Chapter 12
Arthroscopic Grafting and Scapholunate Pinning for Scaphoid Proximal Pole Nonunion

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Case Presentation

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 a proximal pole fracture with a very small proximal fragment of the scaphoid on X-rays. The patient was sent to a specialized surgical center 18 months after the initial injury.

Physical Assessment

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

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J. Yao (ed.), *Scaphoid Fractures and Nonunions,*
DOI 10.1007/978-3-319-18977-2_12

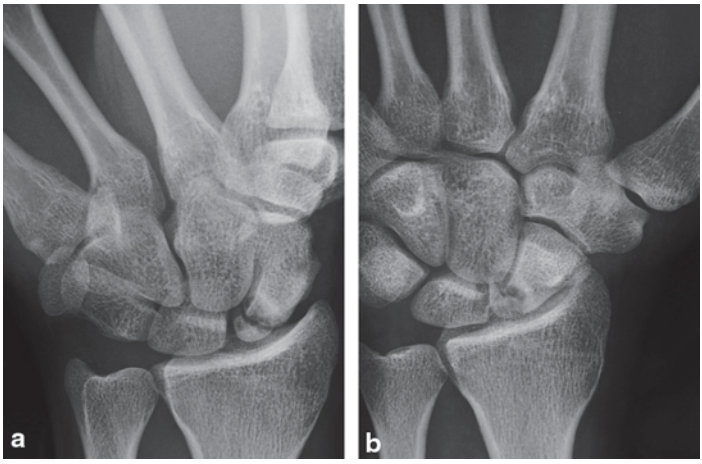

Fig. 12.1 a–b X-rays of very small proximal pole nonunion. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

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

Diagnostic Studies

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

Management Options

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

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

Management Chosen

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

Surgical Procedure

The patient was operated 1 month and a half after smoking cessation. The procedure was performed on an outpatient basis under regional anesthesia and with an arm tourniquet.

First Step: Graft Harvesting The graft was harvested from the lateral radius through a longitudinal incision centered over the radial styloid process. The cutaneous and sensory branches of the radial nerve were protected. Subperiosteal dissection between the first and second extensor compartments was carried out to keep the tendon sheaths intact. A three-sided osteotomy was made on the lateral cortex of the radial styloid; a bone lid was created that had a proximal hinge. The graft was harvested with a curette and about twice the estimated volume of the defect was taken. The bone lid was then repositioned and the first and second compartments were spontaneously repositioned so as to stabilize the harvest site.

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

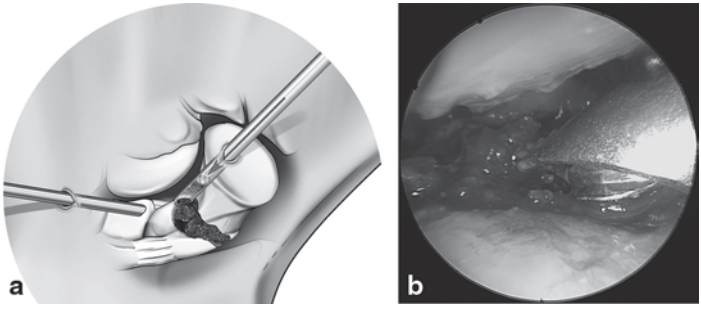

Fig. 12.2 **a** Drawing and **b** arthroscopic view showing the way to push the cancellous bone graft into the bone loss of the scaphoid nonunion, using the burr. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

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

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

The arthroscopic portal incisions were not closed. A simple volar splint in slight wrist extension was used by the patient until bone union was achieved. X-rays were taken every 15 days. The pins were removed in the second month after union. Rehabilitation was started immediately thereafter (Figs. 12.4a, b, c).

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

Clinical Course and Outcome

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

Extension was 80°, flexion was 80°, radial deviation was 25°, ulnar deviation was 40°, and pronation and supination were possible over the full range of motion and grip strength was 55 kg. Figure 12.6 demonstrates the clinical view of the final result with complete range of motion.

Clinical Pearls/Pitfalls

- Arthroscopic technique requires only a local-regional anesthesia
- First step is to harvest the cancellous bone graft from distal radius by lateral 1–2 approach, keeping the cortical bone to close the graft donor area

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)

