

# Complex transradial carpal dislocation in a Professional Pianist: Case Report

*Alessio Pedrazzini, Marco Paterlini, Massimo Pompili, Silvio Tocco, Francesco Ceccarelli*

Orthopaedic Clinic – University of Parma – Via Gramsci 14, 43100 Parma - Italy. <sup>1</sup>Italian Association of Hand Therapists (A.I.R.M.), University Modena and Reggio Emilia

**Abstract.** Carpal fracture-dislocation associated to distal radius fractures is an uncommon injury of the wrist. Clinical assessment, instrumental diagnosis and treatment are all challenges for the surgeon. In addition, the prognosis in high-functioning patients is nearly always poor. The authors describe an early diagnosis of scapholunate dissociation and joint capsule tear associated with radial styloid and triquetral fractures in a 39-year-old professional piano player. A dorsal approach was used to reduce and fixate the fracture with k-wires, and to repair soft-tissue injuries with a Titanium micro-anchor. Early controlled mobilization was prescribed post-operatively. No other similar investigations were found because of the various associated fractures in the current case study, which normally excludes subjects from retrospective outcome studies on wrist ligament repair. Early diagnosis and surgical management associated with early controlled mobilization resulted in excellent clinical outcomes, according to radiograph imaging, the Italian version of the DASH score (Disabilities of the Arm, Shoulder and Hand), goniometry and dynamometry.

**Key words:** Carpal; dislocation; wrist; fracture; radiocarpal joint

## Introduction

Carpal fracture-dislocation associated to distal radius fractures is an uncommon injury often sustained with high-energy trauma. Clinical assessment, instrumental diagnosis and treatment are all challenges for the surgeon. In addition, the prognosis in high-functioning patients is nearly always poor. These challenges are confirmed by conflicting reports in the literature (1). In high-functioning young adults, these injuries can lead to long-term disability if secondary osteoarthritis sets in.

The authors describe an early diagnosis of scapholunate (S-L) dissociation and joint capsule tear associated with radial styloid and triquetral fractures in a 39-year-old professional piano player. No other investigation could be found in the literature. The diagnosis, surgical approach, post-operative care and mid-term outcomes are reported in this paper.

## Case Report

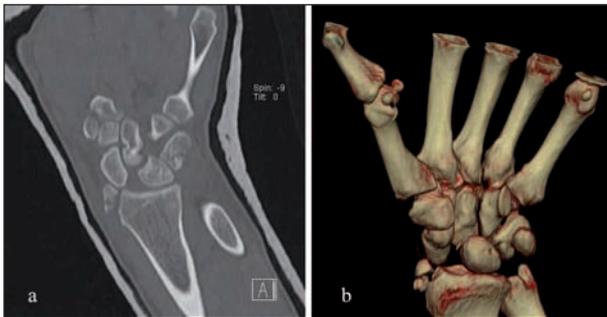
A unique case of a 39-year-old male professional piano player involved in a motor-vehicle accident (MVA) in April 2011 with multiple injuries to upper and lower extremities is described.

The patient was admitted to ER Unit with pain, minimal edema and tenderness over his left wrist, and with limited wrist motion. S-L dissociation associated with radial styloid and triquetral fractures were detected once conventional wrist radiographs (X-ray's) (Fig. 1 a,b) and a computerized tomography scan (CT) (Fig. 2 a,b) were examined. In addition, the patient sustained an anterior-superior iliac spine fracture on his left side. The patient underwent wrist surgery 2 days following the MVA after careful consultation between the patient, his family and the orthopedic team.

A dorsal approach was used and an incision was made between the 3rd and 4th extensor tendon com-

