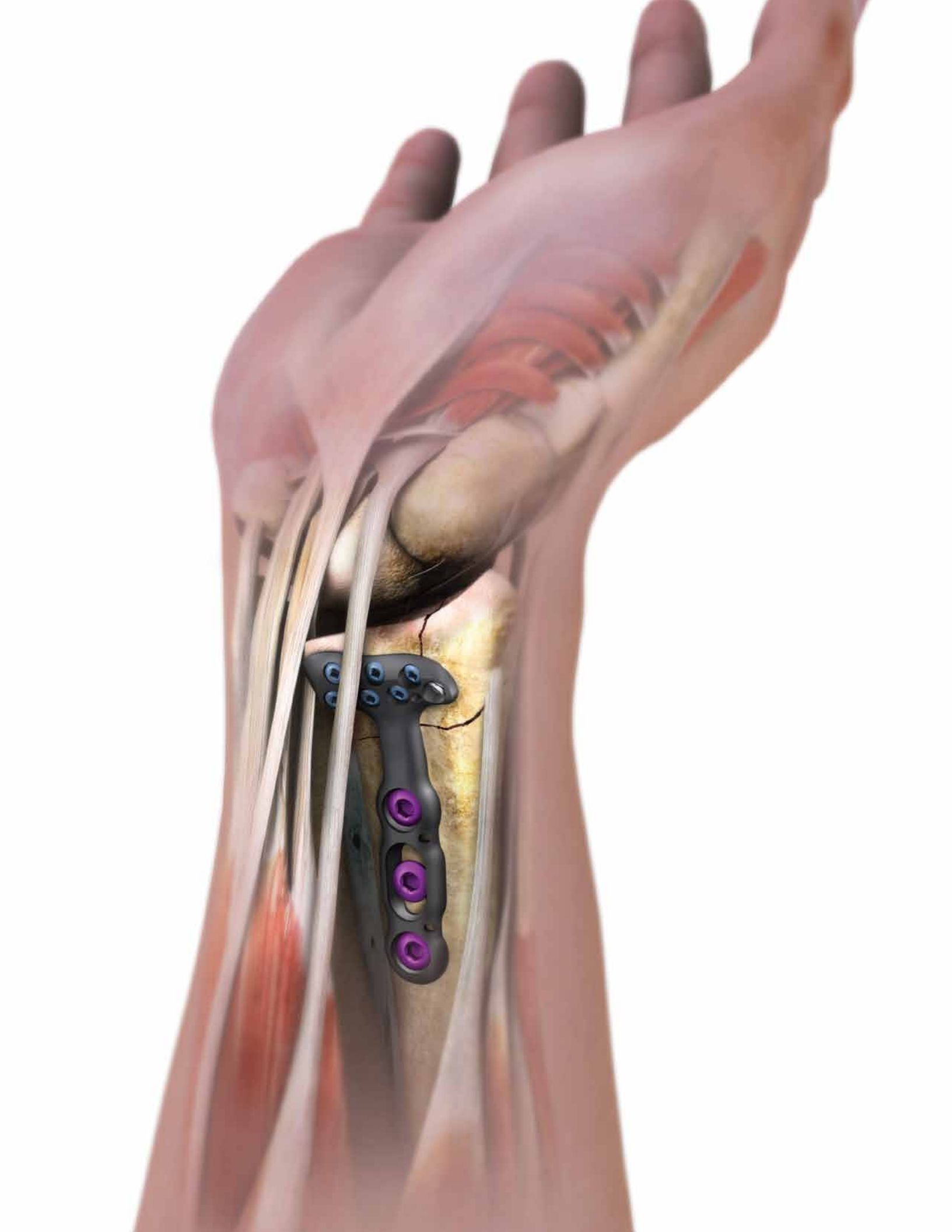
DVR® ANATOMIC
Volar Plating System

Surgical Technique

never stop moving®

DePuy TRAUMA
A division of DePuy Orthopaedics, Inc.



Introduction

In 2000 the DVR helped change the treatment of distal radius fractures. Through the past decade the DVR has been continually improved and adapted to provide a broad range of surgical options to help surgeons address the needs of their patients. With 10 years of positive clinical experience and over 350,000[1] plates sold worldwide, DePuy Orthopaedics, Inc. is proud and honored to have participated with Dr. Orbay and the surgeon community to advance the art and science of fracture fixation. DePuy Orthopaedics, Inc. is committed to providing our surgeons with the best combination of technology and service possible in order to treat their patients. We look forward to another 10 years of innovation and clinical success for the DVR® Anatomic Volar Plating System.

WW President, Trauma and Extremities
DePuy Orthopaedics, Inc.

The list of DVR innovations include:

- The first implant system with divergent pegs to capture dorsally displaced fractures from a volar approach
- A low profile implant designed to mimic the volar aspect of the bone and be used as a reduction template
- Fixed angle K-wires to confirm implant placement prior to final implantation
- F.A.S.T. GUIDE® Technology to simplify and speed up surgery
- Cobalt chrome multi-directional pegs to provide the surgeon the flexibility to adjust peg trajectories while still creating a strong, stable construct

