Rotation Correction Plates 1.5 and 2.0. Reposition plates for fractures and osteotomies at the metacarpals and phalanges.

Surgical Technique
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## MRI Information

## Warning
This description alone does not provide sufficient background for direct use of DePuy Synthes products. Instruction by a surgeon experienced in handling these products is highly recommended.

## Processing, Reprocessing, Care and Maintenance
For general guidelines, function control and dismantling of multi-part instruments, as well as processing guidelines for implants, please contact your local sales representative or refer to:
http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance
For general information about reprocessing, care and maintenance of Synthes reusable devices, instrument trays and cases, as well as processing of Synthes non-sterile implants, please consult the Important Information leaflet (SE_023827) or refer to:
http://emea.depuysynthes.com/hcp/reprocessing-care-maintenance
Rotation Correction Plates 1.5 and 2.0. Reposition plates for fractures and osteotomies at the metacarpals and phalanges.

Anatomically precontoured
Minimal irritation of ligaments and soft tissue thanks to a flat plate and screw profile, rounded edges and polished surfaces.

Transversally elongated holes
An elongated hole transversal to the axis of the plate shaft allows intraoperative inspection of the reduction and allows the surgeon to correct the rotational axis of the bone if necessary.

Angular stability
∅ 2.0 mm locking screws can be used in the head. Cortex or locking screws can be used in the shaft, depending on the plate size.

The design of the plate head makes it easy to adjust to the anatomy of the condyles.

Two shaft lengths
Two different shaft lengths of the plates allow fragment-specific treatment of fractures of the metacarpals and proximal phalanges.
Indications and Contraindications

Indications

1. All fractures of the phalanges and metacarpals, where the exact reposition is difficult or where a rotational error can easily occur.
   - subcapital fractures of the metacarpals (in particular impacted compression fractures)
   - transverse fractures
   - short oblique fractures
   - comminuted fractures
   - defect fractures (circular saw injuries)
   - amputation injuries to the fingers (with primary shortening)
   - Winterstein fracture, Rolando fracture

2. Corrective osteotomies for fractures of the phalanges or metacarpals that have healed with axial errors and/or rational errors.

   In the case of metaphyseal fractures, comminuted fractures and osteoporotic bone, the clinical results can be improved by the angular-stable screw/plate connection.

Contraindications

Easily reduced oblique or spiral fractures that can be precisely and firmly stabilized using screw osteosynthesis.
Case 1
Subcapital comminuted fracture of the 2nd metacarpal bone

42-year-old man, fall from bike.

Compressed fracture of the metacarpal head with 4 mm shortening and 20° ulnar malangulation. Instable, subcapital impacted compression zone with bony collateral ligament tears. Primary treatment with plaster splint with only 30° flexion of the metacarpophalangeal joints.

Intraoperative far distal angular stable fixation of the head, compensating for errors in the length and rotation. Immediate active exercise treatment.
Case 2
Pseudoarthrosis of the 4th metacarpal bone following failed screw osteosynthesis

32-year-old woman with screw osteosynthesis treated elsewhere.

The patient presented with pain, swelling and rotational error 6 months after the primary treatment.

Intraoperatively, an anatomical reposition is no longer possible. Angularly stable fixation close to joint. Proximal with cortex screws. Immediate active exercise treatment.

Preoperative with pseudoarthrosis and 6 mm shortening, dorsopalmar

Postoperative following compensation of length and rotational error, dorsopalmar

Postoperative, laterale
Implantation

If fractures to the metacarpals or the proximal phalanges are misaligned, the function of the hand can be severely affected. Especially rotational misalignments are problematic because of crossing and scissoring digits whenever full flexion of the fingers to a fist is attempted. Even minor rotational errors in the fingers frequently have to be surgically corrected after a fracture has healed.

For metacarpal fractures and fractures of the proximal phalanges, optimal recovery of hand function includes the meticulous restoration of alignment, length and rotation of digits and metacarpals. A careful approach needs to be chosen in order not to further compromise the soft tissue situation which again requires proper reconstruction. The fixation has to be stable enough in order to facilitate immediate active and passive finger exercises.

Approaches
For the metacarpal bones, the 2nd ray may be approached dorso-radially above the palpable bone, the 5th ray dorso-ulnar above the bone, and the 3rd and 4th metacarpal either directly above the respective bone or between both of them when two adjacent bones are affected.

