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## Scaphoid - Displaced waist fractures



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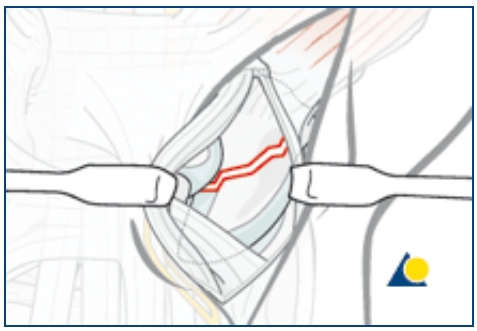
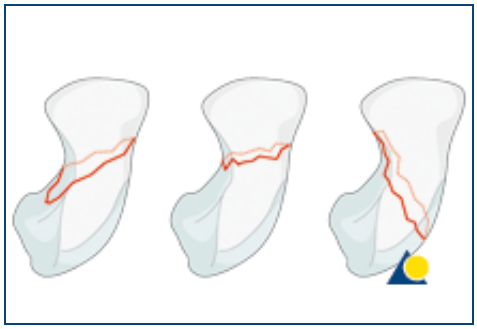
# Screw and K-wires fixation

## 1 Introduction

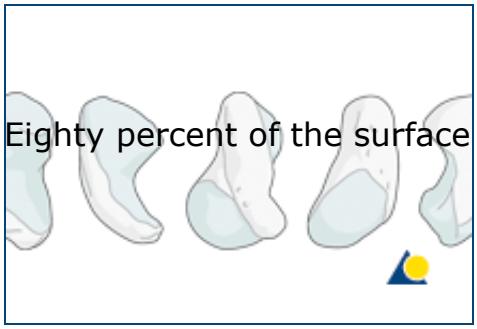


**Palmar approach**
The palmar approach to the scaphoid gives access to displaced waist fractures that can not be reduced and fixed by percutaneous techniques.



When using internal fixation, bone healing is quicker than in nonoperative treatment, and the period of postoperative immobilization is shortened.
Any displacement of a scaphoid fracture is a strong indication for internal fixation. Most waist fractures are transverse. Some fractures may be oblique either in the horizontal or in the vertical plane.

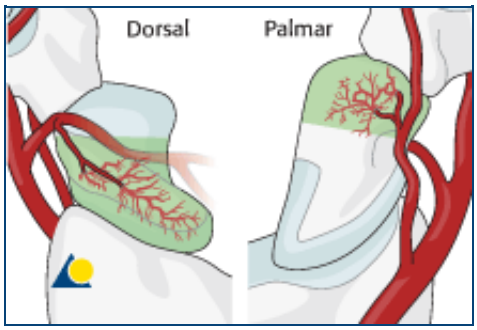
**Imaging**
Conventional radiographs do not adequately demonstrate the complete fracture configuration. A CT scan is strongly recommended to reveal the degree of displacement.



### Anatomical considerations

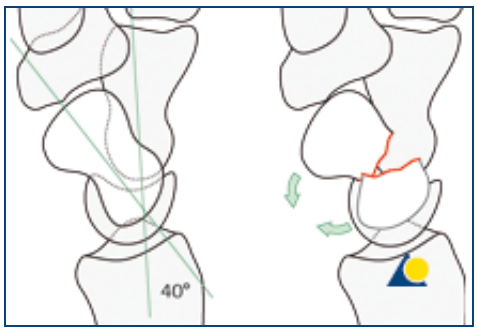
Eighty percent of the surface of the scaphoid is covered with articular cartilage. This greatly limits potential points of entry for fixation devices. An additional constraint is the curved shape of the scaphoid.

This means that a wire or fixation device along the true central axis of the scaphoid is not possible. Occasionally, access to a distal entry point for a device can only be gained by a limited excavation of the trapezium.




### Vascularity

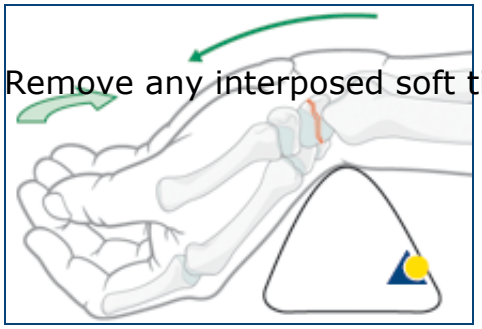
The blood supply of the scaphoid derives from two sources: a group of vessels entering the palmar aspect of the distal pole, and a group entering the dorsal aspect of the distal pole. The first group contributes largely to the vascularity of the distal one third, and the dorsal group supplies the proximal two thirds of the bone.




