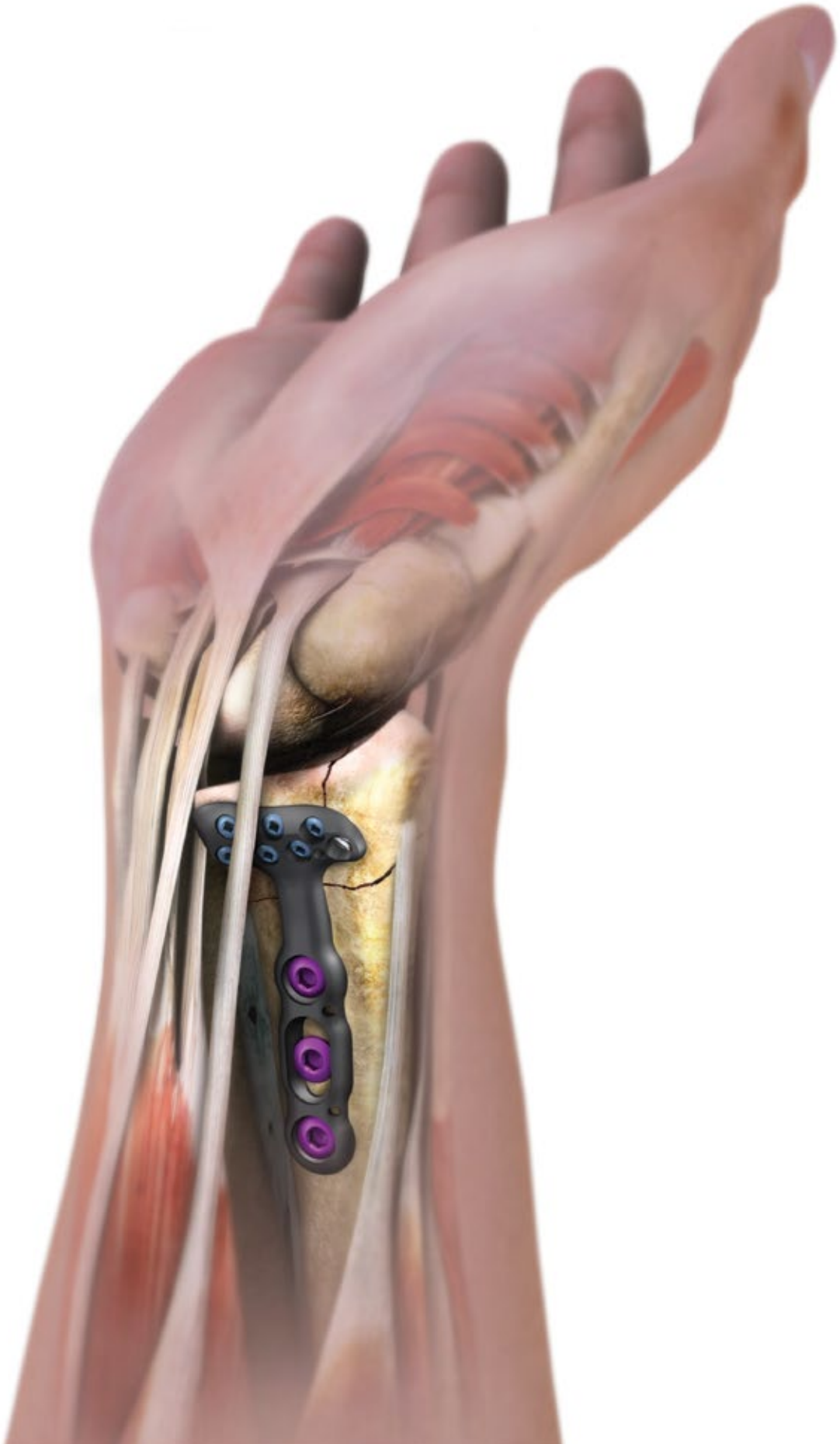
DVR Anatomic
Volar Plating System

Surgical Technique

ZIMMER BIOMET

DVR Anatomic Volar Plating System



Introduction

Over ten years ago 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 over 10 years of positive clinical experience and over 300,000[1] plates sold worldwide, Zimmer Biomet 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 Distal Radius Plating System.

