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Abstract	<p>An otherwise healthy 23-year-old metalworker, without any previous medical history other than smoking, was presented in March 2010 after falling on his left wrist during a motorcycle accident. His wrist had been immobilized in a splint without X-rays being taken. Pain had disappeared during the third week, so the splint was removed and he started using his hand normally. One year later, the pain recurred and then increased. He consulted his doctor who found nonunion of a very small distal fragment of the proximal pole of the scaphoid on X-rays. The patient was sent to a specialized surgical center 18 months after the initial injury.</p>	
Keywords	<p>Grafting for scaphoid proximal pole nonunion - Scapholunate pinning - Scaphoid proximal pole nonunion - Treatment of scaphoid nonunion - Arthroscopic scapholunate pinning</p>	

# Chapter 12

## Arthroscopic Grafting and Scapholunate Pinning for Scaphoid Proximal Pole Nonunion

Christophe Mathoulin

### 1 Clinical Presentation

2 An otherwise healthy 23-year-old metalworker, without any previ-  
3 ous medical history other than smoking, was presented in March  
4 2010 after falling on his left wrist during a motorcycle accident.  
5 His wrist had been immobilized in a splint without X-rays being  
6 taken. Pain had disappeared during the third week, so the splint was  
7 removed and he started using his hand normally. One year later,  
8 the pain recurred and then increased. He consulted his doctor who  
9 found nonunion of a very small distal fragment of the proximal  
10 pole of the scaphoid on X-rays. The patient was sent to a special-  
11 ized surgical center 18 months after the initial injury.

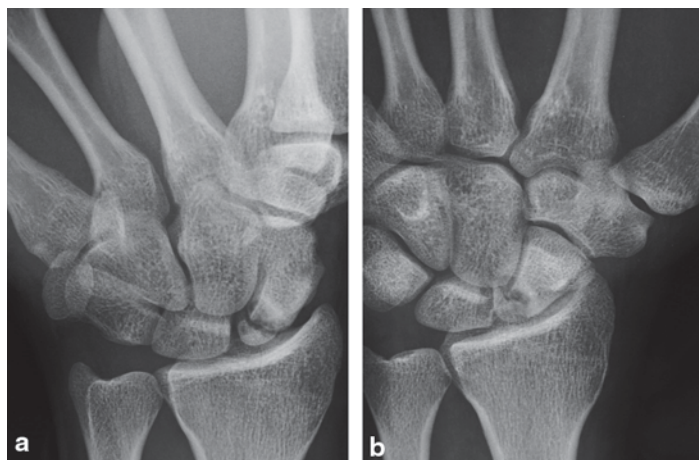
### 12 Clinical Examination

- 13 • Pain score was 7 on the VAS scale  
14 • Extension was 60 vs. 85° on the opposite side  
15 • Flexion was 60 vs. 80° on the opposite side  
16 • Radial deviation was 10 vs. 30° on the opposite side

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**Fig. 12.1 a–b** X-rays of very small proximal pole nonunion. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

- 17 • Ulnar deviation was 20 vs. 40° on the opposite side
- 18 • Full pronation and supination
- 19 • Grip strength was 30 kg versus 50 kg on the opposite side
- 20 • Disabilities of arm, shoulder and hand (DASH) score was 80.82

### 21 ***Diagnostic Studies***

- 22 • X-rays showed a very proximal nonunion of the scaphoid's
- 23 proximal pole with bone loss. There were no signs of necrosis
- 24 (Fig. 12.1a, b).

### 25 **Management Options**

- 26 Conventional grafting by open techniques does not always achieve
- 27 a satisfactory union rate. The advent of vascularized grafts was an
- 28 indisputable technical advancement that enhanced the vascularity

29 of the proximal pole and improved the union rate. However, the  
30 surgical technique is challenging, especially in the case of a small  
31 proximal pole fragment.