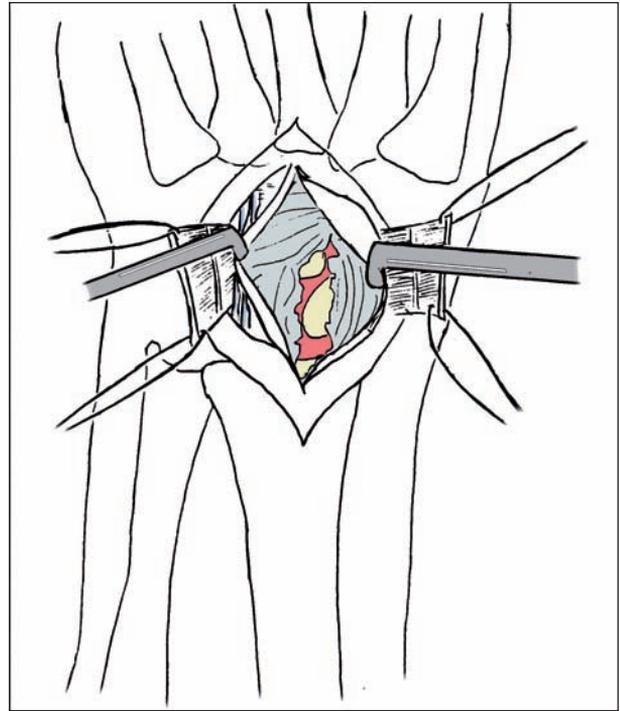


**Figure 1.** Conventional wrist radiographs in the Emergency Unit showing a scapholunate dissociation associated with a radial styloid fracture. A: Anteroposterior view; B: Lateral view.

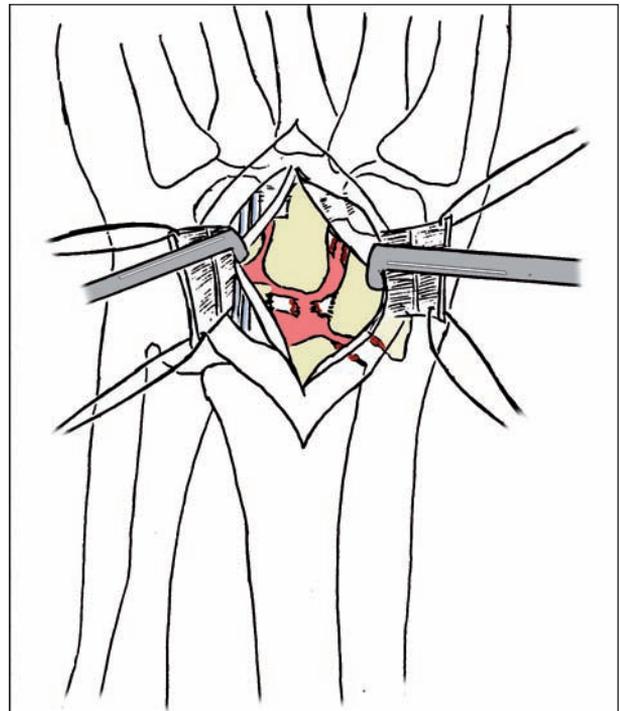


**Figure 2.** Computerized tomography scan showing the scapholunate dissociation, radial styloid and triquetral bone fractures. A: Standard view; B: Tridimensional.

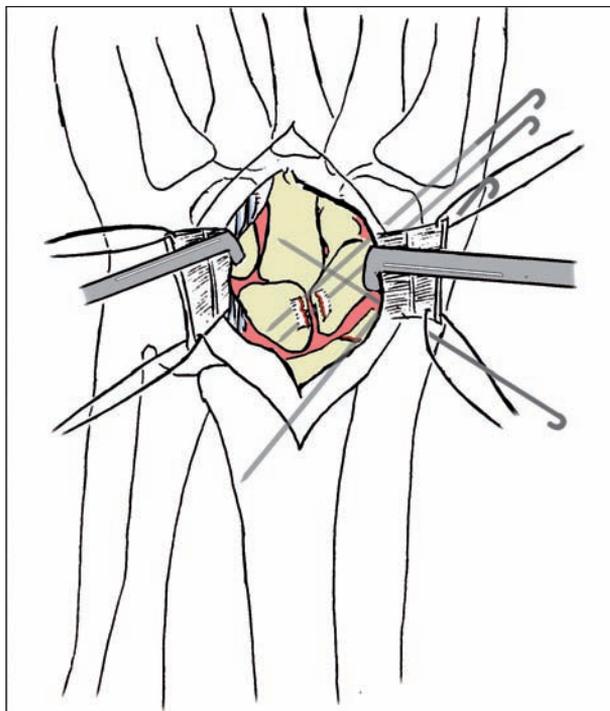
partments (Fig. 3). The dorsal capsule over the radiocarpal joint appeared lacerated and a complete rupture of the scaphocapitate (S-C) and S-L ligaments was detected (Fig. 4). The radial styloid process was reduced and stabilized with a single 1.6 mm k-wire using video fluoroscopy. The S-C diastasis was reduced and stabilized with a single 1.4 mm k-wire whereas the same was done for the S-L dissociation with 2 diverging 1.4 mm k-wires (Fig. 5). The ruptured ligaments were then re-inserted in their origins with a single Titanium micro-anchor (DePuy Mitek, Raynham, MA) (Fig. 6, 7). A dorsal capsulodesis of the scaphoid was performed as the final step (Fig. 8). The wrist was immobilized in a cast slab following skin closure (Fig. 9).