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 designed 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

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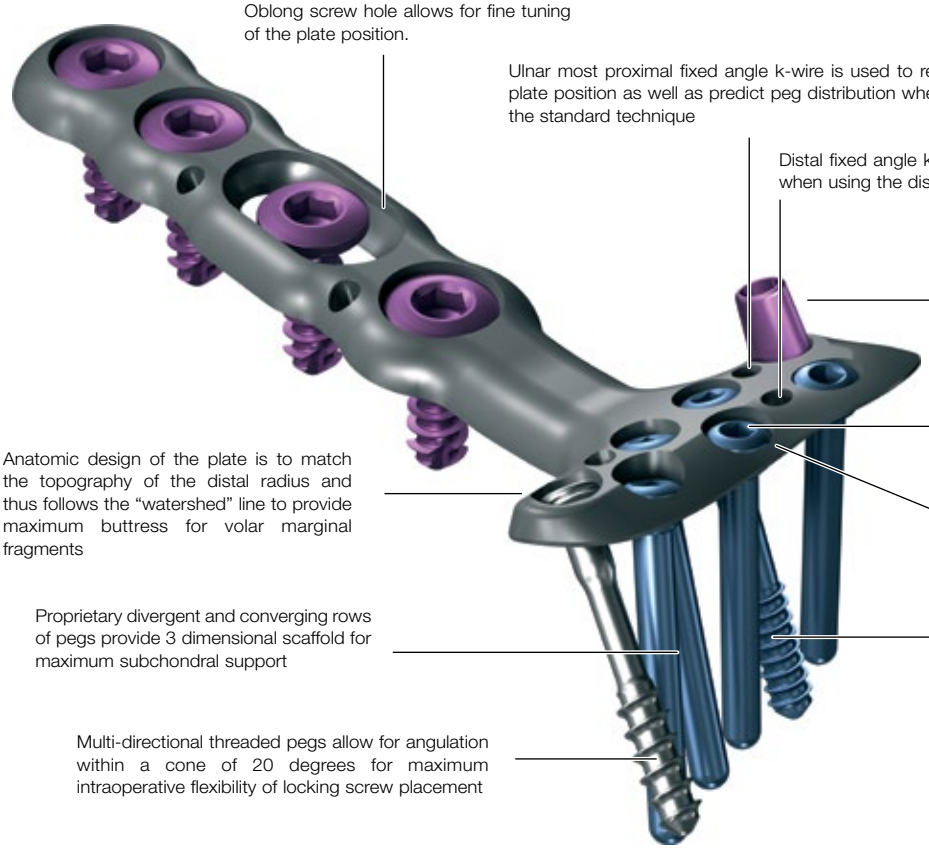


Available plate sizes and lengths listed on page 16.

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

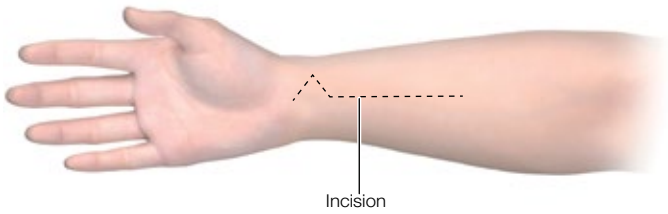


Figure 1

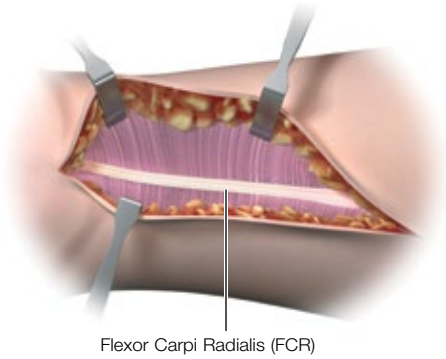


Figure 2

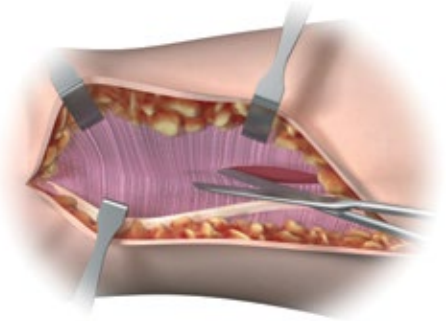


Figure 3

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)

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.

