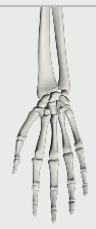


Hand & Wrist

stryker®

Trauma & Extremities

Diamond Carpal Fusion System

Four Corner Fusion Plate

Operative Technique

Stryker

Disclaimer

This publication sets forth detailed recommended procedures for using Stryker devices and instruments.

It offers guidance that you should heed, but, as with any such technical guide, each surgeon must consider the particular needs of each patient and make appropriate adjustments when and as required.

A workshop training is recommended prior to first surgery. All non-sterile devices must be cleaned and sterilized before use. Follow the instructions for use. Multi-component instruments must be disassembled for cleaning. Please refer to the corresponding assembly/disassembly instructions.

Please remember that the compatibility of different product systems have not been tested unless specified otherwise in the product labeling.

See package insert (Instruction for Use) (V15143 and V15142) for a complete list of potential adverse effects, contraindications, warnings and precautions. The surgeon must discuss all relevant risks including the finite lifetime of the device with the patient when necessary.

Contents

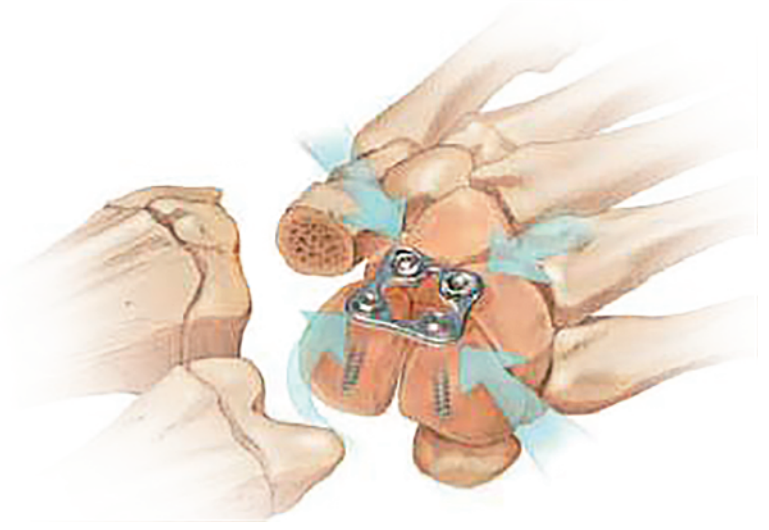
Introduction

Diamond Carpal Fusion System

The Diamond Carpal Fusion Plate is designed for carpal fusion applications. The plate is offered in two sizes to accommodate variations in patient anatomy. The Diamond Plate is constructed of 316L stainless steel, and has a unique concave geometry, with an opening cut in the center of the plate. The plate is designed to allow for strength and dynamic compression.

Screws

The Diamond Carpal Fusion Plate screws are also constructed of 316L stainless steel, and offer a major diameter of 2.7mm (.106") and a minor diameter of 1.4mm (.054"). While all screws are self-tapping and cancellous in design, pre-drilling with a .054" (1.4mm) K-Wire is required. The low profile screw head design is spherical allowing for oblique placement through the plate and into the carpal bones. A 2.5mm hex is used for driving these screws.



Indications & Contraindications

Indications

The Diamond Carpal Fusion System plate implant is designed for fusion of the carpal bones of the hand including; capitate, hamate, lunate, and triquetrum. The fusion plate is intended for use in patients suffering from pain and / or loss of function due to osteoarthritis, post-traumatic arthritis, fractures, revision of failed partial wrist fusions, carpal instability, or rheumatoid arthritis. The fusion plate is used in conjunction with screws that fix the plate to the carpal bones of the hand.

Please see package insert for Warnings, Precautions, Adverse Effects, and other essential product information.

Contraindications

- Active or latent infection
- Osteoporosis, insufficient quantity or quality of bone / or tissue
- Material sensitivity - if suspected perform test prior to surgery
- Sepsis
- Patients with mental or neurological conditions who are unwilling or incapable of following postoperative care instructions

Operative Technique

Dorsal Procedure

Pre-operative Assessment and Anatomy

Limited wrist fusion is often required in the treatment of advanced arthritis of the wrist. The most common conditions are scapholunate advanced collapse (SLAC wrist), and scaphoid non-union advanced collapse (SNAC wrist) (Fig. 1). Limited wrist fusion may also be required to treat failed treatment of perilunate fracture-dislocations of the wrist.