Clinical Indications

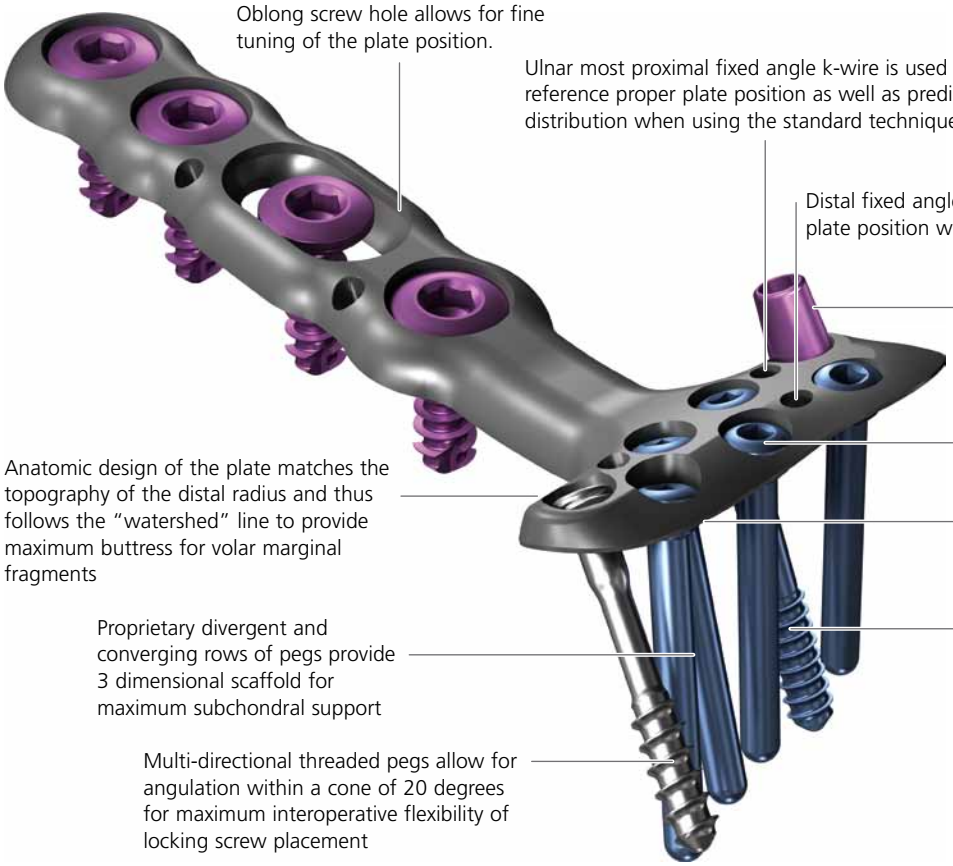
The DVR® Anatomic Plate is intended for the fixation of fractures and osteotomies involving the distal radius.

Surgical Approaches

Simple and acute fractures can be treated through the standard Flexor Carpi Radialis (FCR) approach.

Intra-articular fractures, nascent malunions and established malunions are best managed through the extended form of the FCR approach.

DVR® Anatomic Volar Plating System



Available plate sizes and lengths listed on page 18.

Screws and Pegs

Screws/Pegs		Available Lengths
Smooth Pegs (Locking)		10, 12, 14, 16, 18, 20, 22, 24, 26, 28 and 30 mm
Partially Threaded Pegs (Locking)		10, 12, 14, 16, 18, 20, 22, 24, 26, 28 and 30 mm
Multi Directional Threaded Pegs (Locking)		10, 12, 14, 16, 18, 20, 22, 24, 26, 28 and 30 mm
Cortical Bone Screws		10, 12, 13, 14, 15, 16, 18 and 20 mm
Screws (Non-locking)		10, 12,14, 16, 18, 20, 22, 24, 26, 28 and 30 mm

FCR Approach

Incision

Make an incision over the course of the flexor carpi radialis (FCR) tendon.

A zigzag incision is made across the wrist flexion creases to allow better access and visualization. (Figure 1)

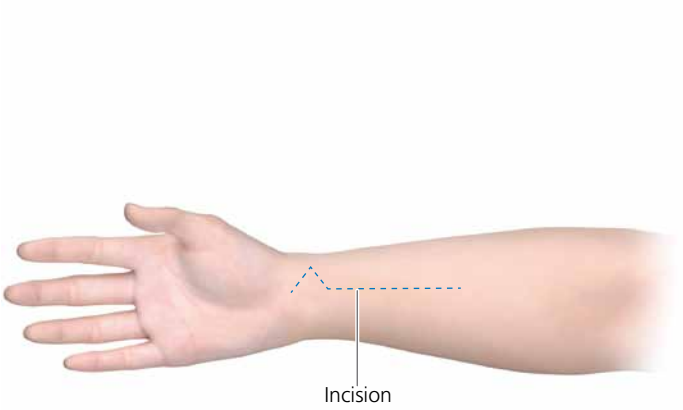


Figure 1

Release the Flexor Carpi Radialis (FCR) Tendon Sheath

Expose and open the sheath of the FCR tendon. (Figure 2)

Dissect the FCR tendon distally to the level of the superficial radial artery.

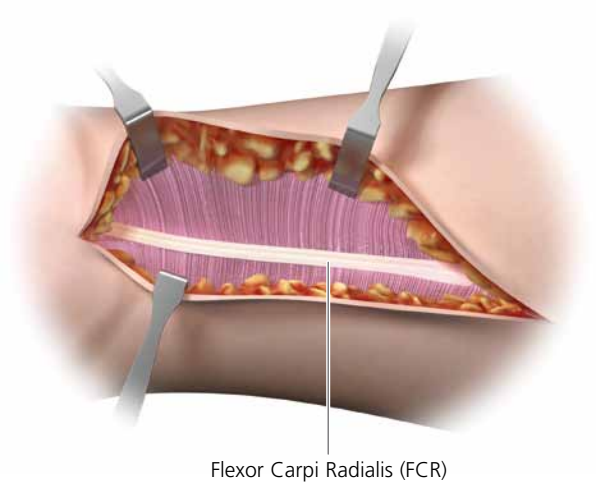


Figure 2

Crossing the Deep Fascia

Retract the FCR tendon towards the ulna while protecting the median nerve. (Figure 3)

Incise through the floor of the FCR sheath to gain access to the deeper levels.

Split the sheath of the FCR tendon distally up to the tuberosity of the scaphoid.

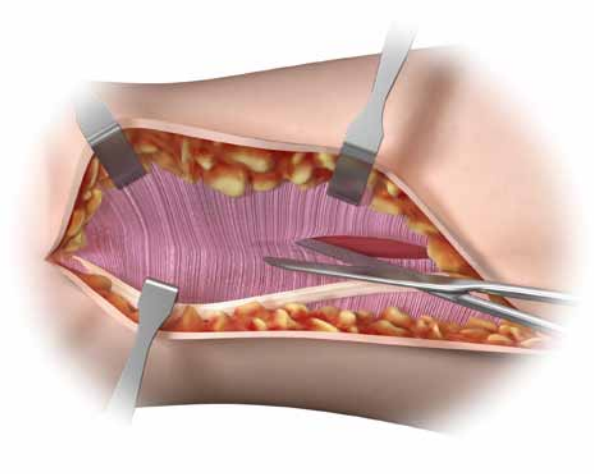


Figure 3

FCR Approach

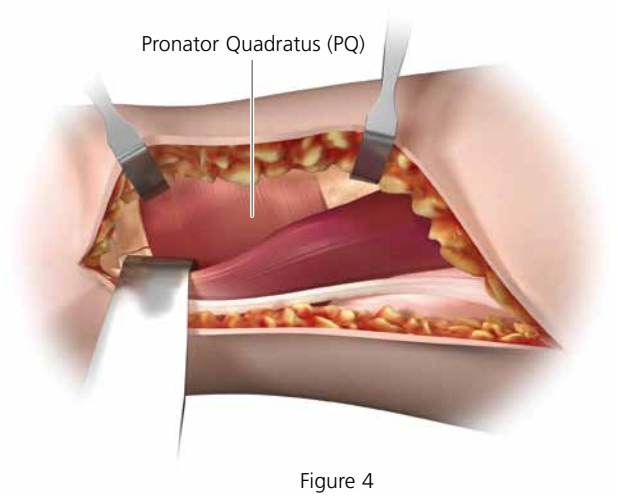


Figure 4

Mid-Level Dissection

Develop the plane between the flexor pollicis longus (FPL) and the radial septum to reach the surface of the radius.

