motion are significantly increased compared with preoperative data.

**Fig. 2** Comparisons of postoperative ranges of motion and grip strength with the healthy contralateral side. Ranges of motions correspond to the sum of active radiocarpal motion in flexion–extension and radio–ulnar inclination.
Table 3 Mean preoperative and postoperative functional scores with range and significance level (p)

<table>
<thead>
<tr>
<th></th>
<th>Preoperative scores</th>
<th>Postoperative scores</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRWE</td>
<td>38.2 (20–65)</td>
<td>11.2 (0–28)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>QuickDASH</td>
<td>40.5 (20.4–61.4)</td>
<td>15.2 (0–59)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MWS</td>
<td>60.4 (25–75)</td>
<td>93 (80–100)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Abbreviations: MWS, Mayo wrist score; PRWE, patient-rated wrist evaluation; QuickDASH, quick disabilities of the arm, shoulder, and hand.

Three extrinsic or secondary stabilizers:4–6 The radioscapophocapitate ligament (palmar bolt), the scaphotrapeziotrapezoid ligament complex (distal bolt), and the dorsal intercarpal ligament (dorsal bolt) linked to the SL ligament by the DCSS.6

Moreover, for Salvà-Coll et al, the FCR tendon represents a dynamic stabilizer of the SL complex.15 Its action is close to the scaphotrapeziotrapezoid ligament complex and it resists the scaphoid from rotating into flexion and pronation.

In a cadaveric study, Elsaidi et al16 and Overstraeten et al31 found that the DCSS appeared to be the main stabilizer of the SL complex through its posterior capsular restraints. Mitsuyasu et al reached the same conclusions by insisting on the major role of the intercarpal dorsal ligament.7

In case of tears in the SL complex, the joint repair of DCSS and the dorsal portion of the SL ligament thus appear essential when considering its mechanical and proprioceptive functions.9,30 Specific strengthening program for the radial muscles, FCR and ECRL, is also recommended, regarding their actions on dynamic stabilization of the SL complex.15,16,30

Van Overstraeten and Camus32 and Messina et al19 consider that the genesis of SL instability would then be an association of one lesion of the interosseous SL ligament and at least one extrinsic ligament, they insist on preoperative testing of each.32,33 According to Short et al, the development of intracarpal instability following a section of the interosseous SL ligament is secondary to the deficiency of the extrinsic stabilizers.4–6

Arthroscopic dorsal SL capsuloplasty is a single, minimally invasive procedure involving few complications and providing encouraging results in terms of pain relief, mobility, and wrist strength.10–13 It also does not preclude the use of a more radical, secondary surgery. From our point of view, it is conceived only for early lesions of the SLIL without or with minimal lesions of the extrinsic stabilizers: stage 2 (even 3) of the Garcia-Elias et al’s classification (Table 4),34 or stages IIIB and IIIC of the EWAS (Table 1).9 According to Garcia-Elias et al, stage 2 defines a complete lesion of the SL ligament without intracarpal destabilization corresponding to the predynamic instability described by Watson et al.14,15 Stage 3 includes the dynamic intracarpal destabilization with SL gap. According to EWAS, stages IIIB and C represent a subdivision of stage 2 of Garcia-Elias et al with only dorsal or complete lesion of the SLIL, respectively.

From our point of view, a single arthroscopic dorsal SL capsuloplasty appears mechanically too weak to prevent a true dynamic instability (stage 3 of Garcia-Elias et al). The aim of the procedure is to obtain a SL arthrofibrosis allowing a stabilization of the proximal pole of the scaphoid, as well as healing of the associated extrinsic ligamentous lesions. Nevertheless, Mathoulin et al highlighted a posterior capsular thickening during magnetic resonance imaging, 12 months after a dorsal arthroscopic capsuloplasty, corresponding to the scarring of the DCSS.10 Restoration of this anatomic crossroad would allow the stabilization of the SL complex in cases of more evolved instabilities (dynamic or static). According to series, indications for arthroscopic dorsal capsuloplasty were represented by gradual lesions EWAS II or III,12 or Garcia-Elias et al 2,3, or 4,10,11,13 According to the original cadaveric study, these correspond to lesions of the intrinsic ligament involving a lesion of a single extrinsic stabilizer for EWAS stage IIIIC.9 Stages 3 and 4 of Garcia-Elias et al were fixed with SL and scaphocapitate pinning to maintain reduction during scarring of the procedure.