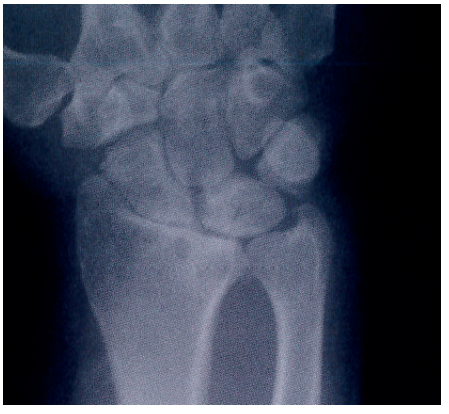


Fig. 1

Dorsal Incision

Begin with a dorsal midline or lazy "S" shaped incision on the distal radius centered on Lister's tubercle (Fig. 2). A dorsal, "T" shaped incision may also be used.

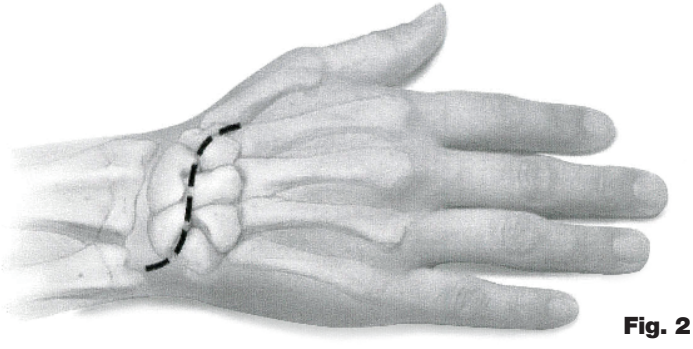


Fig. 2

Extensor Retinaculum Reflection

An incision is made in the extensor retinaculum between the 1st and 2nd extensor compartments and the extensor retinaculum reflected ulnarly (Fig. 3). This approach allows for later use of the extensor retinaculum for capsular repair, if needed.

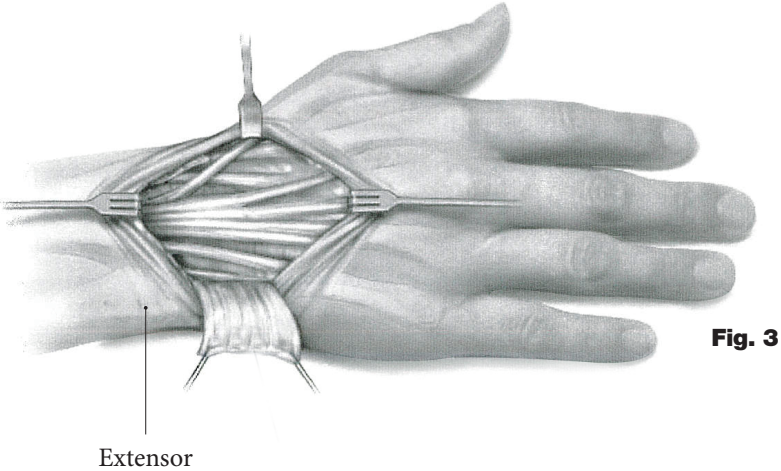


Fig. 3

Operative Technique

Capsular Exposure

Capsular exposure is preferred with a "H" shape distal flap, or a radial-based (Mayo) triangular flap (Fig. 4).

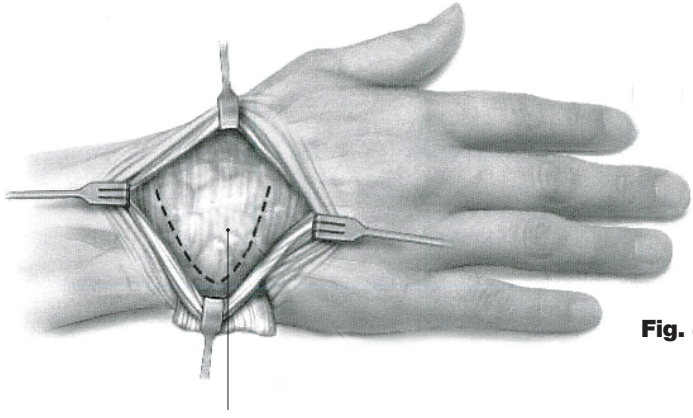


Fig. 4

Mayo Triangular
Flap Incision

Carpal Bone Exposure

The carpal bones are exposed with distal wrist traction and soft tissue capsule retraction (Fig. 5A). The proximal third to half of the scaphoid is resected for SLAC or SNAC conditions (Fig. 5B). A K-Wire can be temporarily inserted into the scaphoid to assist in bone resection.