Develop widely the subtendinous space of parona and expose the pronator quadratus muscle (PQ). (Figure 4)

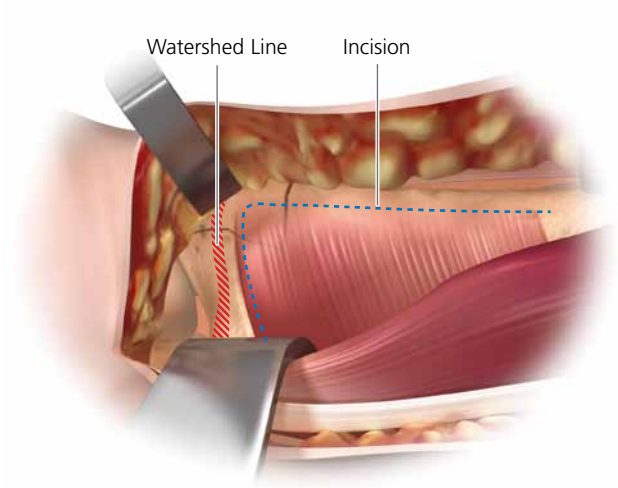


Figure 5

Identifying the Watershed Line

Palpate the radius distally to identify the volar rim of the lunate fossa. This establishes the location of the watershed line. (Figure 5)

The transitional fibrous zone (TFZ) is a 1 cm wide band of fibrous tissue located between the watershed line and the PQ that must be elevated to properly visualize the fracture.

Release the PQ by sharply incising over the watershed line and proximally on the lateral edge of the radius. (Figure 5)

Elevating the Pronator Quadratus (PQ)
Use a periosteal elevator to elevate the PQ to expose the volar surface of the radius. (Figure 6)

The fracture line on the volar cortex is usually simple, facilitating reduction.

The origin of the FPL muscle can be partially released for added exposure.

Note: *The pronator quadratus is frequently ruptured.*

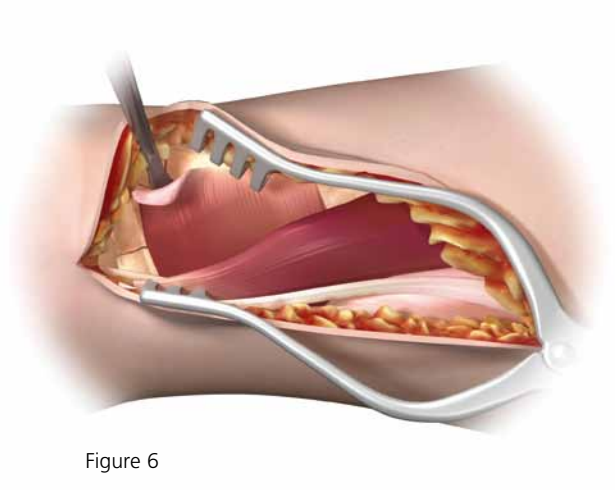


Figure 6

Caution: Please refer to Warning and Precautions Section on Page 21.

Release of the Distal Fragment
Release the insertion of the brachioradialis which is found on the floor of the first compartment in a step cut fashion. (Figure 7)

Note: *The brachioradialis is the prime deforming force of the distal fragment.*

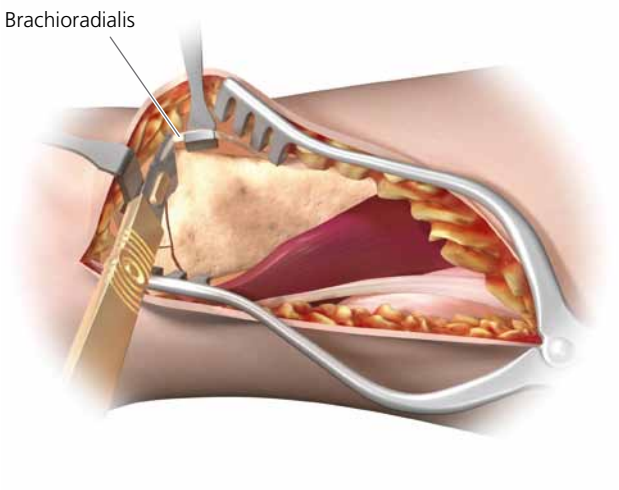


Figure 7

Identify and retract the Abductor Pollicis Longus (APL) and Extensor Pollicis Brevis (EPB) tendons.