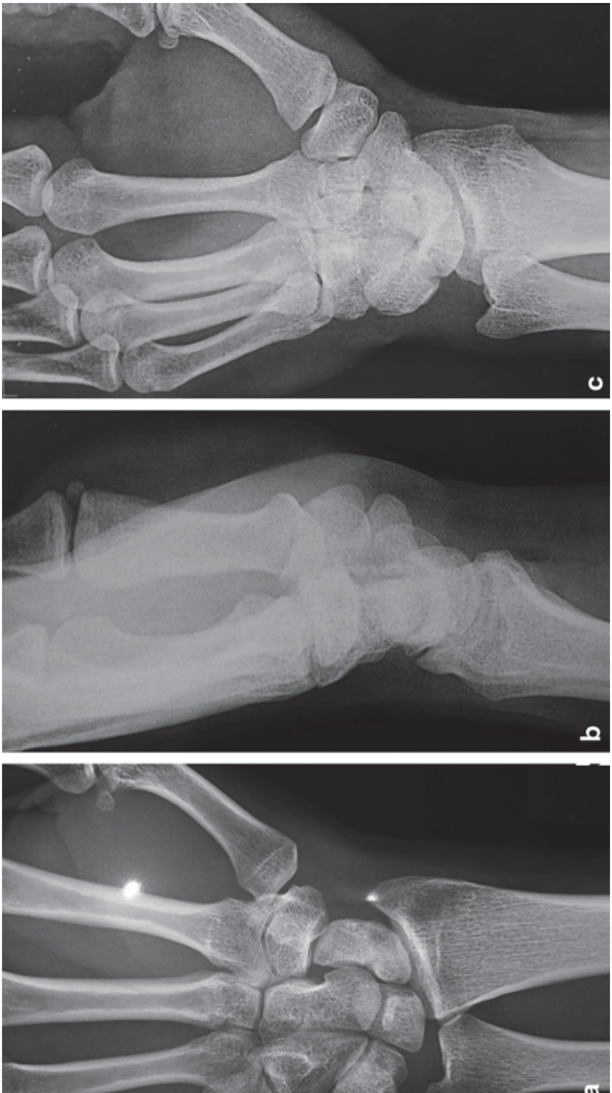

Fig. 12.5 a, **b**, **c** X-rays after 2 years showing a complete reconstruction of scaphoid. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

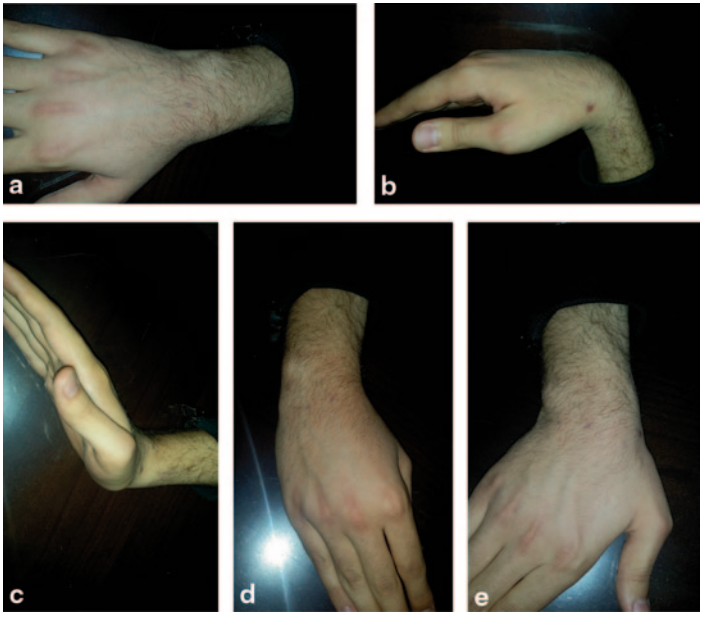

Fig. 12.6 **a–e** The final result with complete range of motion. (Published with kind permission of ©Christophe Mathoulin 2015. All Rights Reserved)

- Midcarpal portals are classically sufficient to check and treat the nonunion area. Ulnar midcarpal portal for scope and radial midcarpal portal for grafting
- Implementation of the graft should be done without water in the procedure of dry arthroscopy
- No need to fix the cancellous bone graft, the shape of capitate maintain bone graft in a good position after releasing tension
- The fixation of scaphoid needs a lateral scapholunate pinning, fixing distal scaphoid, graft area, proximal pole, and lunate

Literature Review and Discussion

The treatment of scaphoid nonunion has long been controversial and different techniques have been described. Fractures of the proximal pole are susceptible to nonunion because of its precarious blood supply. The small size of the proximal fragment makes it less amenable to standard fixation techniques and leads to divergent results.

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

Ho also recommends harvesting grafts from the iliac crest. We have always preferred harvesting bone from the radius for two reasons: The patient is usually young and the quality of the cancellous bone of the radius is excellent. As a consequence, the procedure can be performed as an outpatient procedure under regional anesthesia, which is very popular with patients.

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

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

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

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

Reference

1. Ho PC, Hung LK. Arthroscopic bone grafting in scaphoid nonunion and delayed union. In: Slutsky D, Slade J, editors. The scaphoid. NY: Thieme; 2001. pp. 131–43.