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.

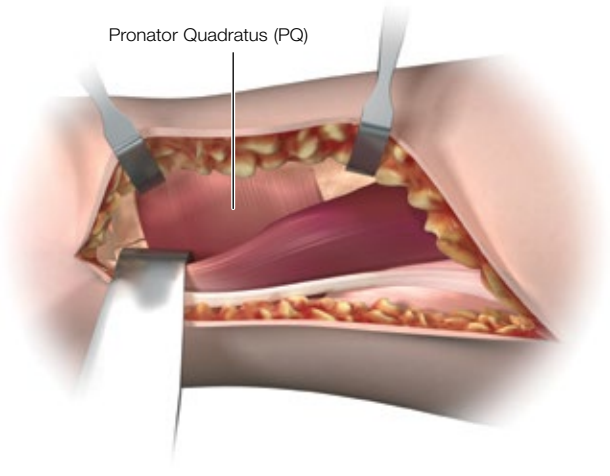


Figure 4

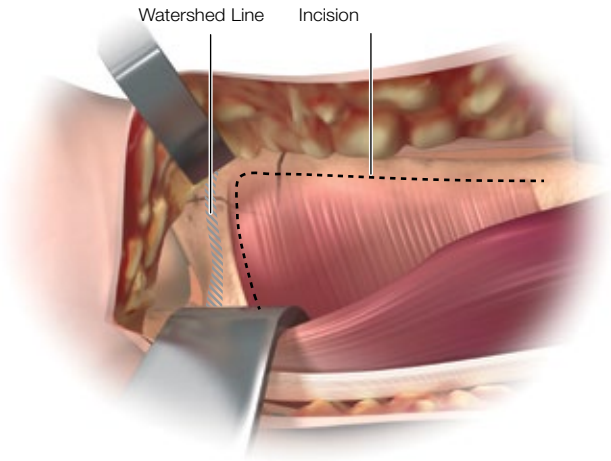


Figure 5

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)

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 visualise the fracture.

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

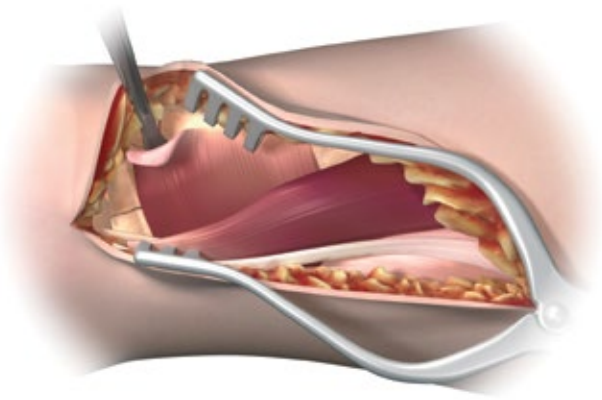


Figure 6

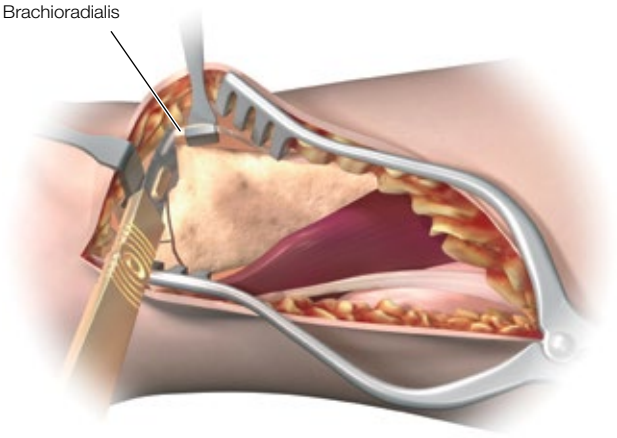


Figure 7

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.