Note: *Care should be taken to protect the radial artery.*

Extended FCR Approach

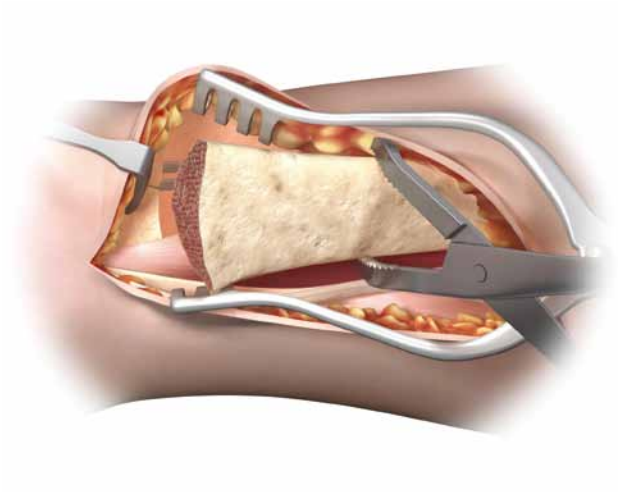


Figure 8

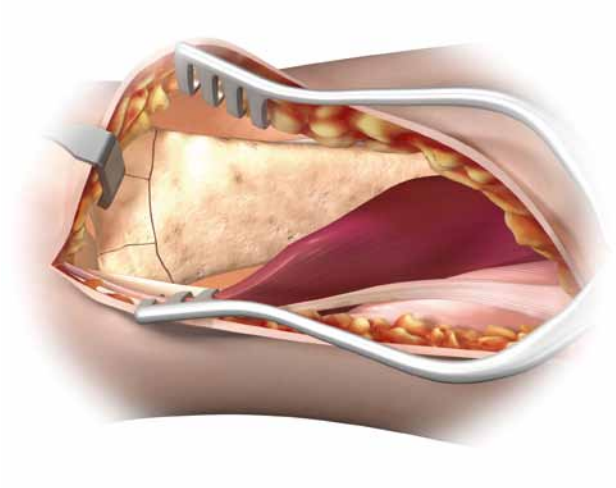


Figure 9

The Extended FCR Approach
Pronation of the proximal fragment out of the way provides exposure to the dorsal aspect of the fracture allowing fracture debridement and reduction.

Intra-Focal Exposure
Intra-focal exposure is obtained by pronating the proximal fragment out of the way. A bone clamp facilitates this maneuver. (Figure 8)

Preserve the soft tissue attachments to the medial aspect of the proximal fragment.

Note: *This is where the anterior interosseous vessels that feed the radial shaft are located.*

Provisional Fracture Reduction
After fracture debridement, supinate the proximal radius back into place and restore radial length by reducing the volar cortex. (Figure 9)

Proximal Plate Positioning

Determine the correct position for the plate by judging how the plate conforms to the watershed line and the volar surface of the radius.

Using the 2.5 mm bit, drill through the proximal oblong hole of the plate, which will allow for plate adjustments. (Figure 10)

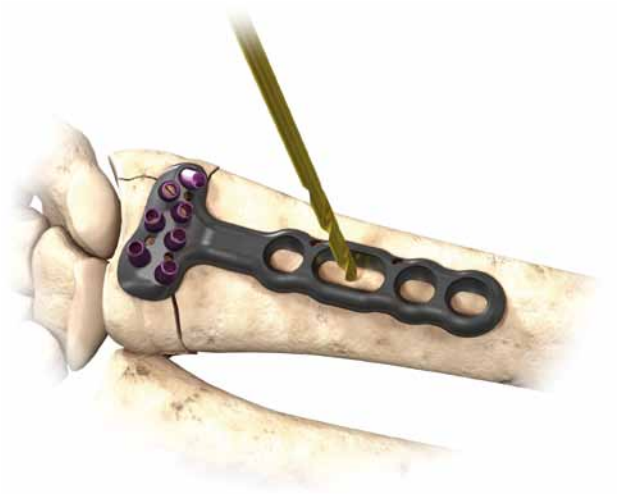


Figure 10

Measure the required screw depth using the flat side of the Depth Gauge. (Figure 11)

Figure 11

Insert the appropriate length cortical screw. (Figure 12)

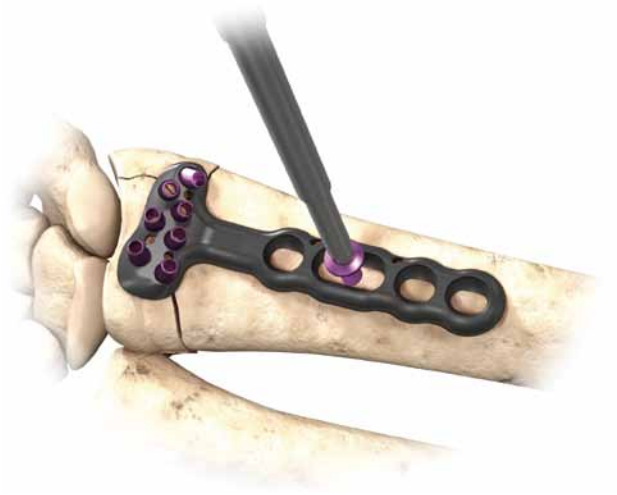


Figure 12

Distal Plate Fixation

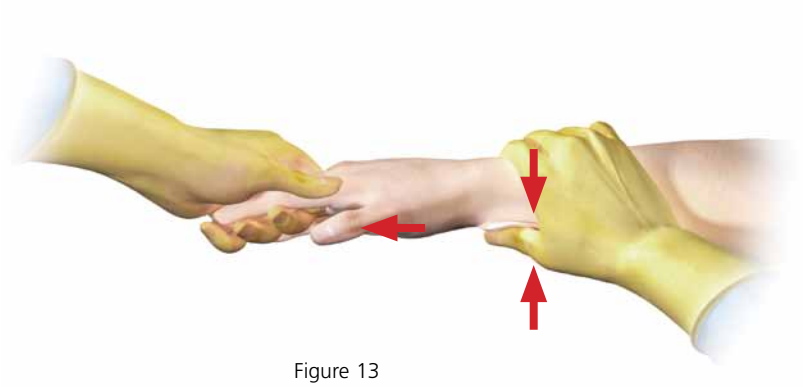


Figure 13

Final Fracture Reduction

Final reduction is obtained by indirect means using the DVR Anatomic Plate as a template, then applying traction, ligamentotaxis and direct pressure over the dorsal aspect. (Figure 13)

Note: *A properly applied bolster helps to maintain the reduction.*

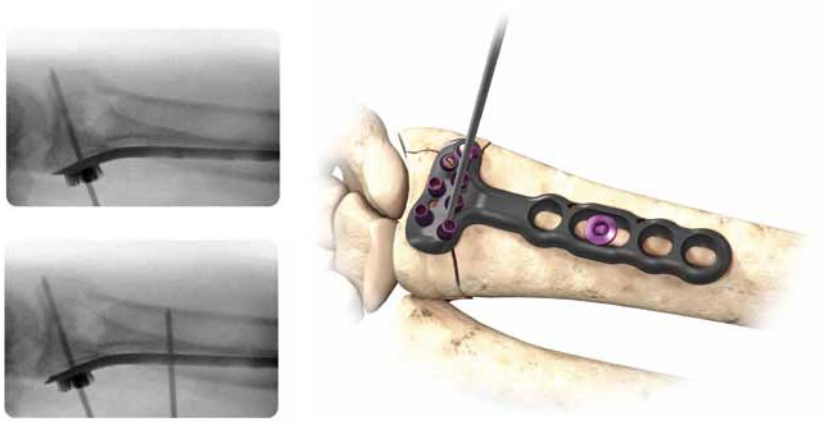


Figure 14

Distal Plate Fixation

First, secure the distal fragment to the plate by inserting a k-wire through the most ulnar k-wire hole on the proximal row. (Figure 14) Proper plate positioning can be confirmed by obtaining a 20-30 degree lateral. The k-wire should be 2–3 mm subchondral to the joint line on this view.