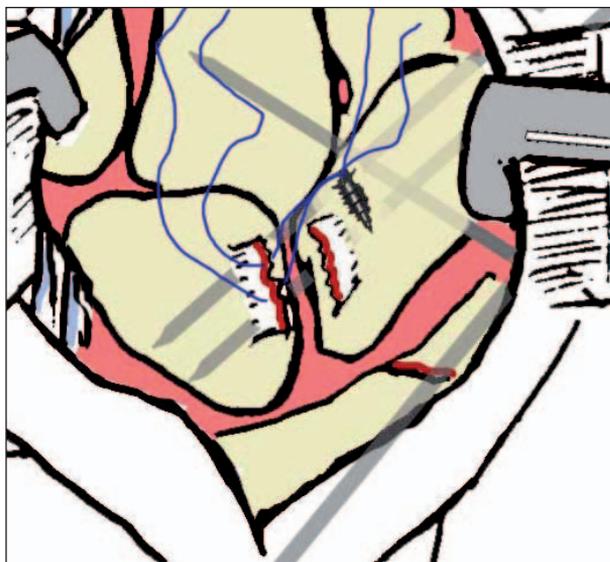
**Figure 3.** Dorsal surgical approach exposing the lacerated dorsal capsule over the radiocarpal joint.



**Figure 4.** Complete rupture of the scapholunate and scaphocapitate ligaments.

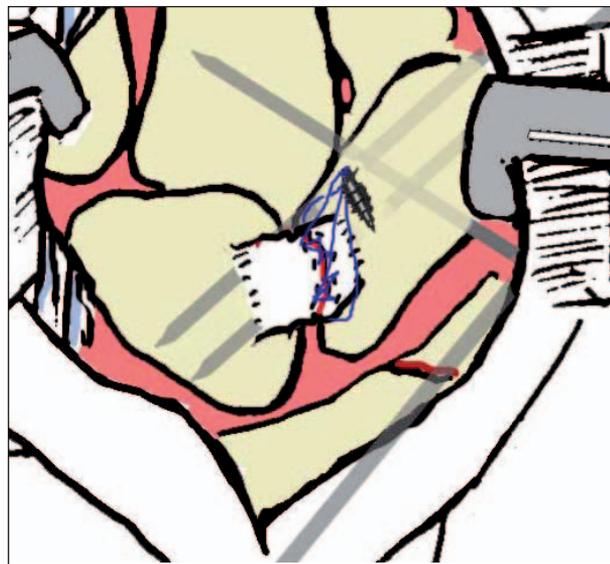


**Figure 5.** Reduction and fixation of the radial styloid fracture (single 1.6 mm k-wire), and the scaphocapitate (single 1.4 mm k-wire) and scapholunate diastases (2 diverging 1.4 mm k-wires).

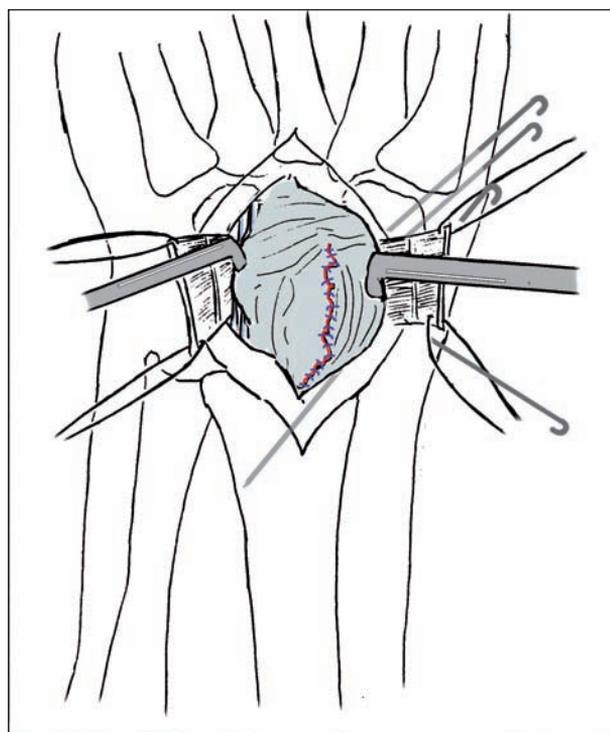


**Figure 6.** Scapholunate ligaments repair with a single Dupuy Mitek Titanium micro-anchor.

The patient was treated post-operatively by an experienced hand therapist. Therapy sessions were scheduled twice a week for a total of 15 visits distrib-