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.

Identify and retract the APL and EPB tendons.

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

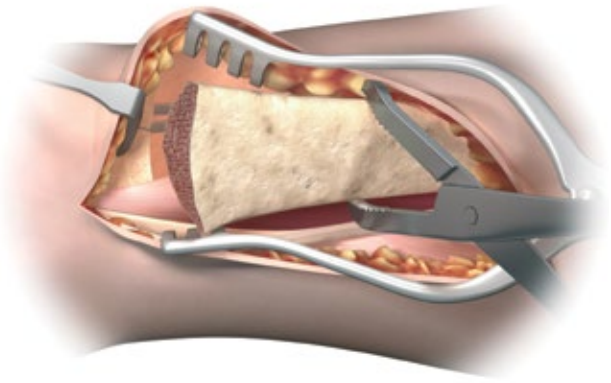


Figure 8

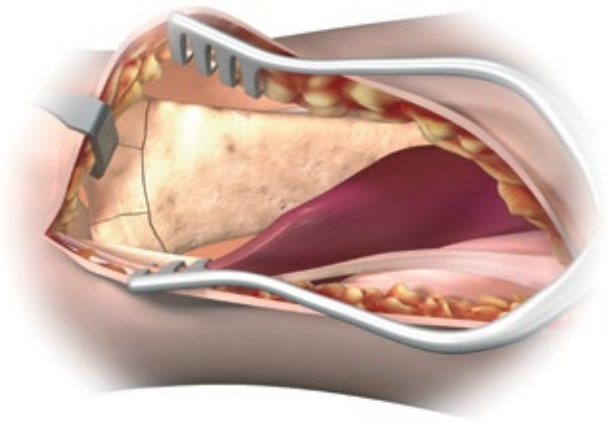


Figure 9

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)

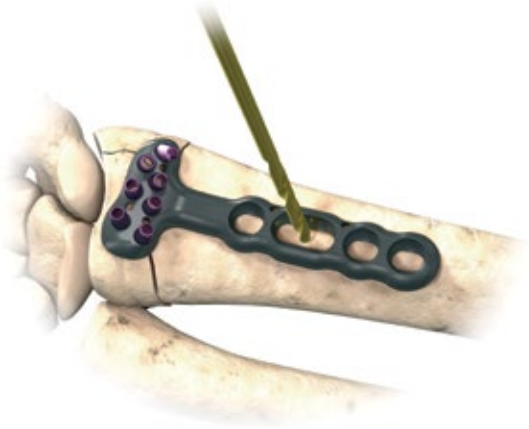


Figure 10

Figure 11

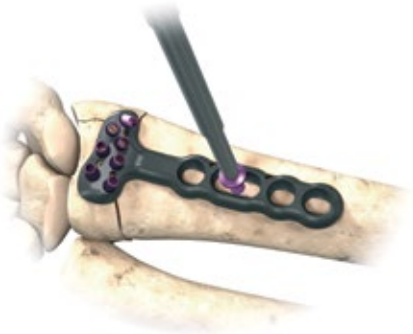


Figure 12

Proximal Plate Positioning

Determine the appropriate 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)

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

Insert the appropriate length cortical screw. (Figure 12)