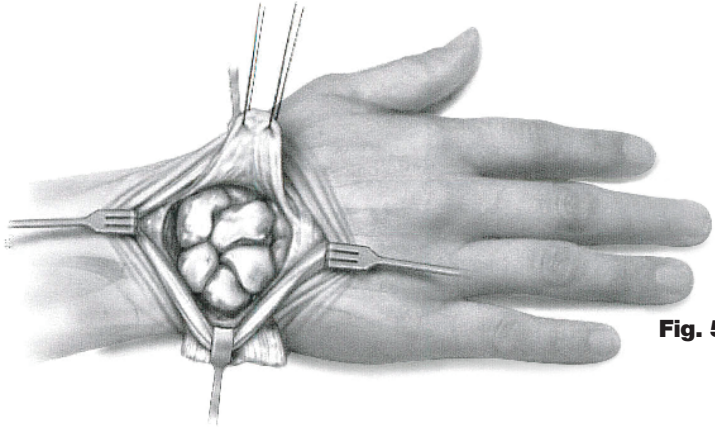


Fig. 5A

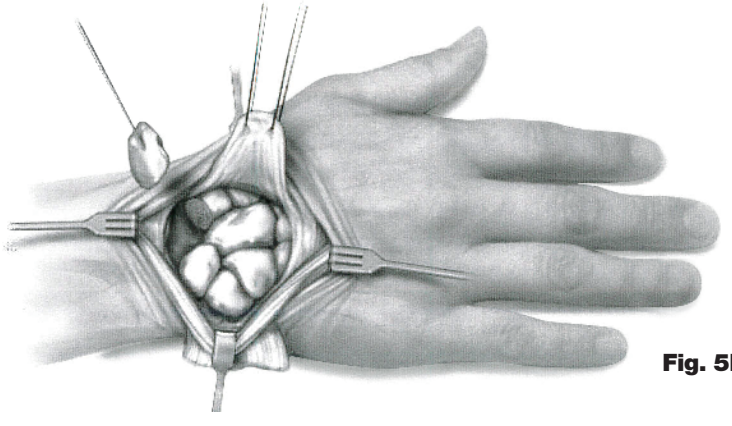


Fig. 5B

Operative Technique

Mid-Carpal Joint Cartilage Removal

Cartilage is removed from the mid-carpal joint using a rongeur, osteotome, or curette (Fig. 6). Occasionally for hard bone, a bone burr may be needed.

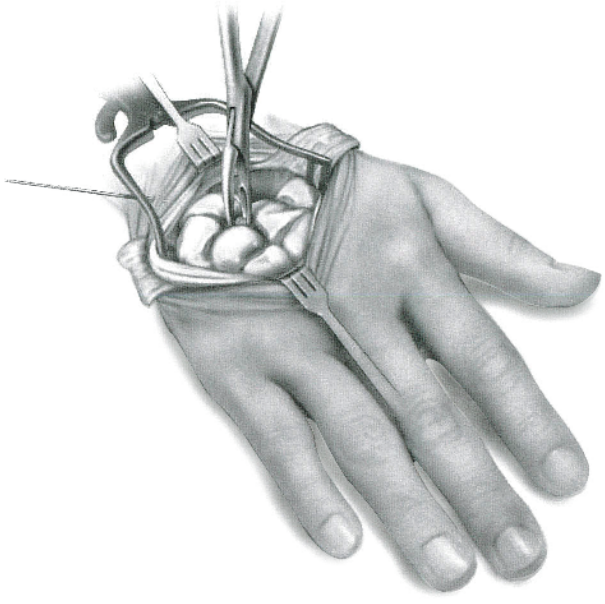


Fig. 6

Reduction of Lunate

The lunate is identified and reduced in alignment with the capitate using one of the K-Wires (Fig. 7).

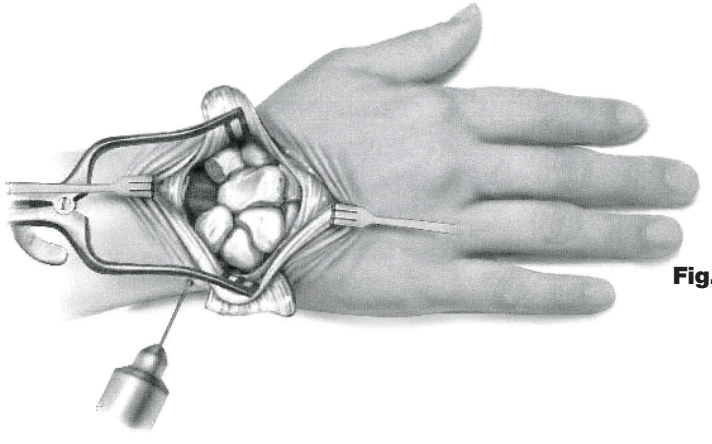


Fig. 7

Reduction of Mid-Carpal Joint

Additional K-Wires are used to hold the mid-carpal joint in alignment (Fig. 8). This includes using a K-Wire to maintain reduction of the lunate.