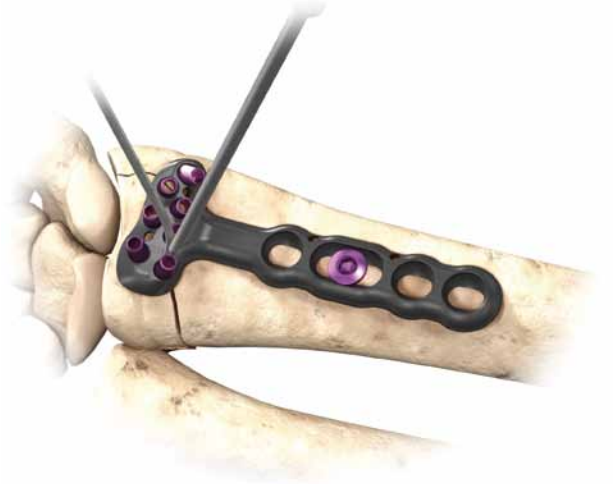


Figure 15

Drilling the Proximal Rows

Using a 2.0 mm bit, drill through the proximal single-use F.A.S.T. GUIDE starting on the ulnar side in order to stabilize the lunate fossa. (Figure 15)

Note: *Bend the K-wire out of the way to facilitate drilling.*

Gauging Through the F.A.S.T. GUIDE
Assess carefully the length of the proximal row pegs with the appropriate side of the depth gauge. (Figure 16)

Caution: Avoid excessive peg length as this can potentially cause extensor tendon irritation.

Note: *if the F.A.S.T. GUIDE is removed before gauging the screw depth, use the scale on the flat side of the depth gauge.*

Figure 16

Proximal Peg Placement
Remove each F.A.S.T. GUIDE with the peg driver after checking the drilled depth. (Figure 17)

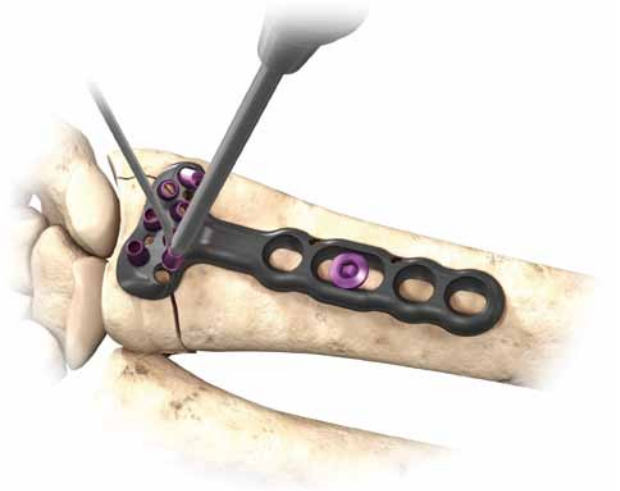


Figure 17

Using the same peg driver, fill the peg holes with the appropriate length peg. (Figure 18)

Note: *The use of threaded pegs will help to capture dorsal comminuted fragments.*

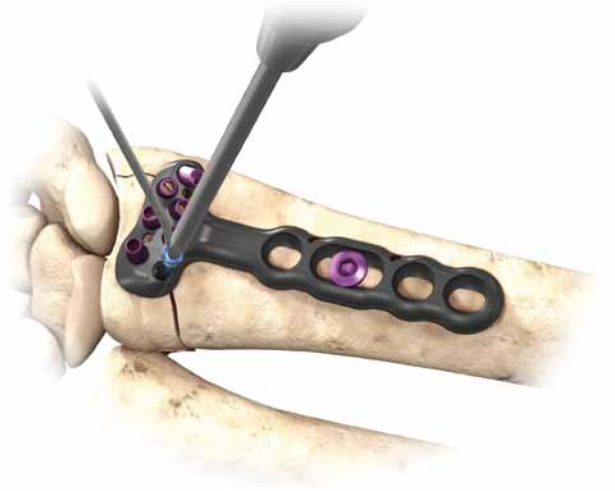


Figure 18

Final Proximal Plate Fixation

Figure 19

Final Plate Fixation
Fill all the holes of the distal peg row.

As the distal row converges on the proximal row between 16 mm and 18 mm, an 18 mm length peg is all that is needed in the distal row.

Apply the remaining proximal cortical screws. (Figure 19) SP screws are not intended to provide subchondral support and use should be limited to capture of remote bone fragments where partially threaded pegs can not be used.

Note: *The proximal row of pegs provides support to the dorsal aspect of the articular surface. The distal row of pegs provides support to the central and volar aspects of the subchondral plate.*

Remove all F.A.S.T. GUIDE even if the peg hole is not used.

Figure 20

Final Radiographs
A 20° – 30° elevated lateral fluoroscopic view allows visualization of the articular surface, evaluation of volar tilt, and confirmation for proper peg placement 2 – 3 mm proximal to the subchondral plate. (Figure 20)

To confirm that the length of each individual peg is correct, pronate and supinate the wrist under fluoroscopy.

Final Appearance

Final Appearance
A properly applied plate should be just proximal to the watershed line and not project above or beyond it in order to avoid contact with the flexor tendons. (Figure 21)

Wound Closure
Repair the TFZ in order to cover the distal edge of the DVR Anatomic Plate.

Repair the brachioradialis.

Suture the PQ to the TFZ and the repaired brachioradialis.

Figure 21

Distal Fragment First Technique
For Established Malunions

Complete exposure and place a K-wire 2 – 3 mm proximal to the articulating surface and parallel to the joint line.