Arthroscopic dorsal SL capsuloplasty is not expected to substitute to open surgical procedures in the treatment of static SL instabilities.10 Open capsulodesis, ligamentoplasty, or partial arthrodesis is still gold standard in stages 3 to 5 of Garcia-Elias et al, corresponding to lesions EWAS IV or V and characterizing a dynamic or static SL instability.14 There are then, important associated lesions of the extrinsic stabilizers of the SL complex which are beyond, in our opinion, the arthroscopic treatment.9 Thus, comparison between the two types of open and arthroscopic procedures is not feasible because of the differences between the two treated lesions.

Several authors have studied arthroscopic dorsal SL capsuloplasty in the context of SL instability.10–13 These authors

Table 4 Staging of SLD by Garcia-Elias et al34

<table>
<thead>
<tr>
<th>SLD stage</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there a partial rupture with a normal dorsal SL ligament?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>If ruptured, can the dorsal SL ligament be repaired?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Is the scaphoid normally aligned (radioscaphoid angle ≤45 deg)?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Is the carpal malalignment easily reducible?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Are the cartilages at both RC and MC joints normal?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Abbreviations: MD, midcarpal; RC, radiocarpal; SL, scapholunate; SLD, scapholunate dissociation.
Arthroscopic dorsal SL capsuloplasty provides encouraging results, both clinically and functionally in cases of SL tears. Its benefits include pain relief, improved wrist range of motion, and grip strength, with excellent postoperative clinical improvement. This is likely due to the resection of inflammatory synovitis and denervation of the wrist. Both series found significant clinical improvement after arthroscopic debridement for SL tears. However, repairing the SL joint could induce secondary instabilities, which may be avoided by addressing extrinsic stabilizers. Only a comparative study between arthroscopic dorsal capsuloplasty and arthroscopic debridement would clarify the beneficial effect of capsuloplasty on pain relief and overall stability. It is wise to evaluate the mechanical capacities of arthrofibrosis created by dorsal capsuloplasty.

No biomechanical study has been conducted to demonstrate the stabilizing effect of arthroscopic dorsal capsuloplasty. Does DCSS suture allow for the restoration of normal persistent motion? The difficulty of such study lies in the fact that capsulodesis and arthrofibrosis require scarring phenomena, which is impossible to study during cadaveric studies. Nonetheless, postoperative disappearing of SL symptoms leads us to think that dorsal SL capsuloplasty is effective.

We described two cases of complex regional pain syndrome found in our series. Despite the psychological aspect of the accident at work, it remains possible that a lesion of the posterior interosseous nerve during the procedure could lead to a complex regional pain syndrome. No studies include sufficient long-term postoperative checks. We must test rotational stagger of the scaphoid as well as posterior damages of radioscaphoid cartilage, both indicators of failure of the procedure. Long-term monitoring is crucial to avoid these signs of instability and prevent arthritis, by using a more radical stabilizing technique on the SL complex.

### Conclusion

Arthroscopic dorsal SL capsuloplasty provides encouraging results, both clinically and functionally in cases of SL tears. It leads us to think that dorsal SL capsuloplasty is effective. The difficulty of such study lies in the fact that capsulodesis and arthrofibrosis require scarring phenomena, which is impossible to achieve during cadaveric studies. Nonetheless, postoperative disappearing of SL symptoms leads us to think that dorsal SL capsuloplasty is effective. We described two cases of complex regional pain syndrome found in our series. Despite the psychological aspect of the accident at work, it remains possible that a lesion of the posterior interosseous nerve during the procedure could lead to a complex regional pain syndrome. No studies include sufficient long-term postoperative checks.
EWAS 3. It is a single, minimally invasive procedure with low rate of complications and excellent results regarding to pain relief, range of motion, and grip strength.

It must be performed in the strict context of predynamic instability mainly corresponding to SL intrinsic ligaments tears, always after failed medical treatment.

This procedure does not offer a replacement for open surgery procedures and allows for a subsequent more radical surgery, if needed.

Funding
None.

Conflict of Interest
None.

References