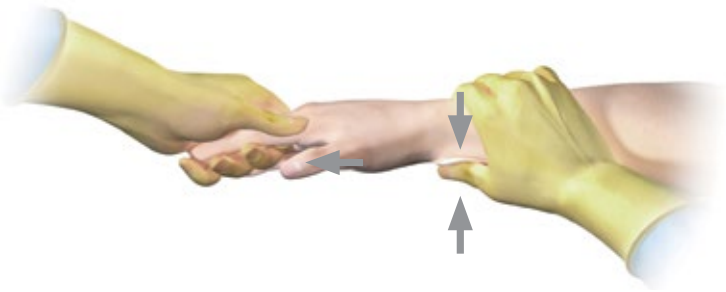


Figure 13

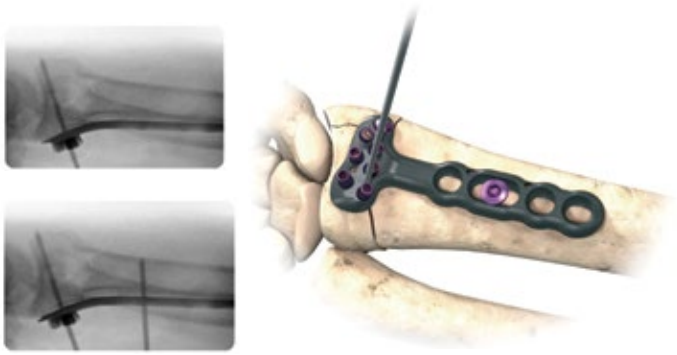


Figure 14

Figure 15

Distal Plate Fixation

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.

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.

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.

Figure 16

Figure 17

Figure 18

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.

Proximal Peg Placement

Remove each F.A.S.T. Guide® with the peg driver after checking the drilled depth. (Figure 17)

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

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

Figure 19

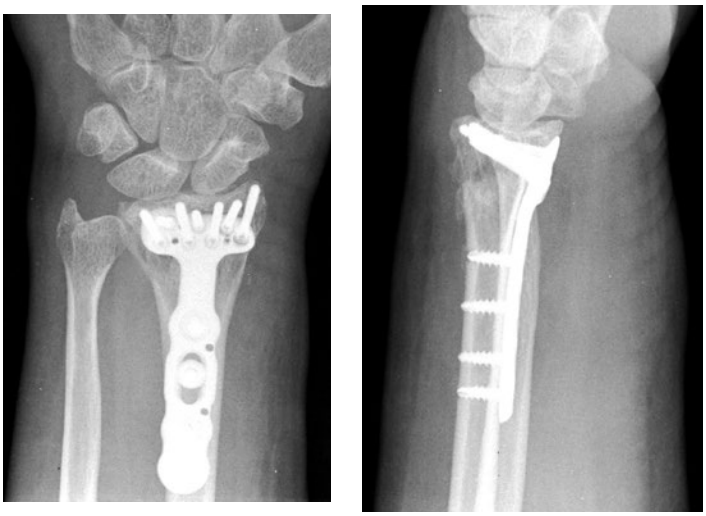


Figure 20

Final Proximal Plate Fixation

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 the length that is needed in the distal row.

Apply the remaining proximal cortical screws. (Figure 19) Non-locking peg 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® inserts even if the peg hole is not used.

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 appropriate, pronate and supinate the wrist under fluoroscopy.

Figure 21

Final Appearance

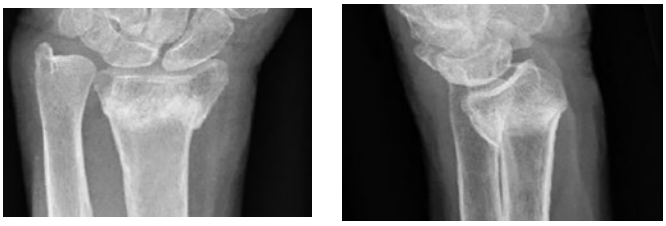
An appropriately applied plate should be just proximal to the watershed line and not project above or beyond it in order to avoid contact with the flexor tendons. (Figure 21)

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.