Figure 22

Note: *Use the K-wire hole on the distal row of the DVR Anatomic Plate as a guide for proper K-wire placement. (Figure 22)*

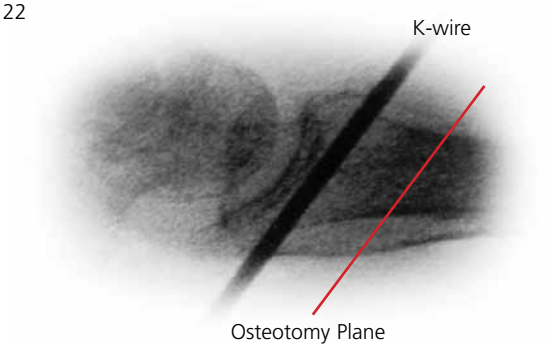


Figure 23

Create the osteotomy plane parallel to the K-wire. (Figure 23)

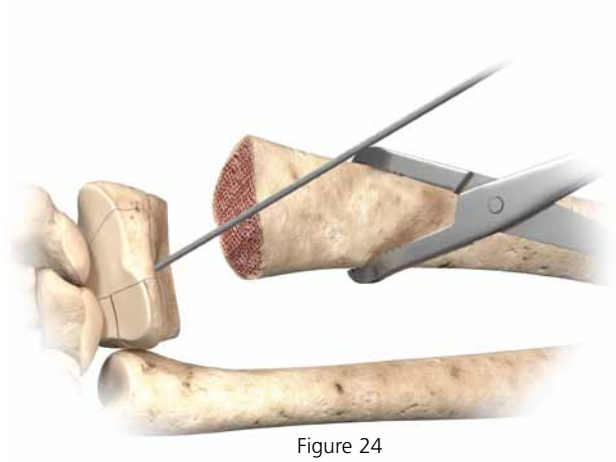


Figure 24

Release the brachioradialis, then pronate the radius and release the dorsal periosteum. (Figure 24)

Note: *The location of the distal peg rows can be identified and drilled prior to the osteotomy.*

Supinate the proximal fragment and slide the DVR Anatomic Plate over the K-wire. (Figure 25) The K-Wire will assure proper restoration of volar tilt.

Figure 25

Fix the DVR Anatomic Plate to the distal fragment. (Figure 26) The watershed line provides guidance for proper radiolunate deviation.

Once distal fixation is complete, the tail of the implant is secured to the shaft of the radius to re-create the 12 degrees of normal volar tilt.

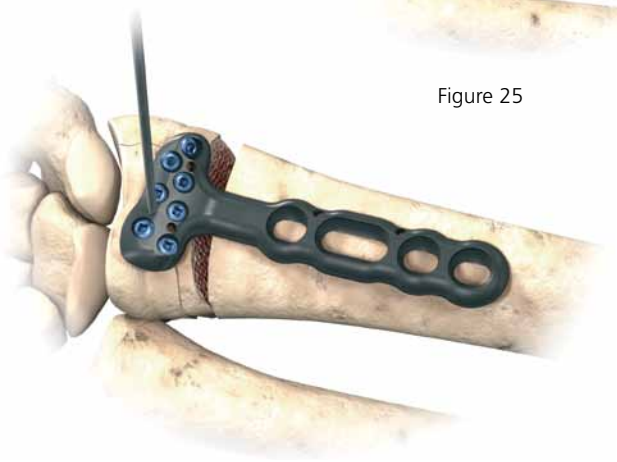


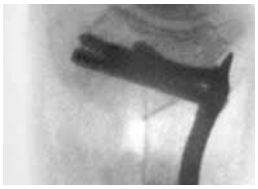
Figure 26

Figure 27

After fixation, autograft is applied and the wound closed. (Figure 28)

Confirm postoperative results with radiographs.

Figure 28



Installation of Multi Directional Threaded Peg

Figure 29

Ensure that the fixed-angle pegs have been installed prior to installing the MDTP.

Remove the F.A.S.T. GUIDE using the peg driver.

Place the 2.0 mm end of the Soft Tissue Guide (STG) into the radial styloid and/or the most ulnar hole in the proximal row of the DVR Anatomic plate.

Note: *The MDTPs are not recommended for the distal row.*

Place the 2.0 mm drill bit through the STG until it comes in contact with the bone. Determine the trajectory of the drill bit by varying the angle of the STG and drill (Figure 29). The MDTP's can be successfully installed within a cone of 20 degrees off of the fixed angle trajectory.

Figure 30

Assemble the Multi Direct 2.0 mm insert (231211002) into the modular handle (MQC), verifying that it is firmly attached. (Figure 30)

Measure the depth of the hole using the flat side of the F.A.S.T. Bone Depth Gauge (FBDG). (Figure 31)

Figure 31

Load the appropriately sized MDTP into the driver. The peg should grip the driver. (Figure 32)

Figure 32

Install the MDTP into the pre-drilled hole. Be careful to keep the driver fully engaged with the peg. Install the peg firmly until increased torque yields in no further rotation. (Figure 33)

Note: *If necessary, after installation the MDTP can be removed and reinstalled to further improve positioning.*

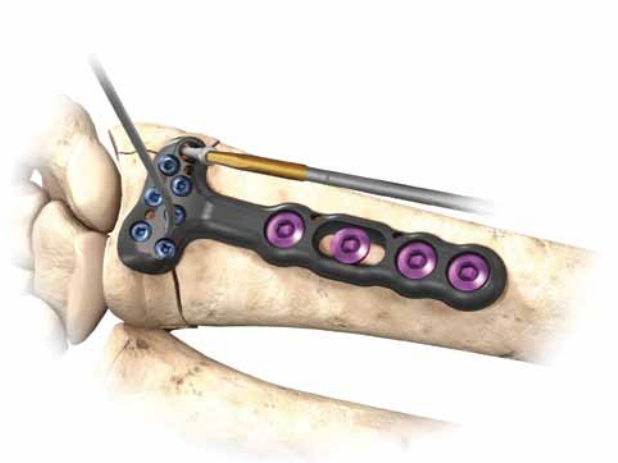


Figure 33

Ordering Information

Pegs and Screws

Smooth Peg, Locking
Provides subchondral support

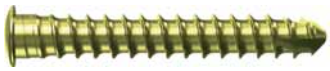
PXX000
Diameter: 2.0 mm
10 mm – 30 mm lengths (2 mm steps)

Threaded Peg, Locking
Distal threads to capture and lag fragments

TPXX000
Diameter 2.5 mm
10 mm – 30 mm lengths (2 mm steps)

Multi Directional Threaded Peg
Provides interoperative freedom to vary the trajectory of a fixed angle locking trajectory within a cone of 20 degrees.