Note:

The Diamond Carpal Fusion System comes with ten .054" (1.4mm) diameter K-Wires.

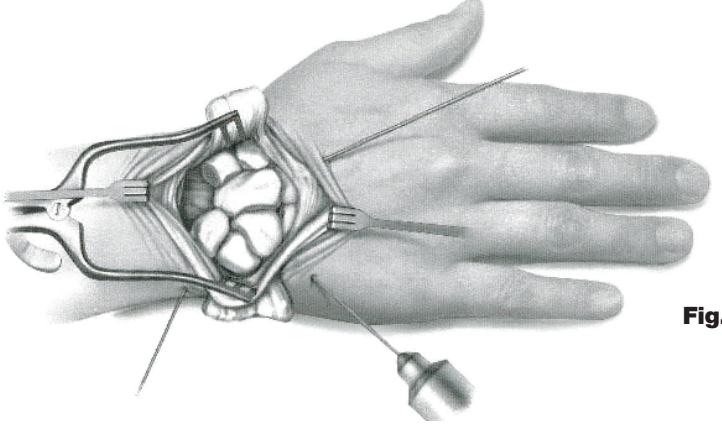


Fig. 8

Operative Technique

Rasping of Mid-Carpals

The Diamond Carpal Fusion System instrumentation includes a burr that is used to resect cortical bone from the dorsal surfaces of the lunate, capitate, hamate, and triquetrum. Cortical bone resection is needed in order to properly seat the Diamond plate (Fig. 9A). The burr can be separated from the tap handle and integrated into a standard AO power drill chuck.

Note:

When using power, care should be taken to avoid excessive removal of bone material, as well as excessive heat generation leading to necrosis.

A smooth, contoured surface should be created by the burr, and this void should only plunge as deep as the plate is thick (Fig. 9B). Any additional bone fragments can be removed using a rongeur.

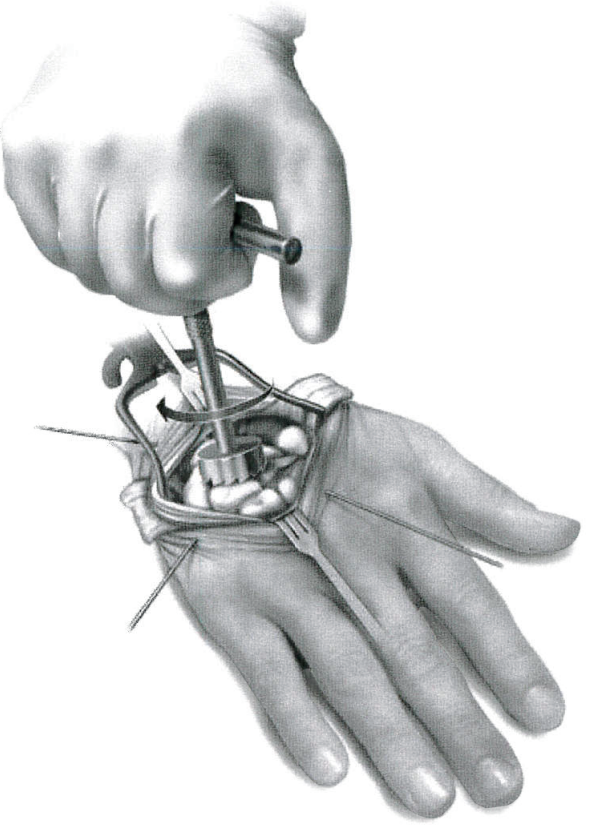


Fig. 9A

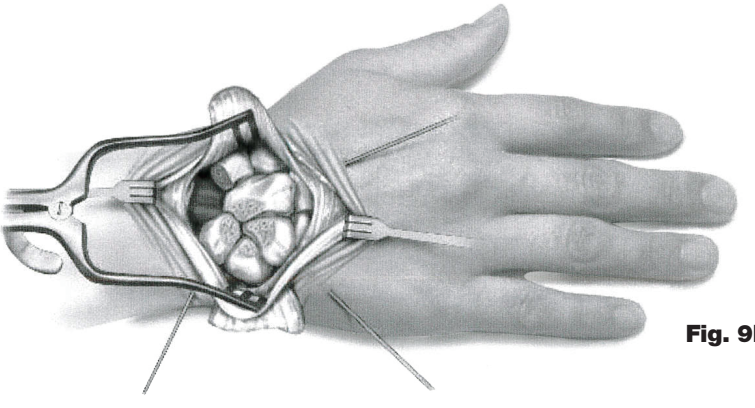


Fig. 9B

Operative Technique

Plate Selection and Placement

The two trial components in the instrument set are used to determine the appropriate size plate. Center the Diamond plate over the four corner bone fusion site (Fig. 10A). The corner of the plate that does not have an elongated screw hole is aligned with the lunate. The elongated screw holes are aligned over the hamate, capitate and triquetrum (Fig. 10B). The plate is temporarily held in position and dorsi-flexion is performed to assess whether or not there is any impingement with the dorsal ridge of the radius.