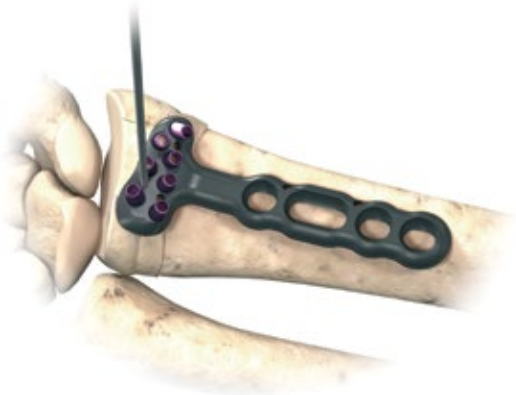


Figure 22

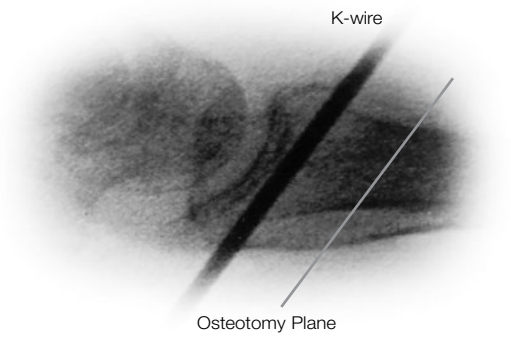


Figure 23

Figure 24

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.

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

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

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.

Figure 25

Figure 26

Figure 27

Figure 28

Supinate the proximal fragment and slide the DVR® Anatomic Plate over the K-wire. (Figure 25) The K-Wire is designed to guide the plate for proper restoration of volar tilt.

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.

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

Confirm postoperative results with radiographs.

Figure 29

Figure 30

Installation of Multi Directional Threaded Peg

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.

Assemble the MDTP Driver Mini Quick connect (231211002) into the modular handle (MQC), verifying that it is firmly attached. (Figure 30)

Figure 31

Figure 32

Figure 33

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

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

Ordering Information

Pegs and Screws

Smooth Peg, Locking
Diameter: 2.0 mm

Sterile	*Non-Sterile*	*Length*
1312-12-210	P10000	10 mm
1312-12-212	P12000	12 mm
1312-12-214	P14000	14 mm
1312-12-216	P16000	16 mm
1312-12-218	P18000	18 mm
1312-12-220	P20000	20 mm
1312-12-222	P22000	22 mm
1312-12-224	P24000	24 mm
1312-12-226	P26000	26 mm
1312-12-228	P28000	28 mm
1312-12-230	P30000	30 mm

Partially Threaded Peg, Locking
Diameter: 2.5 mm

Sterile	*Non-Sterile*	*Length*
1312-12-310	TP1000	10 mm
1312-12-312	TP1200	12 mm
1312-12-314	TP1400	14 mm
1312-12-316	TP1600	16 mm
1312-12-318	TP1800	18 mm
1312-12-320	TP2000	20 mm
1312-12-322	TP2200	22 mm
1312-12-324	TP2400	24 mm
1312-12-326	TP2600	26 mm
1312-12-328	TP2800	28 mm
1312-12-330	TP3000	30 mm

Multi Directional Threaded Peg (MDTP)
Diameter: 2.5 mm

Sterile	*Non-Sterile*	*Length*
1312-12-410	1312-11-110	10 mm
1312-12-412	1312-11-112	12 mm
1312-12-414	1312-11-114	14 mm
1312-12-416	1312-11-116	16 mm
1312-12-418	1312-11-118	18 mm
1312-12-420	1312-11-120	20 mm
1312-12-422	1312-11-122	22 mm
1312-12-424	1312-11-124	24 mm
1312-12-426	1312-11-126	26 mm
1312-12-428	1312-11-128	28 mm
1312-12-430	1312-11-130	30 mm

Peg Screw, Non-Locking
Diameter: 2.5 mm

Sterile	*Non-Sterile*	*Length*
1312-12-510	SP10000	10 mm
1312-12-512	SP12000	12 mm
1312-12-514	SP14000	14 mm
1312-12-516	SP16000	16 mm
1312-12-518	SP18000	18 mm
1312-12-520	SP20000	20 mm
1312-12-522	SP22000	22 mm
1312-12-524	SP24000	24 mm
1312-12-526	SP26000	26 mm
1312-12-528	SP28000	28 mm
1312-12-530	SP30000	30 mm