1312111XX
Diameter: 2.5 mm
10 mm – 30 mm lengths (2 mm steps)



Screws, Non-Locking
Fully threaded to anchor fragments for added fixation

SPXX000
Diameter: 2.5 mm
10 mm – 30 mm lengths (2 mm steps)

Cortical Screws
Provide bicortical fixation for proximal fragments

CSXX000
Diameter: 3.5 mm
10,12,13,14,15,16, 18 and 20 mm

DVR® Anatomic Plates

Narrow Short:
22 mm x 50 mm
DVRANSL
DVRANSR

Narrow Standard:
22 mm x 57 mm
DVRANL
DVRANR

Wide:
28 mm x 63 mm
DVRAWL
DVRAWR

Standard Short:
24 mm x 51 mm
DVRASL
DVRASR

Standard:
24 mm x 60 mm
DVRAL
DVRAR

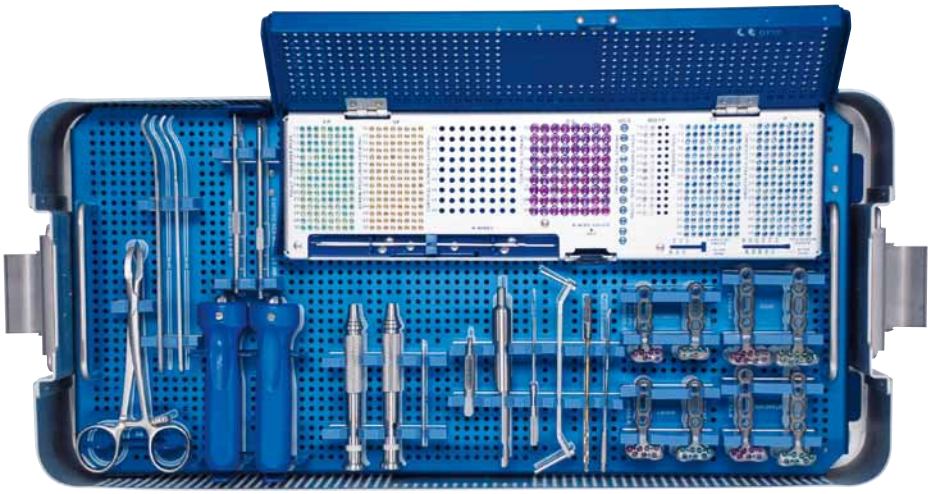
Standard Extended:
24 mm x 90 mm
DVRAXL
DVRAXR

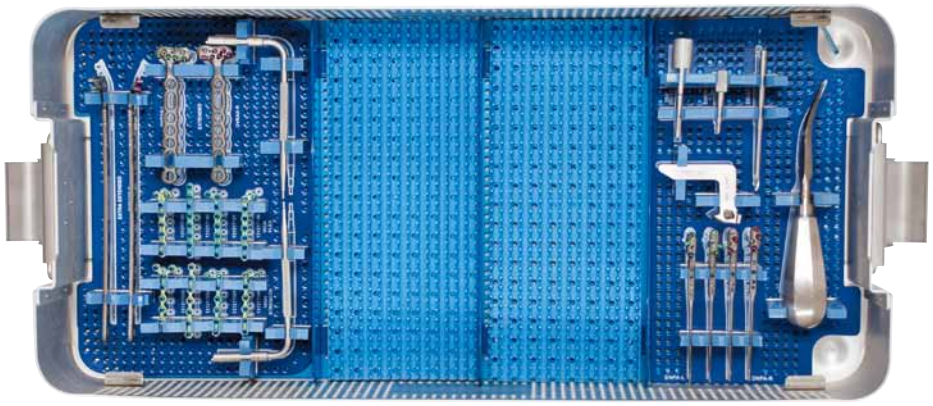
Standard Extra Extended:
24 mm x 175 mm
DVRAXXL
DVRAXXR

DVR® Anatomic Plate Modular Tray

Fully modular tray system addresses multiple applications
with the use of a single tray

- Reduced OR Instruments
- Improved Workflow





System Instrumentation

DG20	Drill Guide 2.0
FPD20	Peg Driver F.A.S.T.
FBDG	Bone Depth Gauge F.A.S.T.
SDG	Depth Gauge Sleeveless
MQC	Handle Peg Driver/Handle Mini Quick Connect
BC	Bone Clamp DR
MHR	Retractor Mini Hohmann
STG	Soft Tissue Guide DR
231211000	Modular QK Connect Handle
231211001	Captive Insert
231211002	MDTP Driver Mini Quick Connect

Cortical Screws

CS10000	Screw Cortical 3.5mm, 10mm
CS12000	Screw Cortical 3.5mm, 12mm
CS13000	Screw Cortical 3.5mm, 13mm
CS14000	Screw Cortical 3.5mm, 14mm
CS15000	Screw Cortical 3.5mm, 15mm
CS16000	Screw Cortical 3.5mm, 16mm
CS18000	Screw Cortical 3.5mm, 18mm
CS20000	Screw Cortical 3.5mm, 20mm

Steel Tray

DRT	Sterilization Tray DVR Anatomic
DRTSC	Screw Caddy DRT

Disposables:

FDB20	Drill Bit F.A.S.T. 2.0mm
DB25	Drill Bit 2.5mm
KW062SS	KWIRE 1.6MM SS

Plate System

DVRAR	DVR Anatomic Standard Right with F.A.S.T. Guides
DVRAL	DVR Anatomic Standard Left with F.A.S.T. Guides
DVRAXR	DVR Anatomic Ext Right with F.A.S.T. Guides
DVRAXL	DVR Anatomic Ext Left with F.A.S.T. Guides
DVRASR	DVR Anatomic Short Right with F.A.S.T. Guides
DVRASL	DVR Anatomic Short Left with F.A.S.T. Guides
DVRANR	DVR Anatomic Narrow Right with F.A.S.T. Guides
DVRANL	DVR Anatomic Narrow Left with F.A.S.T. Guides
DVRANSR	DVR Anatomic Narrow Short Right with F.A.S.T. Guides
DVRANSL	DVR Anatomic Narrow Short Left with F.A.S.T. Guides
DVRAWR	DVR Anatomic Wide Head Right with F.A.S.T. Guides
DVRAWL	DVR Anatomic Wide Head Left with F.A.S.T. Guides
DVRAXXR	DVR Anatomic Extra Ext Right with F.A.S.T. Guides
DVRAXXL	DVR Anatomic Extra Ext Left with F.A.S.T. Guides