Note:

Plate placement over the lunate should be approximately 1mm distal to the articular cartilage of the lunate.

It is critical that placement be accurate so as not to have the plate impinge on the radius in dorsi-flexion. If impingement does occur, options are to move the plate distally, further recess the plate with additional burring, and / or select the smaller plate size.

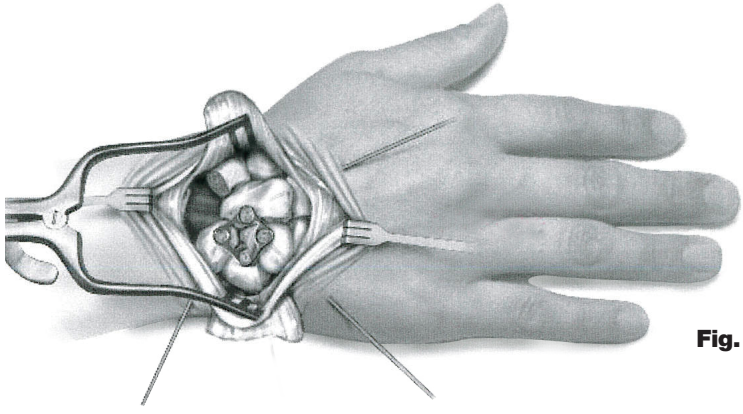


Fig. 10A

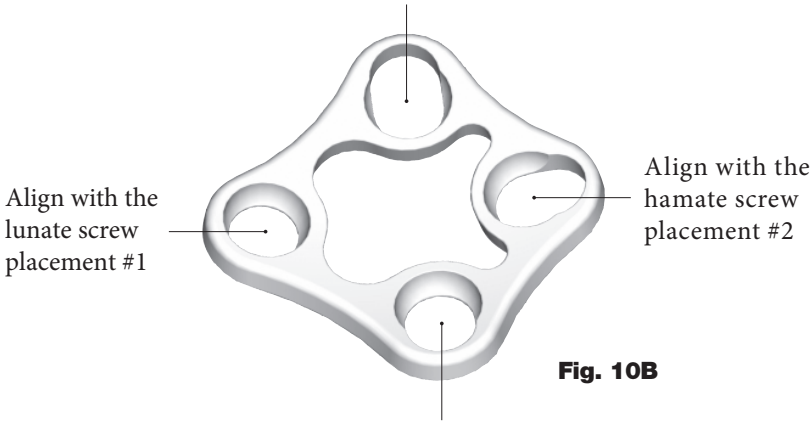


Fig. 10B

Operative Technique

Lunate Pilot Hole and Screw Placement

With the carpal bones reduced and the plate properly aligned over the lunate, use the .054" (1.4mm) K-Wire to pilot a hole in the lunate (Fig. 11A).

The depth gauge is used to determine the proper length of screw required (Fig. 11B). The lunate screw is inserted and tightened at this time (Fig. 11C). Check for dorsal impingement and reposition plate if necessary.