### 32 ***Management Chosen***

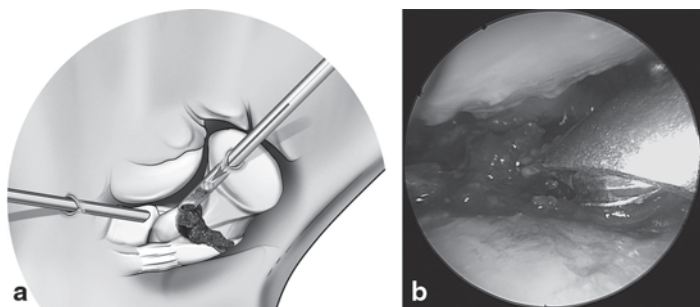
33 After a discussion with the patient, he agreed to completely stop  
34 smoking for a minimum of 1 month before surgery. The surgical  
35 procedure consisted of a fixation method that captured the body  
36 and proximal pole of the scaphoid, along with the lunate in the  
37 radio-ulnar axis, in combination with insertion of cancellous bone  
38 autograft.

### 39 **Surgical Procedure**

40 The patient was operated 1 month and a half after smoking cessa-  
41 tion. The procedure was performed on an outpatient basis under  
42 regional anesthesia and with an arm tourniquet.

43 *First Step: Graft Harvesting* The graft was harvested from the lat-  
44 eral radius through a longitudinal incision centered over the radial  
45 styloid process. The cutaneous and sensory branches of the radial  
46 nerve were protected. Subperiosteal dissection between the first and  
47 second extensor compartments was carried out to keep the tendon  
48 sheaths intact. A three-sided osteotomy was made on the lateral cor-  
49 tex of the radial styloid; a bone lid was created that had a proximal  
50 hinge. The graft was harvested with a curette and about twice the  
51 estimated volume of the defect was taken. The bone lid was then  
52 repositioned and the first and second compartments were spontane-  
53 ously repositioned so as to stabilize the harvest site.

54 *Second Step: Arthroscopic Bone Grafting* Axial traction was  
55 placed on the wrist. The arthroscope was inserted into the mid-  
56 carpal joint through the ulnar midcarpal portal (2 cm distal and  
57 2 cm ulnar to Lister's tubercle) to explore the distal aspect of the  
58 scaphoid. The nonunion was confirmed. Reduction was achieved  
59 using simple axial traction on the thumb. Thorough cleaning and



**Fig. 12.2** **a** Drawing and **b** arthroscopic view showing the way to push the cancellous bone graft into the bone loss of the scaphoid nonunion, using the burr. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

60 curettage of the two scaphoid surfaces was carried out using a  
61 curette and shaver through the radial midcarpal portal (2 cm distal  
62 to Lister's tubercle). This step can be done with or without fluid;  
63 however, dry arthroscopy is required for graft insertion. The can-  
64 nula from a 3.0-mm burr was inserted through the radial midcarpal  
65 portal up to the defect between the proximal pole and the body of  
66 the scaphoid. The graft material was pushed using the head of the  
67 burr into the bone defect site, and then compacted using a spatula  
68 (Figs. 12.2a, b).

69 *Third Step: Fixation by Scapholunate Pinning* We used a typical  
70 percutaneous scapholunate pinning method under arthroscopic and  
71 fluoroscopic control. Two pins were driven percutaneously into the  
72 radial aspect of the wrist, through the distal body of the scaphoid,  
73 so as to bridge the graft area, secure the proximal pole and then was  
74 advanced into the lunate (Fig. 12.3).

## 75 *Postoperative Care*

76 The arthroscopic portal incisions were not closed. A simple volar  
77 splint in slight wrist extension was used by the patient until bone

**Fig. 12.3** Postoperative X-rays showing the special trick of scapholunate pinning. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)



78 union was achieved. X-rays were taken every 15 days. The pins  
79 were removed in the second month after union. Rehabilitation was  
80 started immediately thereafter (Figs. 12.4a, b, c).