Smooth Pegs

P10000	Peg Smooth 2.0mm, 10mm
P12000	Peg Smooth 2.0mm, 12mm
P14000	Peg Smooth 2.0mm, 14mm
P16000	Peg Smooth 2.0mm, 16mm
P18000	Peg Smooth 2.0mm, 18mm
P20000	Peg Smooth 2.0mm, 20mm
P22000	Peg Smooth 2.0mm, 22mm
P24000	Peg Smooth 2.0mm, 24mm
P26000	Peg Smooth 2.0mm, 26mm
P28000	Peg Smooth 2.0mm, 28mm
P30000	Peg Smooth 2.0mm, 30mm

Screw Pegs (Non-Locking)

SP10000	Peg Screw 2.5mm, 10mm
SP12000	Peg Screw 2.5mm, 12mm
SP14000	Peg Screw 2.5mm, 14mm
SP16000	Peg Screw 2.5mm, 16mm
SP18000	Peg Screw 2.5mm, 18mm
SP20000	Peg Screw 2.5mm, 20mm
SP22000	Peg Screw 2.5mm, 22mm
SP24000	Peg Screw 2.5mm, 24mm
SP26000	Peg Screw 2.5mm, 26mm
SP28000	Peg Screw 2.5mm, 28mm
SP30000	Peg Screw 2.5mm, 30mm

Threaded Pegs

TP10000	Peg Thread 2.5mm, 10mm
TP12000	Peg Thread 2.5mm, 12mm
TP14000	Peg Thread 2.5mm, 14mm
TP16000	Peg Thread 2.5mm, 16mm
TP18000	Peg Thread 2.5mm, 18mm
TP20000	Peg Thread 2.5mm, 20mm
TP22000	Peg Thread 2.5mm, 22mm
TP24000	Peg Thread 2.5mm, 24mm
TP26000	Peg Thread 2.5mm, 26mm
TP28000	Peg Thread 2.5mm, 28mm
TP30000	Peg Thread 2.5mm, 30mm

Multidirectional Threaded Pegs (MDTP)

131211110	Peg Thread Multidir 2.5X10Mm
131211112	Peg Thread Multidir 2.5X12Mm
131211114	Peg Thread Multidir 2.5X14Mm
131211116	Peg Thread Multidir 2.5X16Mm
131211118	Peg Thread Multidir 2.5X18Mm
131211120	Peg Thread Multidir 2.5X20Mm
131211122	Peg Thread Multidir 2.5X22Mm
131211124	Peg Thread Multidir 2.5X24Mm
131211126	Peg Thread Multidir 2.5X26Mm
131211128	Peg Thread Multidir 2.5X28Mm
131211130	Peg Thread Multidir 2.5X30Mm

Notes

DVR® Anatomic Volar Plating System

EPI date: 1/21/08

Important

This Essential Product Information sheet does not include all of the information necessary for selection and use of a device. Please see full labelling for all necessary information.

Indications (DVR® Anatomic and DNP® Anatomic Systems)

The Distal Radius Fracture Repair System is intended for the fixation of fractures and osteotomies involving the distal radius.

Indications (Fragment Plate System)

The Fragment Plate System is intended for essentially non-load bearing stabilization and fixation of small bone fragments in fresh fractures, revision procedures, joint fusion and reconstruction of small bones of the hand, foot, wrist, ankle, humerus, scapula, finger, toe, pelvis and craniomaxillofacial skeleton.

Contraindications

If any of the following are suspected, tests are to be performed prior to implantation. Active or latent infection. Sepsis. Insufficient quantity or quality of bone and/or soft tissue. Material sensitivity. Patients who are unwilling or incapable of following post operative care instructions.

Warning and Precautions

Although the surgeon is the learned intermediary between the company and the patient, the important information conveyed in this document should be conveyed to the patient. The patient must be cautioned about the use, limitations and possible adverse effects of these implants. The patient must be warned that failure to follow postoperative care instructions may cause the implant or treatment to fail.

An implant must never be reused. Previous stresses may have created imperfections that can potentially lead to device failure. Protect implant appliances against scratching or nicking. Such stress concentration can lead to failure.

Orthopaedic instrumentation does not have an indefinite functional life. All re-usable instruments are subjected to repeated stresses related to bone contact, impaction, routine cleaning and sterilization processes. Instruments should be carefully inspected before each use to ensure that they are fully functional. Scratches or dents can result in breakage. Dullness of cutting edges can result in poor functionality. Damaged instruments should be replaced to prevent potential patient injury such as metal fragments into the surgical site. Care should be taken to remove any debris, tissue or bone fragments that may collect on the instrument. Most instrument systems include inserts/trays and a container(s). Many instruments are intended for use with a specific implant system. It is essential that the surgeon and operating theatre staff are fully familiar with the appropriate surgical technique for the instruments and associated implant, if any.

- Do NOT open the volar wrist capsule. Doing so may cause devascularisation of the fracture fragments and destabilisation of the volar wrist ligaments.
- If necessary, contour the DVR® Anatomic plate in small increments. Excessive contouring may weaken or fracture the plate.
- Exercise care when bending the fragment plates to avoid weakening or fracture of the plates.
- Ensure removal of all F.A.S.T. GUIDE inserts after use.
- Do NOT use fully threaded pegs (FP) with the DVR® Anatomic and DNP® Anatomic plates. The fully threaded pegs (FP) are designed for use with the fragment plates.
- Do NOT use peg/screw lengths that will excessively protrude through the far cortex. Protrusion through the far cortex may result in soft tissue irritation.
- SP series screws are NOT intended to provide subchondral support and use should be limited to capture of remote bone fragments where partially or fully threaded pegs cannot be used.
- Do NOT permanently implant K-wires through the holes of the plate as they may back out and cause tissue damage. Use of the K-wires allows you to provisionally secure the plates to the anatomy.
- Do NOT use the MDTPs in the distal row of the DVR® Anatomic Plate. The MDTPs are intended to be used only with the DVR® Anatomic plates. Ensure the MDTPs are installed after insertion of the fixed angle pegs.

Adverse Effects

The following are possible adverse effects of these implants: potential for these devices failing as a result of loose fixation and/or loosening, stress, excessive activity, load bearing particularly when the implants experience increased loads due to a delayed union, nonunion, or incomplete healing.

Note: It is NOT required to remove F.A.S.T. GUIDE inserts to sterilize the plate.

References

1. DePuy Internal Sales Data

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