2.4 mm Variable Angle LCP Two-Column Volar Distal Radius Plate. For fragment-specific fracture fixation with variable angle locking technology.
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Two-Column Volar Distal Radius Plate.
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Features and Benefits

**Anatomic fit**
close to the volar ridge with highly polished smooth edges for minimized soft tissue irritation

**Two columns for increased stability with superb fine-contouring properties**

Dedicated screws for fixation of radial styloid (blue) and support of lunate facet and DRUJ (green)

Kirschner wire holes for preliminary plate fixation

Oblongue hole for plate positioning and radius length adjustment
**Variable angle**

Holes allow up to $15^\circ$ off-axis screw angulation in all directions.

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**Variable Angle Locking Screws (VA-LCP)**

Threaded, rounded head locks securely into threaded VA-LCP holes to provide angular stability at angles determined by the surgeon. Also securely locks into standard locking shaft holes (LCP) of the plate at the pre-defined angle (use of threaded drill guide required).

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**Unique drill guides**

Allowing to use $\pm15^\circ$ angulation and pre-defined screw angles.

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Easy x-ray control in pre-defined angle mode and $20^\circ$ inclined lateral view.
Three Column Theory

The treatment of distal radius fractures requires a meticulous reconstruction of the joint surface, as well as stable internal fixation and early functional post-operative treatment. Extra-articular fractures require both the restoration of the volar tilt and radial length to reduce the possibility of displacement. Any malalignment may result in limitations of movement, changes of load distribution, mid-carpal instability as well as the increased risk of osteoarthritis in the radiocarpal joint.

Intra-articular fractures with articular displacement of more than 2 mm in the radiocarpal joint inevitably result in osteoarthritis and functional impairment.

The distal radius and distal ulna form a three-column biomechanical construction:
- The ulnar column is the distal ulna, the triangular fibrocartilage and the distal radio-ulnar joint.
- The intermediate column is the medial part of the distal radius, with the lunate fossa and the sigmoid notch.
- The radial column is the lateral radius with the scaphoid fossa and the styloid process.

A dorsally displaced fracture of the distal radius indicates not only dorsiflection in the sagittal plane, but also radial deviation in the frontal plane and supination in the transverse plane.

Following reduction, stabilization requires optimal fixation of the intermediate column as well as the radial column. In the case of a fractured distal ulna that compromises the distal radio-ulna joint, the ulnar column must be stabilized as well.

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Clinical Case

Case
Male patient, 29 years, AO23C3.2 fracture, fall from a 3-meter height

Preoperative

Peroperative

Functional results: 10 months after surgery
Tips and Tricks
General principles

Indications
Most distal radius fractures requiring surgical treatment can be accessed from the volar aspect. Combined approach is sometimes used in high-energy fractures, burst fractures and significantly dislocated fractures. In this case, volar approach is first created to reduce volar fragments and after achieving reduction, dorsal approach is used to fix dorsal fragments (mainly the key dorso-ulnar fragment) with the LCP DRP 2.4 plating system.

At present, locking implants are indicated for distal radius fractures in case of unstable fractures, i.e. extra-articular fractures with comminuted shaft zone classified by AO as type 23A3, fractures partially affecting the articular area classified as type 23B3 (volar approach) and rare type 23B2 fractures with split dorsal edge (dorsal approach). The ORIF is also indicated for most completely articular, unstable, dislocated, type 23C1–3 fractures. Locking implants are suitable for biologically young patients with osteoporotic bones.

The shape of modern implants for distal radius fractures respects anatomical structures of distal radius epiphysis: the edges of implants do not protrude over anatomical landmarks. (See the image.)

Operation timing
In distal radius fractures, the ORIF is usually implanted 5–7 days post-injury, after soft tissue swelling subsides. This approach is preferred to acute surgeries performed on the day of the injury as it helps to avoid further trauma to soft tissue (the acute carpal tunnel syndrome as a result of swelling-induced compression of the median nerve) when performing invasive treatment shortly after the trauma.

In significantly dislocated fractures, urgent reduction and temporary plaster-splint fixation is preferred, or, if possible, external fixator is used to allow better control of soft tissue condition before performing the final surgery and better control of the alignment after primary reduction.
1  
**Make an incision**

Make a 7–8 cm incision approximately in the axis of the 2\textsuperscript{nd} metacarpal, over the FCR tendon palpable in the volar radial aspect of distal forearm. To avoid formation of a retracting scar, the incision should be performed in an oblique direction towards the horizontal lines on the wrist.