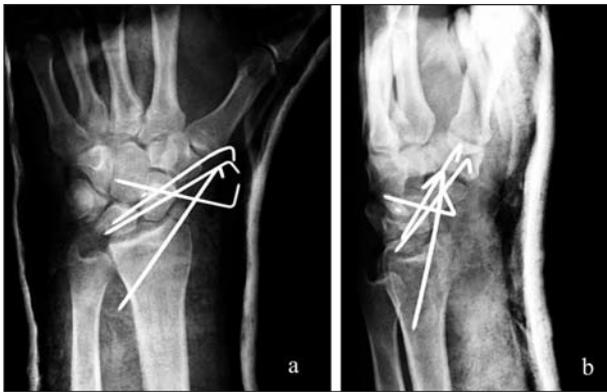


**Figure 7.** End result of the scapholunate ligaments repair.



**Figure 8.** Dorsal scaphoid capsulodesis.

uted over 7 weeks. The duration of the sessions increased from 30 minutes during home visits to 90 minutes once strengthening and Functional Electrical Stimulation (FES) were included in the program. The



**Figure 9.** Post-operative x-ray. A: Anteroposterior view; B: Lateral view.

plaster of Paris wrist slab was replaced with a cock-up thermoplastic splint 17 days post-operatively and was used continuously between exercises and at night. Pin care was done by the treating therapist at each visit. For the following 3.5 weeks, mobilizations consisted in an active-assisted dart-throwers movement of the wrist and great care was taken in this initial phase to protect the S-L ligament repair.

The patient began playing the piano 21 days after surgery with the k-wires still in place to maintain good fine and gross motor dexterity and coordination.

K-wire removal took place at 6 weeks post-operatively and forearm rotation exercises began immediately after. Two weeks later, stretching and light wrist muscle strengthening was begun. Only dart-throwers resisted motion exercises were allowed. Axial loading on the wrist (putty and gripping exercises) began at 9 weeks post-operatively. FES was also added to the rehabilitation program at this time to recruit as many wrist flexor and extensor muscle fibers as possible.

Three functional evaluations were done throughout the rehabilitation process and 3 other clinical and radiological (Fig. 10) follow-ups were done following discharge. All functional assessments were done by the treating therapist.

Thumb and wrist active and passive range of motion and grip and pinch strength were assessed at baseline and periodically until reaching a follow-up of 15 months from injury. Wrist flexion, extension and ulnar deviation were approximately 60 to 75% of the healthy side at final follow-up. On the other hand,



**Figure 10.** Follow-up-rays at 15 months from injury. A: Anteroposterior view; B: Lateral view.

thumb motion was recovered fully and values were similar or slightly better than the unaffected side. Grip and pinch strengths improved constantly (Fig. 11, 12). Left-handed values were below the right hand mostly because of hand dominance. In the current case study, the discrepancy in grip strength between the right dominant hand and the left counterpart fluctuated between 8 and 15% at follow-ups. We used one validated, self-administered questionnaire for the assessment of the disabilities of the arm, shoulder and hand (DASH) scores (2). The DASH score in our case was 4,2.

## Discussion

Carpal fracture-dislocation is uncommon and represent 7% of all carpal injuries. It is often a consequence of a high energy trauma in young males aged between 20 and 40 years (3). In 25% of the cases, this injury is missed or misdiagnosed during the initial examination (4).

Arthroscopic studies found a 17 to 54% incidence rate of S-L dissociation associated with distal radius fractures (5), suggesting that distal radius fractures should be considered complex injuries of the wrist. Few studies report S-L dissociation with radial styloid fractures ("transradial styloid dislocation") since in most investigations the proximal carpal row dislocates dorsally to the distal radio-ulnar joint (1, 6, 7).

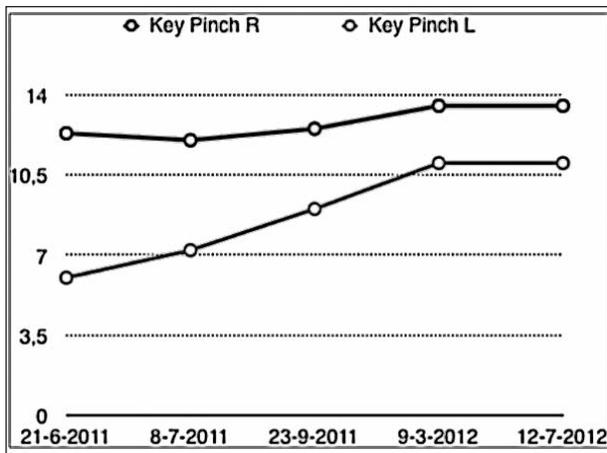


Figure 11. Pinch strength progression in Kg (Pinch gauge).