### Fracture displacement forces

In fractures of the waist of the scaphoid, the distal pole tends to rotate into flexion in relation to the proximal pole, the lunate and the triquetrum, which lie in extension. This can create a rotational and angular deformity at the fracture site – the so-called “humpback deformity”.

## 2 Reduction

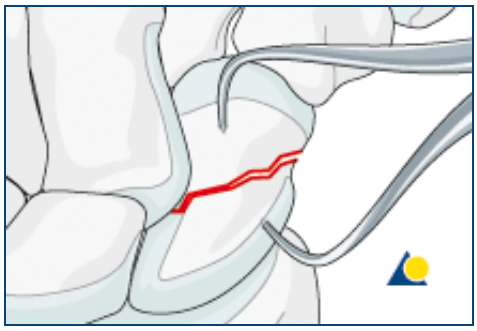


**Identify the fracture**

Remove any interposed soft tissues and loose bone fragments, and irrigate the fracture site.

In delayed treatment, the fracture is not always obvious. Look for a wrinkle in the articular cartilage.

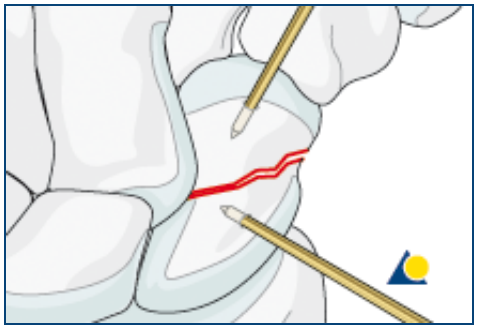
In these cases, distract, extend and deviate the wrist towards the ulna to expose the fracture line.



**Direct reduction**

**Small reduction forceps**

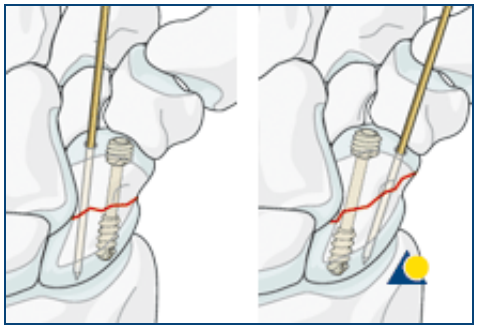
Use small pointed reduction forceps to reduce the fracture.



**Insert K-wires**

If the fracture can not be reduced with the forceps, insert a K-wire into each fragment and use the wires as joysticks to manipulate the fragments.

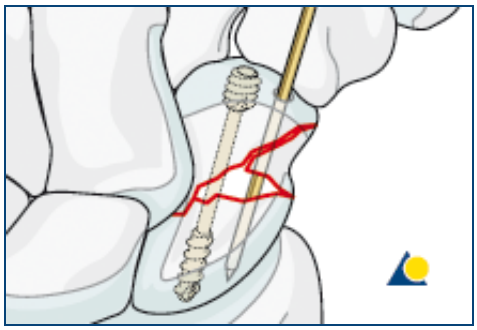
After reduction, make sure that there is no rotational deformity.



**Temporary K-wire fixation**

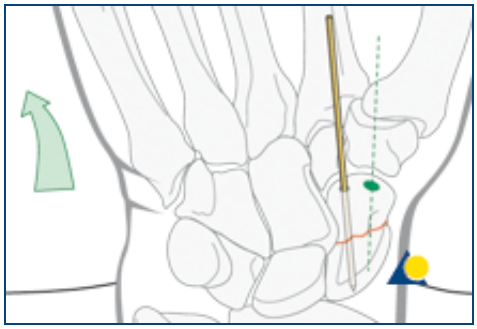
Insert a K-wire provisionally to stabilize the fragments and to maintain rotational alignment during drilling and tapping.

When inserting the K-wire, be careful not to conflict with the planned track of the guide wire for the cannulated screw.
In principle, the screw should be as perpendicular as possible to the fracture plane. With more oblique fractures, such as illustrated, the insertion point of the screw will be more ulnar on the distal pole of the scaphoid. In transverse fractures, the insertion point of the screw will be more radial on the distal pole of the scaphoid. This will influence the site of insertion of the first K-wire.