### 81 **Clinical Pearls/Pitfalls**

- 82 • Arthroscopic technique requires only a local-regional anesthesia
- 83 • First step is to harvest the cancellous bone graft from distal radi-
- 84 • dium by lateral 1–2 approach, keeping the cortical bone to close
- 85 • the graft donor area
- 86 • Midcarpal portals are classically sufficient to check and treat
- 87 • the nonunion area. Ulnar midcarpal portal for scope and radial
- 88 • midcarpal portal for grafting
- 89 • Implementation of the graft should be done without water in the
- 90 • procedure of dry arthroscopy
- 91 • No need to fix the cancellous bone graft, the shape of capitate
- 92 • maintain bone graft in a good position after releasing tension
- 93 • The fixation of scaphoid needs a lateral scapholunate pinning,
- 94 • fixing distal scaphoid, graft area, proximal pole, and lunate

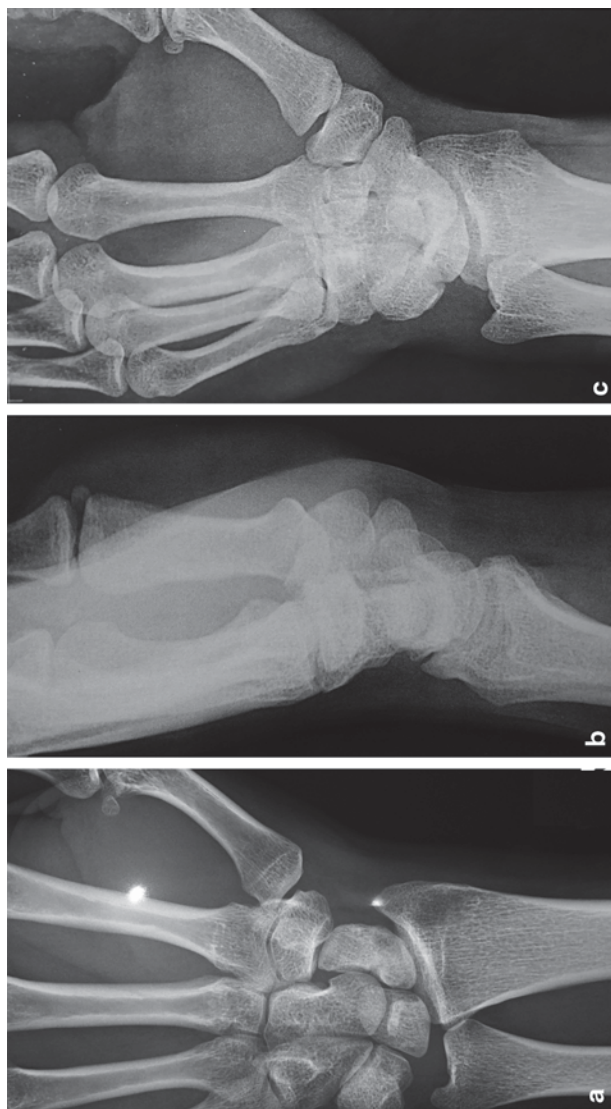


**Fig. 12.4** a, b, c X-rays and clinical view of wrist at 45 days after the removal of K-wires. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

