# Scaphoid Union
## The Role of Wrist Arthroscopy

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**KEYWORDS**

• Scaphoid • Arthroscopy • Union • Nonunion

**KEY POINTS**

- Radiographs and computed tomography scans do not always provide sufficient information to know whether a scaphoid fracture or bone graft has united.
- Arthroscopic surgery provides additional information that assists in determining whether a fracture or bone graft has united, partially united or has united.
- When to use wrist arthroscopy and how to perform wrist arthroscopy to evaluate scaphoid fracture and scaphoid nonunion is described.

## RATIONALE

It can be difficult to know whether a scaphoid fracture or bone graft has united. In some cases, the information obtained from radiographs, computed tomography (CT) scans, and MRI scans may not be enough to make a confident diagnosis of scaphoid union. This problem affects both scaphoid fractures and scaphoid nonunions that have been bone grafted. When this occurs, arthroscopic examination of the fracture or bone graft provides additional information to diagnose whether the scaphoid has united, partially united, or has not united.

Radiographs often do not show enough detail to confidently know whether union has occurred. A double-line sign on MRI represents the fracture line coupled with a revascularization front and is nearly always associated with union.[1] MRI imaging does not clearly show whether bone union has occurred. Internal fixation devices (screws, K-wires, or both) create interference and make it difficult to see the fracture or bone graft site clearly.

Trabecular bone bridging on CT studies is currently the best way to evaluate scaphoid union. It is usually possible to define scaphoid union and nonunion, but there is an intermediate state of partial union for which it is still uncertain how much trabecular bridging is required and if the trabecular bridging is mechanically strong enough to allow return to full activity.[2,3] It has been postulated that if 50% of the fracture has been bridged by trabeculae then the fracture or bone graft can be considered to have united.[2,3] Very rarely, bone may appear to be bridging the fracture site, but it is the cancellous bone of the proximal pole impacting into the cancellous bone of the distal scaphoid, which can give the impression of union (see case 3).

When it is uncertain whether a scaphoid fracture or a bone grafted internally fixed scaphoid has united, the options are limited and comprise of the following:

1. Continue wrist immobilization in a splint until there is interval change in the appearance of the CT scan demonstrating increased trabeculae crossing the scaphoid fracture or bone graft.
2. Remove the splint, mobilize the wrist, and perform follow-up CT scans to ensure the scaphoid has united. In other words, perform a trial of motion.
3. Conduct an arthroscopic examination of the midcarpal surface of the scaphoid to probe

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Hand Clin 33 (2017) 677–686
http://dx.doi.org/10.1016/j.hcl.2017.07.001

and manipulate the fracture or bone graft to determine if it is stable or mobile.

If at arthroscopy the scaphoid is stable and trabeculae can be seen crossing the fracture or bone graft on CT scan, then the options are:

1. Remove the splint and mobilize the wrist.
2. Immobilize the wrist in a thermoplastic splint or cast for a longer period of time and perform a further CT scan to assess if there is an interval increase in the amount of bone trabeculae bridging the scaphoid fracture or bone graft.
3. If there is no internal fixation then consider internal fixation of the scaphoid with a headless compression screw.
4. If the scaphoid has been internally fixed and there is a solid fibrous nonunion that is stable, the nonunion can be arthroscopically excised leaving around the internal fixation and performing an arthroscopic top-up graft (see case 4).

Alternatively, if the scaphoid fracture is unstable there is a nonunion of the scaphoid, and if it has been internally fixed, the fixation devices are loose. Although this can pose a difficult surgical problem, arthroscopy simplifies management because the diagnosis is clear.

## SURGICAL TECHNIQUE

There is often extensive arthrofibrosis obscuring the scaphoid fracture or bone graft. This fibrotic tissue has to be removed with a shaver to get a good view of the fracture or bone graft site. To complicate matters, the bone is often soft and incorrect introduction of arthroscopic instruments can damage the cartilage and carpal bones. The technique involves the use of a wrist tower to apply traction across the wrist. A 1.9 mm arthroscope is inserted into the midcarpal joint using an ulnar midcarpal joint portal. A radial midcarpal joint portal is made to insert the shaver, probe, and a burr if required. The position of the radial midcarpal joint portal is important. To place the radial midcarpal joint portal in the optimal position, an 18-gauge needle is inserted while viewing through the ulnar midcarpal portal. Once the needle can be inserted along the line of the fracture, the radial midcarpal joint portal can be made confidently knowing that the instruments can easily access the entire fracture.

## *Case Studies*

### *Case 1*

A 36-year-old man presented acutely with a trans-scaphoid perilunate fracture dislocation that was arthroscopically reduced and internally fixed with 3.0 mm headless compression screw and an antirotation K-wire. Three months after surgery it was uncertain whether the scaphoid fracture had united (Fig. 1).

The antirotation K-wire was removed and the scaphoid examined arthroscopically (Fig. 2). The fracture was viewed from the midcarpal surface of the scaphoid and was stable on probing under direct vision.

The patient was advised to remove his splint, start a wrist proprioceptive exercise program, and use his wrist normally.

Eighteen months after surgery a CT scan showed increased bone crossing the fracture site and a united scaphoid (Fig. 3).

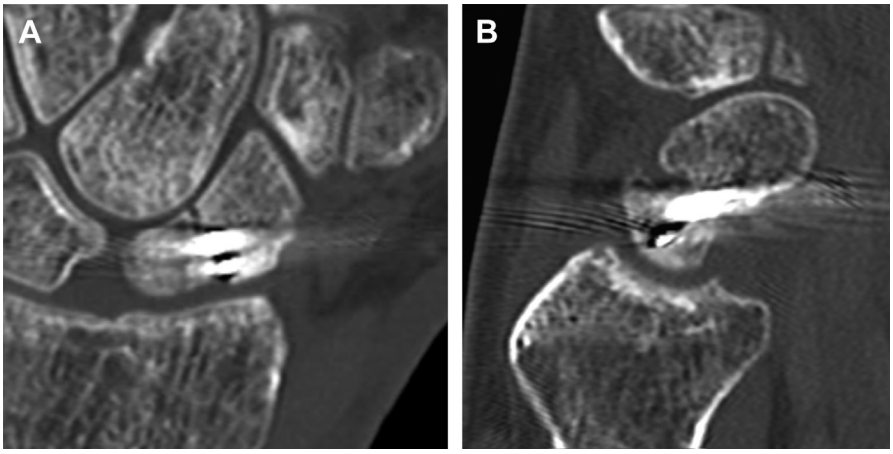


**Fig. 1.** (*A*, *B*) Three months after arthroscopic reduction and internal fixation of a trans-scaphoid perilunate fracture dislocation with compression screw and antirotation K-wire. A small amount of bone can be seen bridging the scaphoid fracture and it is uncertain whether the fracture has united.