2  
**Expose the FCR tendon**

Continue the dissection over or close to the FCR tendon sheath in the radial aspect, in a longitudinal direction, towards the distal radius.
3
Create access over the flexor carpi radialis (FCR) muscle sheath

4
Expose the belly and part of the tendon of the FPL

Perform ulnar retraction of the flexor pollicis longus (FPL) tendon, exposing the pronator quadratus muscle. It is useful to partially separate the FPL belly from its insertion located on the radial side of the radial shaft.
5 Expose the pronator quadratus (PQ) muscle

6 Cut through the pronator quadratus muscle – perpendicularly to the muscle fibre direction

Cut across the PQ fibres approx. 1–1.5 cm from the radial insertion of the muscle.
7
**Cut through the pronator quadratus muscle along the watershed line**

At PQ distal insertion, cut the PQ edge in the area of the watershed line (a line marked by the most volar portion of the distal radius). Although the distal edge of the VA LCP TCP plate reaches the watershed line, it doesn’t cross it thanks to the anatomical shape of the plate, i.e. the plate doesn’t protrude in the direction of finger flexor tendons.

8
**Separate the PQ on the radial and ulnar side**
9

Expose the bone

When the PQ is sufficiently loosened, Hohmann retractors can be introduced behind the radial and ulnar edge of the radius shaft to achieve a sufficient view of the distal radius and the volar aspect of the fracture.
Dorsally dislocated fragments can be reduced through ligamentotaxis. Alternatively, small chisel or raspatory can be inserted in the fracture line to anatomically reduce the fragments of the intermedial column.
Radial column

One of the strongest dislocation forces acting on the radial column is the traction of the brachioradialis muscle, whose insertion is located in the processus styloideus radii. The insertion in the styloid process of the radius can be used to reduce the radial column with a hook carefully inserted between the bone and the tendon, retracting it in the direction of the axis of the extremity, thus reducing the radius styloid process and restoring the ulnar inclination of the distal radius articular surface. After reduction, the fragment can be temporarily fixed by inserting Kirschner wire or reduction forceps (see the peroperative image).
12
Place and fix the plate

Place the plate and fix it to the proximal fragment with a 2.7 mm cortical screw inserted in the elongated hole. This will allow for a sufficient correction of the position of the distal edge of the plate towards the watershed line.
Fix the reduced distal fragments to the plate with Kirschner wires

Before inserting VA LCP screws, distal fragments can be temporarily fixed with 1.25 mm Kirschner wires inserted in up to six holes in the plate (most often, only two distal holes are used to fix articular surface fragments).
Find optimal VA screw trajectories using conical guide

As VA LCP screws allow insertion in multiple directions, they can be inserted in subchondral bone as close to the articular surface as possible to ensure optimal support of distal fragments.
Complete the osteosynthesis

The lay-out of distal holes allows you to insert a sufficient number of screws ensuring fixation of individual distal radius columns. At least 1–2 LCP screws should be inserted in the diaphyseal part of the plate, mainly in patients with osteoporotic bones to prevent secondary bone shortening or loosening of the plate from the radius shaft.
16
Close the pronator quadratus muscle using interrupted stitches

Start closing the surgical site by suturing the pronator quadratus muscle using interrupted stitches. You will thus separate the plate from finger flexor tendons.

17
Close the incision
Follow-up care

In current medical practice, a slim suction drain is inserted in the wound after each open reduction performed via volar approach and is left in situ for 24 hours. The drain is placed on the pronator quadratus muscle after it has been sutured.

To complete the treatment, wrist brace is used. Patients are recommended to wear the brace for 6 weeks. In case of osseosynthesis in significantly osteoporotic bones or if a patient suffers concurrent distal ulnar fracture, the extremity is fixed with plaster splints reaching above the elbow line to avoid forearm rotation for 4–6 weeks.

Rehabilitation starts immediately, on the first day after the operation. Patients begin exercising fingers and after postoperative pain subsides (2–4 days after operation), physiotherapist-led rehabilitation may be initiated up to approx. $\frac{1}{2}$–$\frac{3}{4}$ ROM in the first 3–4 weeks. The beginning and the length of rehabilitation is always decided according to a particular case, based on the nature of the fracture, osteosynthesis stability and bone quality. Increase of the movement range up to full ROM is usually permitted after 4 weeks.

**Extraction**

At present, extraction of plates after distal radius fractures is generally not done. Implants are only extracted in situations where secondary reconstruction surgery is expected or in the course of such operation and also in case of increased prominence of the plate in the radial direction (this applies mainly to older-type plates, 3.5 and 2.4 LCP).
About the author

Petr Toufar, MD., has been working at the Department of Traumatology and Plastic Surgery at the Traumacenter of Nemocnice České Budějovice, a.s. for 15 years. Under the supervision of the head physician Pavel Kopacka, MD. he could introduce the state-of-the-art methods in the department, gaining skill and experience with new implants manufactured by various companies.

Each year, approximately 2,000 injuries are surgically treated at the Department of Traumatology with around 350 polytrauma injuries and multiple serious injuries and the total of 670 patients with distal radius fracture treated with the ORIF. Thanks to this the department ranks among the prominent sites in the Czech Republic.

Petr Toufar has been involved in the treatment of distal radius fractures for over 10 years, participating in giving physicians specialized trainings within the AO group in AO courses organized both in the Czech Republic and abroad.