DVR®
Anatomic Plate
Surgical Technique
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Introduction

Launched in 2000, the DVR® Anatomic was the first plate designed to address both dorsal and volar displaced distal radius fractures from a volar approach. Today over 200,000 patients have been treated with the DVR® worldwide.

The DVR® plate provides stable internal fixation for the treatment of fractures and deformities of the distal radius. Designed to mirror natural anatomy, the DVR® plate stabilises distal radius fractures by taking full advantage of the principle of subchondral support and buttress fixation.

The DVR® Anatomic Plate offers a unique plate design combined with a locking dual row of smooth pegs, resulting in a strong construct with minimal potential for soft tissue irritation. Pre-loaded Fixed Angle Screw Targeting Guide (F.A.S.T. Guide™) technology minimises OR time and facilitates efficient surgery.

Intended Use

The DVR® Anatomic Plate is indicated for the volar fixation of distal radius fractures unstable in either dorsal or volar direction and for the fixation of osteotomies.

Surgical Approaches

Simple 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 Plate

Unique peg distribution

- The two rows of pegs provide a three dimensional surface to support the subchondral bone.

- The unique fan shaped distribution of the pegs in the proximal row supports the dorsal aspect of the subchondral bone, preventing displacement of dorsal fractures.

- The distal row provides support to the central and volar aspect of the subchondral bone, stabilising central articular and volar marginal fragments.

Proprietary F.A.S.T. Guide™ Technology

Anatomical Plate Design

- The “watershed line” is the natural landmark for most distal plate positioning without tendon irritation.

- The DVR® Anatomic Plate is anatomically contoured to match the watershed line and the topographic surface of the distal volar radius without causing tendon complications.

- Once the plate is applied to the volar cortex it can be used as a template to facilitate reduction of dorsally displaced fractures.

Smooth Locking Pegs and Screws

- Locking pegs facilitate the creation of a scaffold that supports the reduction of the fracture and provide a strong peg to plate interface.

- The blunt tip is forgiving and prevents extensor tendon damage in case of dorsal protrusion. Partially threaded pegs help capture dorsal comminuted fragments.

- Multidirectional pegs, with a cone of 20 degree angulation and threaded locking pegs are also available to allow maximum interoperative flexibility.

Smooth Locking Peg  
Partially Threaded Locking Peg  
Multi Directional Threaded Peg (MDTP)
FCR Approach

Incision
Make an incision approximately 8 cm long 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 visualisation (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.
FCR Approach

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 (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 intermediate fibrous zone (IFZ) 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).
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: *Do not open the volar wrist capsule. Doing so may cause devascularisation of the fracture fragments and destabilisation of the volar wrist ligaments.*

The Radial Septum
Near the radial styloid process, the radial septum becomes a complex fascial structure which includes the first extensor compartment, the insertion of the brachioradialis and the distal part of the FCR tendon sheath (Figure 7).

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 8).

*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.*
Extended FCR Approach

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 manoeuvre (Figure 9).

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 10).
Proximal Plate Positioning

Decide the correct position for the plate by feeling 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 11).

Determine the required screw depth using the flat side of the Depth Gauge (Figure 12).

Fix the plate into place with a cortical screw of the pre-determined length (Figure 13).
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.

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

Distal Plate Fixation
Secure the distal fragment to the plate using a K-wire through the most ulnar K-wire hole on the proximal row (Figure 15). Proper plate positioning can be confirmed using fluoroscopy and a 20º elevated lateral view.

*Note: K-wires applied through the holes on the proximal row aid in the reduction of the distal fragments and allow assessment of the proper peg placement prior to drilling. The K–wire should be 2 – 3 mm subchondral to the joint line in 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 stabilise the lunate fossa (Figure 16).

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

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 17).

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 18).

Proximal Peg Placement
Remove each F.A.S.T. Guide™ with the peg driver after checking the drilled depth (Figure 19).

Using the same peg driver, fill the peg holes with the appropriate length peg or screw (Figure 20).

Note: The use of partially threaded pegs will help to capture dorsal comminuted fragments. Fully threaded pegs are not intended for use with DVR® Anatomic Plates.

Caution: Do not permanently implant K-wires through the holes of the plate as they may back out and cause tissue damage.
Final Proximal Plate Fixation

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

As the distal and proximal rows converge, an 18 mm length peg is all that is needed in the distal row.

Apply the remaining proximal cortical screws (Figure 21).

Note: SP series screws are not intended to provide subchondral support and use should be limited to capture of remote bone fragments where partially threaded pegs cannot be used.

Caution: Remove all F.A.S.T. Guide™ devices, even if the peg hole is not used, to prevent tissue damage.

Final Radiographs
A 20° – 30° elevated lateral fluoroscopic view allows visualisation of the articular surface, evaluation of volar tilt, and confirmation for proper peg placement 2 – 3 mm proximal to the subchondral bone (Figure 22).

To confirm that the length of each individual peg is correct, pronate and supinate the wrist under fluoroscopy.
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 23).

Wound Closure

Repair the IFZ in order to cover the distal edge of the DVR® Anatomic Plate.