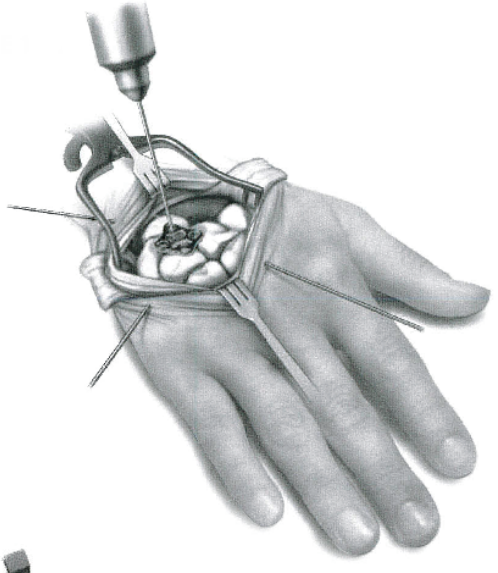


Fig. 11A

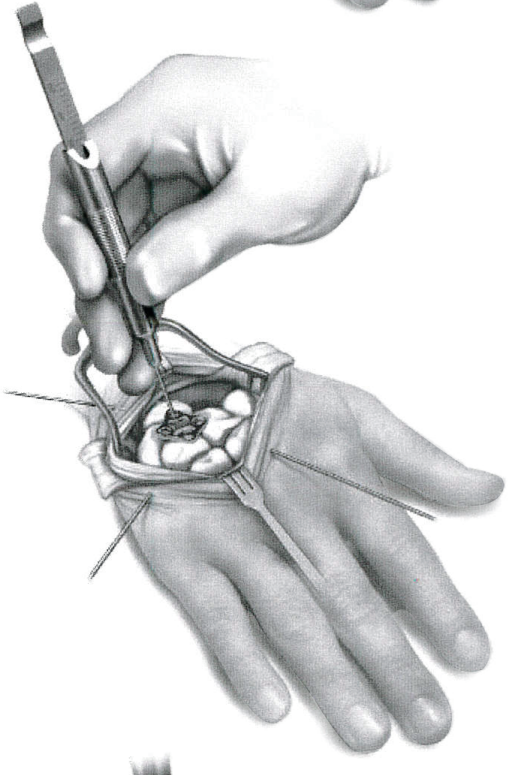


Fig. 11B

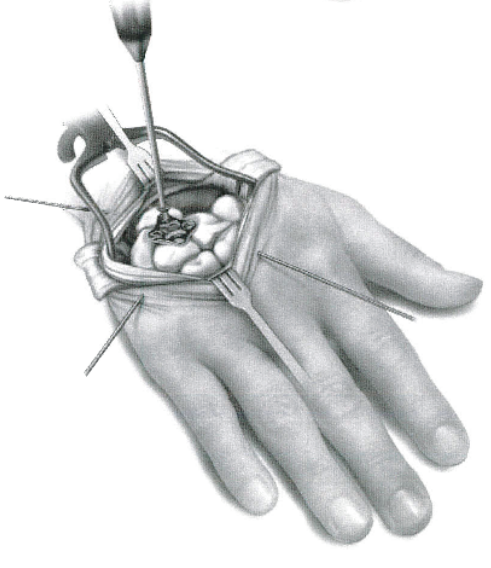


Fig. 11C

Operative Technique

Remaining Pilot Holes and Screw Placement

For the three remaining holes which are elongated, the pilot hole is again drilled with the .054" (1.4mm) K-Wire but at the far, outer edge of each hole. The elongated holes, with the screws started at the outer edge, provide the compression of the carpal bones when the screws are tightened. In each case, the pilot hole is drilled, screw length determined with the depth gauge and the screw loosely placed (do not tighten) (Fig. 12A - 12C).