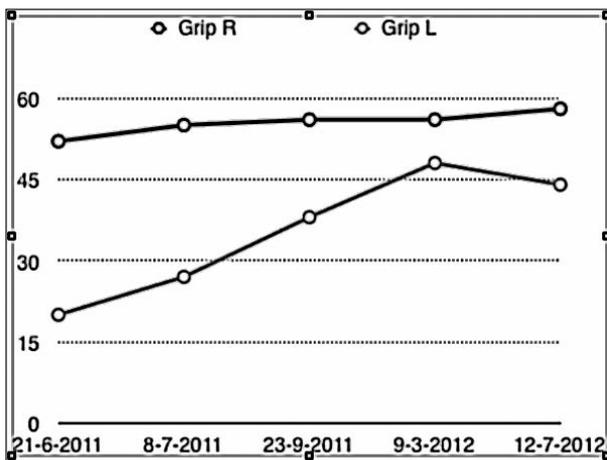


Figure 12. Grip strength progression in Kg (Hand dynamometer).

These complex injuries arise from unusual force patterns transferred through the carpal bones and deviate from the normal pathomechanics well illustrated by Mayfield and colleagues. These authors described perilunar instability as a result, in most cases, of a fall on an outstretched hand which sustains tridimensional forces in extension, ulnar deviation, and intercarpal supination. These dislocations occur in a sequential fashion due to progressive and specific ligamentous disruptions which leads to ulnar perilunar instability producing ultimately 4 stages of instability depending on the amount of perilunar extension (8).

In cases of transradial dislocation, the fracture mechanism of the radial styloid is seemingly associat-

ed to its impact with the proximal row, more specifically with the scaphoid which remains intact. There may be several associated but undetected soft-tissue lesions such as the S-L, S-C and ulnotriquetral ligaments which can produce various carpal malrotations. In cases where there is also an associated carpal bone fracture, such as the triquetrum in the patient currently described, an avulsion mechanism of the dorsal intercarpal, radiocarpal and lunotriquetral ligaments is to be expected while the wrist impacts in hyperflexion and radial deviation, as described by Hocker and Menschik (9).

Early diagnosis of all of these lesions is possible with anteroposterior and lateral wrist x-rays done under local anesthesia, while spreading the carpus in axial traction with a 5 Kg weight. This technique reveals the deformity patterns and suggest which ligaments have ruptured. A standard CT and 3D CT complete the diagnosis and aid in treatment planning. Herzberg's classification best describes these uncommon lesions (3).

These complex lesions fare poorly with conservative treatment and result in long-term disability in young patients. It is thus fundamental to not underestimate this injury and manage it surgically to repair the fractures, realign the carpal bones and stabilize the joints. Treatment must be done within 48 hours of the trauma once the wrist has been placed in continuous traction in an elevated position. This favors edema reduction, prevents soft-tissue shortening and vasculo-nervous deficits in the hand (10).

From the authors' experience, a dorsal approach is preferable over the volar technique as it allows a better view of the S-L rupture, offers the possibility to reduce and fixate the radial styloid, and to repair the S-C ligament and joint capsule.

In the current case study, early controlled mobilization was used following a strong ligament reconstruction despite stabilizing the fractures with k-wiring. Gentle active-assisted dart-throwers motion shortened the immobilization phase that could permanently limit wrist motion in this high-functioning patient. Pain was never an issue during and after therapy sessions and there was no need to treat edema at any point during the treatment process, which were indications that no major complications were arising.

Motivation levels and compliance were excellent in this case as the patient feared of not returning to his professional career. The home-program was given early in the rehabilitation process and was continued after discharge. Despite sustaining several serious injuries to his non-dominant wrist, the patient reached excellent levels of strength only 1 year after injury. The DASH score for our patient was considerably good.

In conclusion, an important factor which the authors believe has contributed in reaching excellent outcomes is that the patient began playing the piano early in his rehabilitation process. The ability to play softly early on may have encouraged the patient to remain constant with his program. Discharge was decided as a team once the patient was able to resume his play in concerts and in symphony orchestras. No other similar investigations were found because of the various associated fractures in the current case study, which normally excludes subjects from retrospective outcome studies on wrist ligament repair.

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Correspondence:

Marco Paterlini MD,

Orthopaedic Clinic - University Of Parma

Via Gramsci 14, 43100 Parma - Italy

E-mail: marco.pate@gmail.com