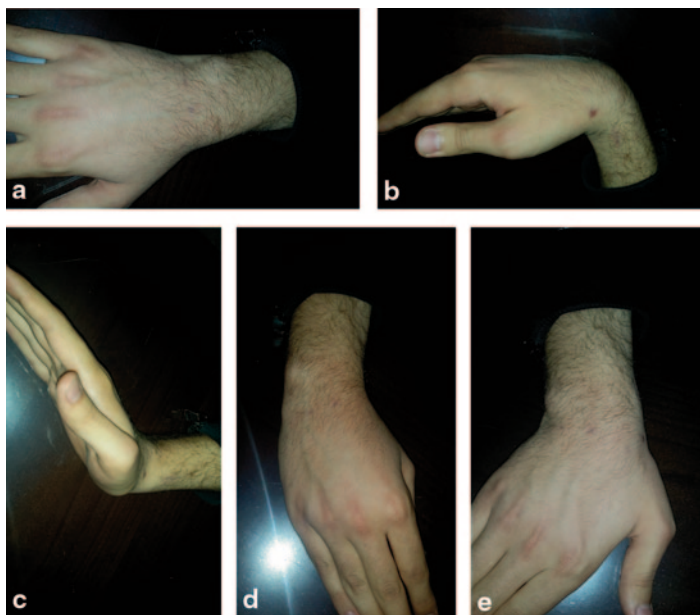
## 95 **Clinical Course and Outcome**

96 At final follow-up in the 30th month, the patient had obtained  
97 union, and the pain had disappeared completely and the VAS was 0  
98 (Figs. 12.5a, b, c). The DASH was 0 with no functional impairment.





**Fig. 12.5** a, b, c X-rays after 2 years showing a complete reconstruction of scaphoid. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)



**Fig. 12.6** a–e The final result with complete range of motion. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

99        Extension was  $80^\circ$ , flexion was  $80^\circ$ , radial deviation was  $25^\circ$ ,  
100        ulnar deviation was  $40^\circ$ , and pronation and supination were possible  
101        over the full range of motion and grip strength was 55 kg.  
102        Figure 12.6 demonstrates the clinical view of the final result with  
103        complete range of motion.

## 104        Literature Review and Discussion

105        The treatment of scaphoid nonunion has long been controversial  
106        and different techniques have been described. Fractures of the  
107        proximal pole are susceptible to nonunion because of its precarious  
108        blood supply. The small size of the proximal fragment makes

109 it less amenable to standard fixation techniques and leads to diver-  
110 gent results.

111 Ho has shown arthroscopic bone grafting to be an effective  
112 treatment of scaphoid nonunion; preservation of the scaphoid's  
113 vascularity was an asset [1]. At the proximal pole, especially in  
114 small fragments, not opening or touching the structures that pro-  
115 vide blood to the proximal pole (scapholunate ligament, dorsal and  
116 volar extrinsic wrist ligaments) is a key point in this technique.  
117 Graft insertion is easily done arthroscopically. Ho recommends us-  
118 ing biological glue to stabilize the cancellous graft once implanted.  
119 In our experience, this is not necessary—when traction is released,  
120 the anatomical position of the capitate fits into the curvature of the  
121 scaphoid and stabilizes the graft material.

122 Ho also recommends harvesting grafts from the iliac crest. We  
123 have always preferred harvesting bone from the radius for two rea-  
124 sons: The patient is usually young and the quality of the cancellous  
125 bone of the radius is excellent. As a consequence, the procedure  
126 can be performed as an outpatient procedure under regional anes-  
127 thesia, which is very popular with patients.

128 Fixation is no longer done with conventional retrograde screws,  
129 which are not a good indication in this proximal location, or with  
130 anterograde screws given the small size of the fragment. Placing a  
131 proximal screw in such a small fragment induces a significant risk  
132 of fracture, along with the fact that it passes through an important  
133 area of the cartilage in the radiocarpal joint.

134 We chose to perform an original, more anatomical scapholunate  
135 pinning method, which provides excellent stabilization of the graft  
136 and the proximal pole. Fixation between the scaphoid and lunate is  
137 very easy to achieve. The pins are cut under the skin and removed  
138 after union. In our first series, the union rate was 100% with an  
139 average time of 8 weeks. In a more recent series involving only the  
140 proximal pole, the union rate was excellent, with only one case of  
141 delayed union at 6 months.

142 Another important point to consider is that smoking must be  
143 stopped completely, at least until union is achieved. In our expe-  
144 rience, smokers have a much lower union rate than nonsmokers.  
145 This pretext must be used to help patients stop smoking, which was  
146 achieved in all cases in our series.

147 Arthroscopic bone grafting associated with an original scaph-  
148 olunate pinning method for treating proximal pole nonunion of the  
149 scaphoid is an elegant and simple technique that is less traumatic  
150 for the patient and results in an excellent union rate.

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