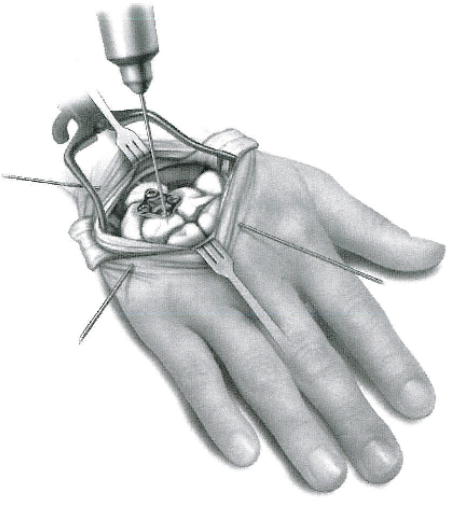


Fig. 12A

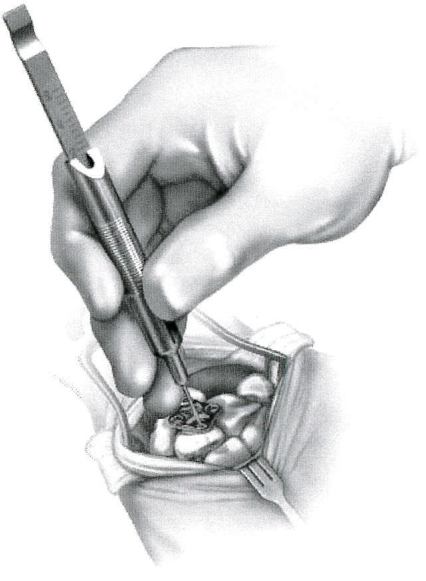


Fig. 12B

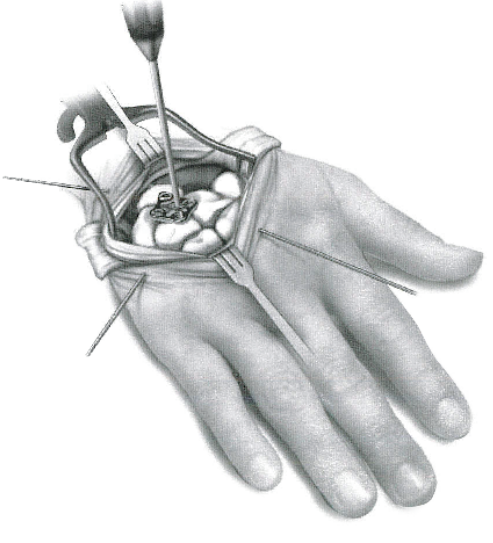


Fig. 12C

Operative Technique

Bone Graft

Cancellous autograft from the distal radius (elevating Lister's tubercle), proximal ulna, or iliac crest; cancellous allograft; or another form of bone substitute can now be placed between the bones of the mid-carpal fusion site through the central opening of the plate (Fig. 13).

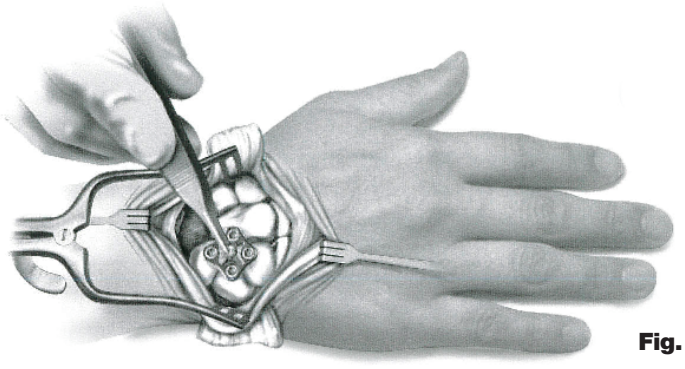


Fig. 13

Screw Tightening

After the bone graft has been inserted, the screws are tightened to compress the bones together. The lunate screw has been tightened on placement.

Tighten hamate, triquetrum and capitate screws as shown (Fig. 14). The central opening of the Diamond Carpal Fusion Plate allows manipulation of the bone graft while reducing the bones.

The temporary K-Wires are removed.

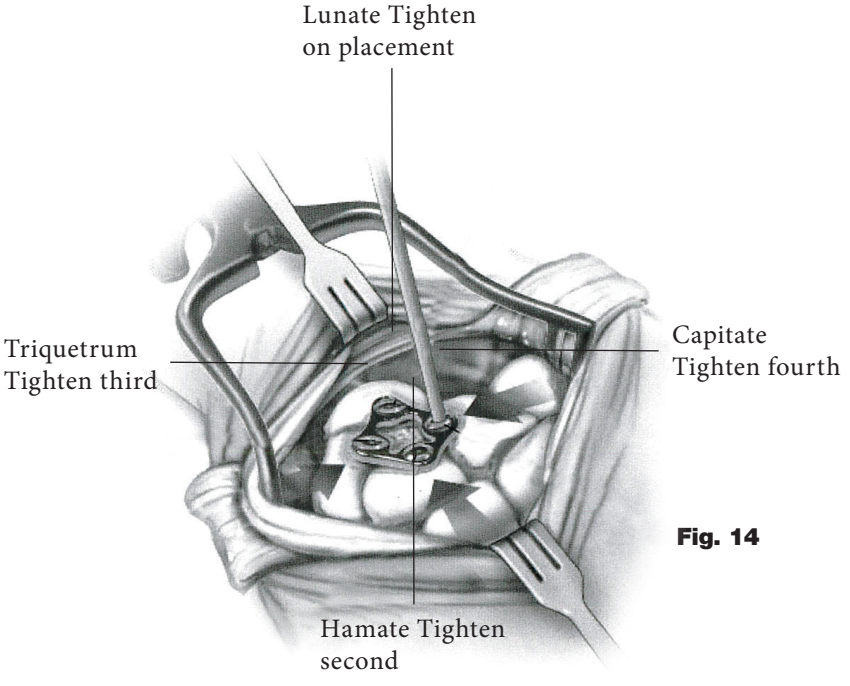


Fig. 14

Range of Motion Assessment

Using C-arm imaging, place the hand in motion in all planes to determine the stability of the fusion (Fig. 15). Look for impingement between the plate and the rim of the dorsal radius in extension. If impingement is present, consider trimming back the dorsal edge of the radius to prevent the occurrence of plate-bone impingement, or consider additional options as described in Fig. 10 of this technique.