Cortical Screw
Diameter: 3.5 mm

Sterile	*Non-Sterile*	*Length*
1312-12-110	CS1000	10 mm
1312-12-112	CS1200	12 mm
1312-12-114	CS1400	14 mm
1312-12-116	CS1600	16 mm
1312-12-118	CS1800	18 mm
1312-12-120	CS2000	20 mm

DVR Anatomic Plates

Sterile	*Non-Sterile*	*Description*
1312-12-001	DVRAR	DVR Anatomic Standard Head Right (4-Hole)
1312-12-002	DVRAL	DVR Anatomic Standard Head Left (4-Hole)
1312-12-005	DVRASR	DVR Anatomic Short Right (3-Hole)
1312-12-006	DVRASL	DVR Anatomic Short Left (3-Hole)
1312-12-007	DVRANR	DVR Anatomic Narrow Right (4-Hole)
1312-12-008	DVRANL	DVR Anatomic Narrow Left (4-Hole)
1312-12-009	DVRANSR	DVR Anatomic Narrow Short Right (3-Hole)
1312-12-010	DVRANSL	DVR Anatomic Narrow Short Left (3-Hole)
1312-12-011	DVRAWR	DVR Anatomic Wide Head Right (4-Hole)
1312-12-012	DVRAWL	DVR Anatomic Wide Head Left (4-Hole)
1312-12-003	DVRAXR	DVR Anatomic Extended Right (7-Hole)
1312-12-004	DVRAXL	DVR Anatomic Extended Left (7-Hole)
1312-12-013	DVRAXXR	DVR Anatomic Extra Extended Right (12-Hole)
1312-12-014	DVRAXXL	DVR Anatomic Extra Extended Left (12-Hole)

Note: Right plates are shown.

Narrow Short:
21.6 mm x 48.9 mm

Narrow:
21.6 mm x 57.2 mm

Wide Head:
28.2 mm x 62.6 mm

Short:
24.4 mm x 51.3 mm

Standard Head:
24.4 mm x 59.5 mm

Extended:
24.4 mm x 89.5 mm

Extra Extended:
24.4 mm x 175.3 mm

DVR Anatomic Templates

2312-12-102	Standard Head Left
2312-12-104	Extended Left
2312-12-106	Short Left
2312-12-108	Narrow Left
2312-12-110	Narrow Short Left
2312-12-112	Wide Head Left
2312-12-114	Extra Extended Left

2312-12-101	Standard Head Right
2312-12-103	Extended Right
2312-12-105	Short Right
2312-12-107	Narrow Right
2312-12-109	Narrow Short Right
2312-12-111	Wide Head Right
2312-12-113	Extra Extended Right