Repair the brachioradialis in a side-to-side fashion.

Suture the PQ to the IFZ and the repaired brachioradialis.
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 proper K-wire placement (Figure 24).

Create the osteotomy plane parallel to the K-wire (Figure 25).

Release the brachioradialis, then pronate the radius and release the dorsal periosteum (Figure 26).

Note: The location of the distal peg rows can be identified and drilled prior to the osteotomy.
Distal Fragment First Technique
For Established Malunions

Supinate the proximal fragment and slide the DVR® Anatomic Plate over the K-wire (Figure 27). The K-wire will assure proper restoration of volar tilt.

Fix the DVR® Anatomic Plate to the distal fragment (Figure 28). 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 30).

Confirm postoperative results with radiographs.
Installation of Multi Directional Threaded Peg

Ensure that the fixed-angle pegs have been installed prior to inserting the Multi Directional Threaded Peg (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 31). The MDTPs can be successfully installed within a cone of 20 degrees of the fixed angle trajectory.

Assemble the MDTP driver into the Mini Quick handle, verifying that it is firmly attached (Figure 32).

Determine the depth of the hole using the flat side of the F.A.S.T. Bone Depth Gauge (FBDG) (Figure 33).
Load the appropriately sized MDTP into the driver. The peg should grip the driver (Figure 34).

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 35).

*Note: For best results, use a new MDTP driver for each surgery. If necessary, after installation the MDTP can be removed and reinstalled to further improve positioning.*
Ordering Information

**Pegs and Screws**

- **Smooth Peg, Locking**
  Provides subchondral support.
  10 mm – 30 mm lengths (2 mm steps)

- **Partially Threaded Peg, Locking**
  Distal threads to capture and lag fragments.
  10 mm – 30 mm lengths (2 mm steps)

- **Multi Directional Threaded Peg (MDTP)**
  Provides interoperative freedom to vary the trajectory of a fixed angle locking trajectory within a cone of 20 degrees.
  10 mm – 30 mm lengths (2 mm steps)

- **Screw, Non-Locking**
  Fully threaded to anchor fragments for added fixation.
  10 mm – 30 mm lengths (2 mm steps)

- **Screw, Locking**
  Fully threaded screw. Indicated for use with the F³ Fragment Plates.
  10 mm – 30 mm lengths (2 mm steps)

- **Cortical Screw**
  Provides bicortical fixation for proximal fragments.
  10 mm – 20 mm lengths (2 mm steps)

*Note: Non-Locking Fully Threaded screws are not indicated for use with DVR® plates. These screws are used with the F³ Fragment Plates.*

**DVR® Anatomic Plates**

- **Narrow Short:**
  22.0 mm x 57.0 mm
  DVRANS L
  DVRANS R

- **Wide Standard:**
  31.5 mm x 62.7 mm
  DVRAW L
  DVRAW R

- **Standard Short:**
  24.4 mm x 51.0 mm
  DVRAS L
  DVRAS R

- **Standard:**
  24.4 mm x 56.6 mm
  DVRA L
  DVRA R

- **Standard Extended:**
  24.4 mm x 89.0 mm
  DVRAX L
  DVRAX R

- **Standard Extra Extended:**
  24.4 mm x 175.0 mm
  DVRAXX L
  DVRAXX R

*The DVR® Anatomic Plate is manufactured from TiMAX™ anodised titanium alloy Ti-6Al-4V for superior fatigue strength and excellent biocompatibility.*
DVR® Anatomic Plate Modular Tray

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

Top Tray

1. BC  Bone Clamp
2. MHR  Mini Hohmann Retractor
3. 231211002  MDTP Driver
4. 231211001  Captive Hex Insert
5. 231211000  Modular Handle
6. MQC  Mini Quick Connect Handle
7. FPD20  Peg Driver 2.0 mm
8. DG20  Drill Guide 2.0mm
9. FBDG  Bone Depth Gauge
10. SDG  Sleeveless Depth Gauge
11. STG  Soft Tissue Guide
12. DB25  Drill Bit 2.5 mm
13. FDB20  Drill Bit 2.0 mm
14. DVRA L and DVRA R
15. DVRTAS L and DVRTAS R
16. DVRAS L and DVRAS R
17. DVRAX L and DVRAX R
18. DVRAXX L and DVRAXX R
19. F3® Fragment Plates
20. 231207000 and 231207001  F3® Fragment Plate Benders

Bottom Tray

21. DNP™ Anatomic Plate Module
22. DRTDM  DNP™ Anatomic Tray Module
23. DNPDG  Drill Guide 3.3 mm
24. DNPALS  Locking Screw
25. DB33  Drill Bit 3.3mm
26. DNPAJIG  Jig DNP™ Anatomic
27. CBA  Awl Curved
28. DNPA L and DNPA R
29. Extended DVR® and F3® Fragment Plates module
30. DNP™ (Dorsal Nail Plate) module
DVR® Anatomic Plate

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 stabilisation 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 sterilisation 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 implants, 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.
• 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.
References