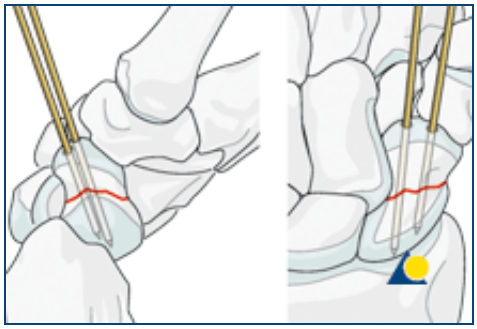


In wedge fractures, ensure that the K-wire engages the additional fragment. In such cases, this first K-wire is left in place after definitive fixation has been completed. Remove the reduction forceps, or the joysticks.

## 3 Preparation

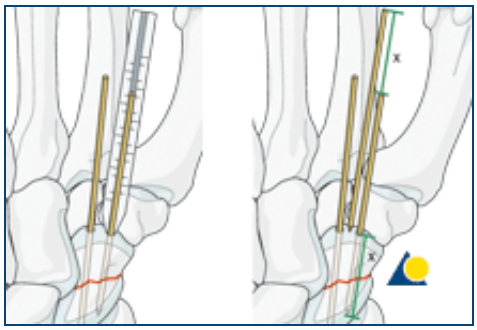


**Determination of entry point**
The entry point for the guide wire should be located at the palmar edge of the scaphotrapezial joint, which can be visualized better with a hyperextended and ulnar-deviated wrist.



**Insertion of guide wire**
Insert a dedicated guide wire along the central axis of the scaphoid. Use the dedicated drill guide, or a protective sleeve.

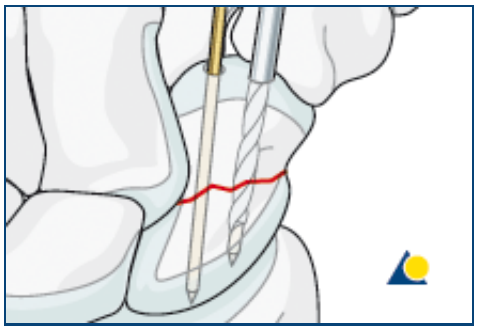
The guide wire track must be angled 45 degrees dorsally, and 45 degrees medially, along the mid-axis of the scaphoid.
The position of the wire should be as perpendicular as possible to the fracture line. In oblique fractures, this principle may have to be compromised.
Do not penetrate beyond the proximal cortex of the scaphoid.
Confirm position under image intensification before drilling and tapping.



**Measuring the length**
Two methods can be employed for measuring the desired screw length:

1. Insert the dedicated measuring device over the guide wire, through the drill guide, which must be firmly positioned on the tubercle for a reliable measurement.
2. If the dedicated drill guide is not available, take another guide wire of the same length and place its tip onto the bone at the insertion point. The difference between the protruding ends of the two wires indicates the length of the drill hole for the screw.

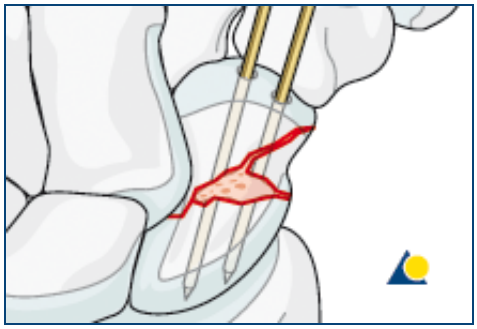
Subtract 2 mm to determine the screw length.



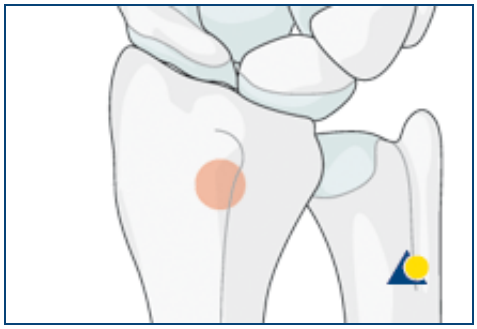
**Drilling and tapping**
Use only the dedicated drill bit. A power drill will exert a smaller and more controlled force on the fragments than manual drilling, and will reduce the risk of displacing the fragments. A small power drill with slow rotation is preferable.
Use Ringer lactate solution to cool the drill bit, in order to

minimize thermal injury.
Tap the drill hole manually if not using self-tapping screws.
If the drill guide is used, attach a nut to the drill bit in order to limit penetration to the desired length only.
Check the position of the tip of the drill bit using image intensification.
Then tap the drill hole manually, if not using self-tapping screws.