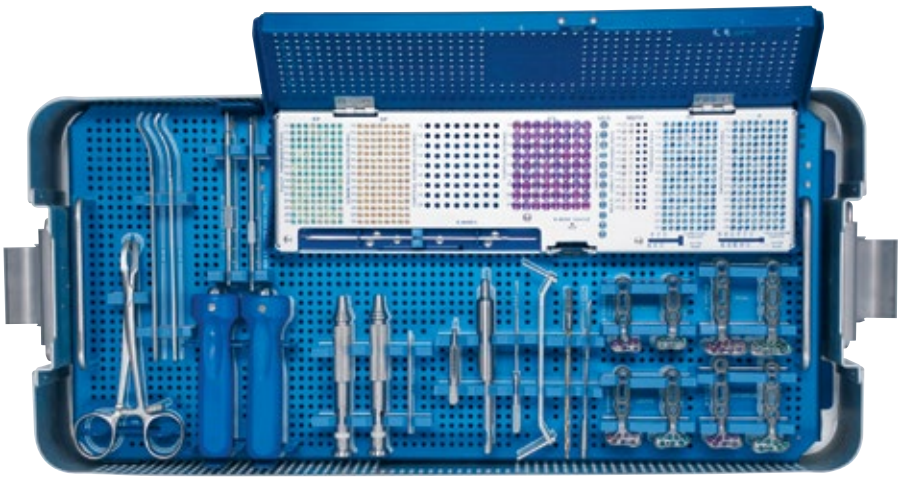
Sterile Disposables

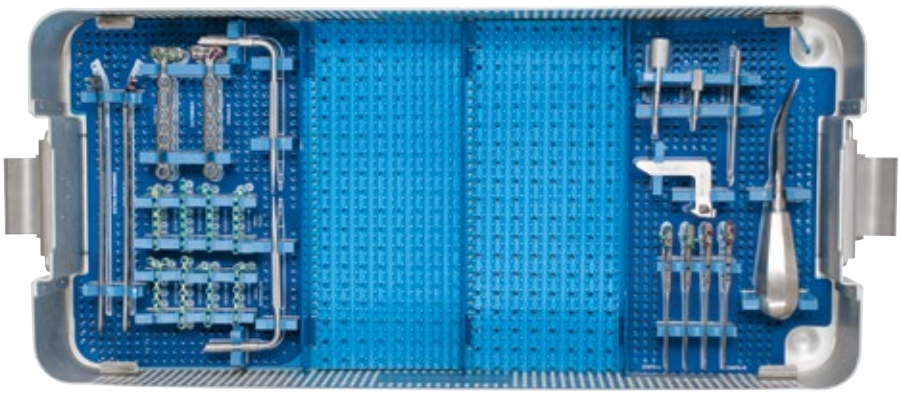
2312-01-300	Drill Bit 3.3mm
2312-01-301	Drill Bit F.A.S.T. 2.0mm
2312-01-302	Drill Bit 2.5mm
2312-01-304	Insert Captive Hex 2.5 mm
2312-01-305	Insert Multi Direct 2.0 mm
2312-01-303	Stainless Steel K-Wire 062

DVR Anatomic Plate Modular Tray

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

2312-12-200	Sterile DVR Case and Tray Set
2312-12-201	Sterile DVR Instrument Tray
2312-12-202	Sterile DVR F^3 Module
2312-12-203	Sterile DVR DNP™ Module
2312-12-204	Sterile DVR Tray Lid
2312-12-205	Sterile DVR Outer Case





DVRA Tray 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 DRT
231211000	Modular QK Connect Handle Medium
231211001	Captive Insert Hex 2.5mm
231211002	MDTP Driver Mini Quick Connect

DVRA Steel Tray

DRT	Sterilization Tray DVR Anatomic
DRTSC	Screw Caddy DRT

Disposables (Non-Sterile)

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

DVR® Anatomic Plate

INDICATIONS

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

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.

PRECAUTIONS:

- 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 do 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 conversant with the appropriate surgical technique for the instruments and associated implant, if any.
- Do NOT open the volar wrist capsule. Doing so may cause devascularization of the fracture fragments and destabilization 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 sub-chondral 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. 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.

WARNINGS:

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 including the 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, non-union or incomplete healing. The patient must be warned that failure to follow postoperative care instructions may cause the implant or treatment to fail.

Notes

References

1.Biomet Internal Sales Data

For indications, contraindications, warnings, precautions, potential adverse effects and patient counseling information, see the package insert or contact your local representative; visit www.zimmerbiomet.com for additional product information. Check for country product clearances and reference product specific instructions for use. Zimmer Biomet does not practice medicine. This technique was developed in conjunction with health care professional. This document is intended for surgeons and is not intended for laypersons. Each surgeon should exercise his or her own independent judgment in the diagnosis and treatment of an individual patient, and this information does not purport to replace the comprehensive training surgeons have received. As with all surgical procedures, the technique used in each case will depend on the surgeon's medical judgment as the best treatment for each patient. Results will vary based on health, weight, activity and other variables. Not all patients are candidates for this product and/or procedure. Caution: Federal (USA) law restricts this device to sale by or on the order of a surgeon. Rx only.

CE Mark on the surgical technique is not valid unless there is a CE Mark on the product (description) label.

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