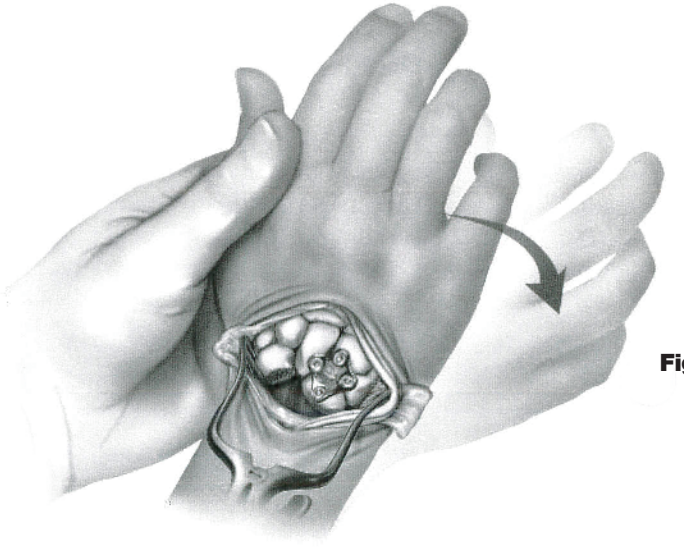


Fig. 15

Operative Technique

Capsular Closure

The dorsal wrist capsule is closed with 3.0 or 4.0 resorbable sutures (Fig. 16A). The extensor retinaculum may provide additional soft tissue reinforcement for the dorsal capsule.

The distal third of the extensor retinaculum previously preserved can be rotated beneath the extensor tendons to reinforce the dorsal capsule of the wrist. This will help insure that there is no risk to the extensor tendons abrading on the Diamond Carpal Fusion Plate (Fig. 16B).

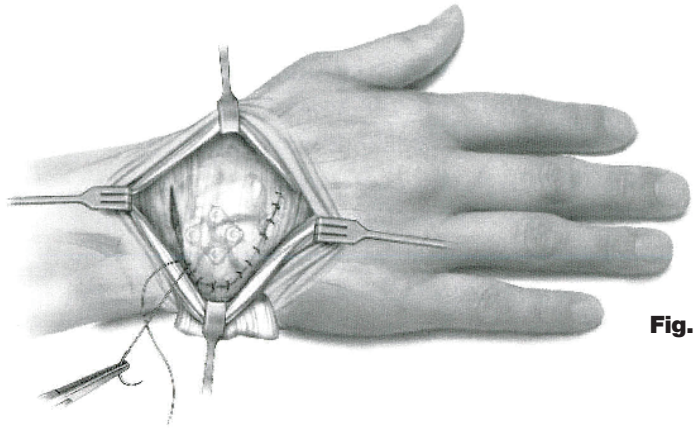


Fig. 16A

Final Capsule Repair and Closure

The remaining extensor retinaculum (proximal two-thirds) is now repaired back to the first extensor compartment with a 3.0 or 4.0 resorbable suture. The tourniquet is deflated, hemostasis obtained and subcutaneous tissue closed.

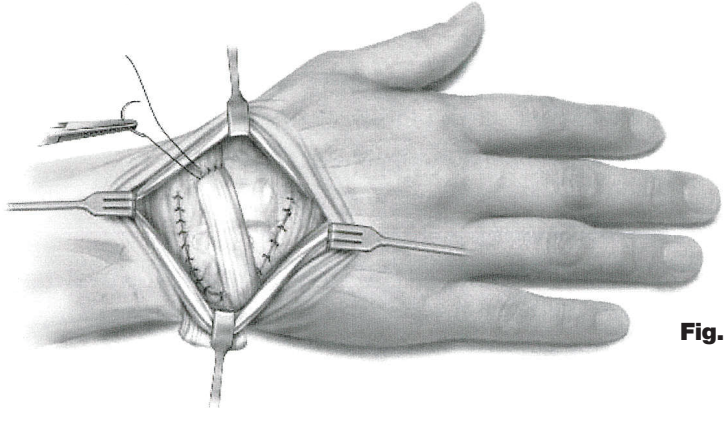


Fig. 16B

Follow Up

Post-operative treatment includes a compressive dressing with support splints for 48 hours followed by cast immobilization for 6 weeks. Rigid internal fixation of the mid-carpal fusion site may allow for cast removal in 4 weeks, and the use of removable splints with earlier range of motion rehabilitation.

Biplanar X-Rays (in some cases computed tomography) is used to confirm a solid intercarpal fusion. Anticipated range of motion is 30 - 40° extension, 25 - 30° flexion and total of 40° radio ulnar deviation, which matches the range of motion needed for most daily activities.

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