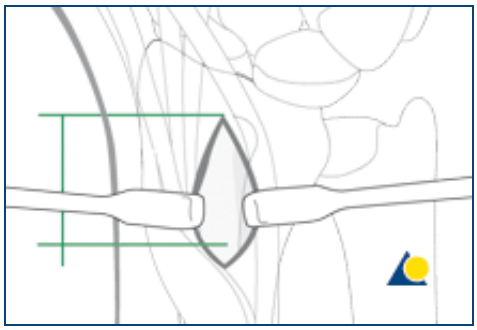
## 4 Graft



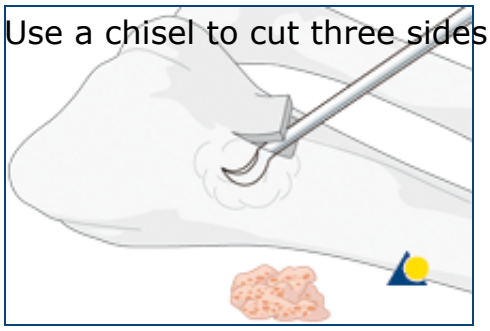
**Fractures with a defect: Add bone graft**
In the case of fracture comminution, particularly with compromise of the palmar cortex, or a defect after removal of loose fragments, autogenous, cancellous bone graft, is necessary.



**Harvest site**
Harvest the graft material from the distal radius. A good and safe place is proximal and slightly radial to Lister’s tubercle.

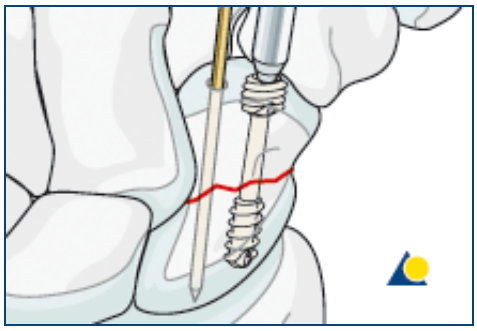


**Harvesting**
Make a 2 cm longitudinal incision proximal to Lister’s tubercle. Retract the tendons of the second compartment radially, and the extensor pollicis longus (EPL) in an ulnar direction.

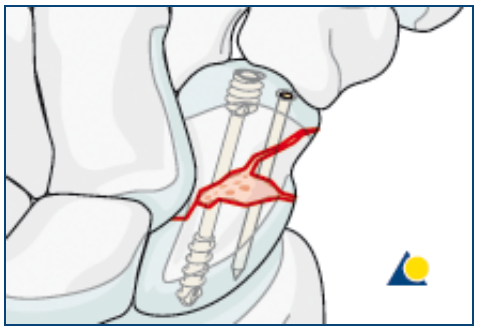


Use a chisel to cut three sides of a small square. Lift the dorsal radial cortex as a flap. After harvesting cancellous bone, replace the "lid", and suture the periosteum and the skin incision.

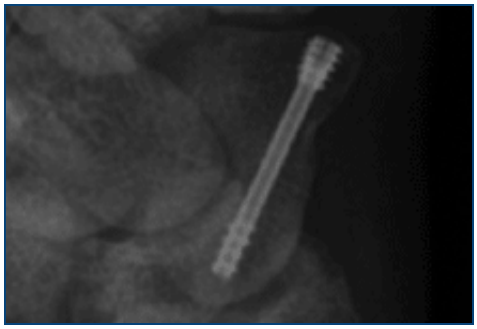
## 5 Fixation



**Screw insertion**
The screw is inserted manually over the guide wire, and tightened fully. Make sure that the near threaded section is fully buried in the bone at the insertion site.
Remove the guide wire and the K-wire used for provisional fixation.



In cases of comminution, leave the temporary antirotational K-wire in place and cut it at the level of its entry point.



**Confirm screw position**
Check the final position of the screw, and the scaphoid stability using image intensification.

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