The proximal phalanges are usually approached through the median line of the respective bone.
1
**Temporary fixation of fractures with Kirschner wires**

Reduction can be preliminary held with Ø 1.0 mm K-wires not protruding the articular surface. Rotational alignment should be less than 10° when carefully checked in full extension, and flexion to a fist.

2
**Select plate**

Rotation correction plates are available in various sizes and lengths, allowing fragment-specific treatment of fractures to the metacarpalia and the proximal phalanges. Determine the approach and select the plates according to the fracture pattern and the anatomical situation.
3

Bending the plate head and plate shaft

Instruments

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>329.921</td>
<td>Bending Pin for LCP Plates 2.0, with thread</td>
</tr>
<tr>
<td>347.901</td>
<td>Pliers, flat-nosed, pointed, for Plates 1.0 to 2.4</td>
</tr>
</tbody>
</table>

If necessary, bend the plate to suit the anatomical conditions.

1. Preferably bend the plate head with two bending pins.

2. Ensure that the shaft is bent between the combination holes, as it will otherwise be difficult to insert the locking screws. We recommend using two pairs of pliers.

**Note:** The design of the plate holes allows a certain degree of deformation tolerance. Locking is, however, not as efficient if the thread holes are significantly deformed. For this reason the surgeon should avoid bending the plate by inserting the bending pins into a combination hole.

**Warning:** The plate should ideally not be cut. The sharp cut edges can damage the radiodorsal tendons and can irritate the soft tissue.
Position plate

Position the plate near the joint. The transverse elongated hole must be on the far side of the fracture on a section of bone that is intact. First fix the head or condyle region near the joint using two $\varnothing$ 2.0 mm locking screws to support the joint surfaces and to prevent repositioning loss.

Please refer to page 19 for information on inserting the locking screws.

**Caution:** Ensure that there is no dorsal or palmar damage to the cartilaginous joint surfaces by either the plate or the screws and that the collateral ligaments are not unintentionally fixed.

**Tip:** If the axis and the length of the bone are not yet exactly set the plate can be fixed to the bone with plate holding forceps and the Kirschner wire can be removed. The length and the axis of the bone can now be corrected using the plate and the plate holding forceps. The Kirschner wire can be left in place if it is already fixing the exact position and is not blocking the transverse elongated hole.
Insert screw into elongated hole

Insert and carefully tighten a standard cortex screw in the exact position in the central part of the transverse elongated hole. Either select Ø 1.5 mm or 2.0 mm cortex screws depending on the plate size.

Please refer to page 16 for information on inserting the cortex screws.
6

Check result of repositioning

Prop up the forearm with the elbow supported on the operating table while the wrist is at maximum flexion. In this position the finger joints are straightened by the tenodesis effect of the extensor tendons. Check the axis and the rotation of the fingers.

Place the wrist passively in the maximum extension position while compressing the forearm anteriorly in the middle of its shaft. In this position, the tenodesis effect of the flexor tendons and the compression of the forearm muscles will cause the fingers to flex to nearly form a fist. This way, rotational errors of the digits are easily detected.

Releasing and tightening the cortex screw in the transverse longitudinal hole ensures that the optimum position of the finger can be identified.

Check the repositioning result with the wrist at maximum extension

Set the optimum finger positions by releasing and tightening the elongated hole screw.
Final fixation

Fix a screw in the optimum position distal or proximal to the transverse elongated hole. The other holes may remain free or can be fitted with additional cortex screws. The hole above the fracture line generally remains free.

Please refer to page 16 for information on inserting the cortex screws.

Note: For 2.0 correction plates either Ø 2.0 mm locking screws or Ø 2.0 mm cortex screws may be used in the shaft. Only Ø 1.5 mm cortex screws are used in the stem of 1.5/2.0 correction plates.

The synovial sheath above the plate should be closed with a resorbable 6/0 suture as far as possible. The extensor tendon is readapted in the median line with a resorbable 5/0 suture. After fitting a «size 6» Redon Drain, close the skin with a single button suture and then apply an elasto-compressive bandage.
8

Postoperative treatment

Post-operatively, the hand is consequently put upright. Remove the Redon Drain one day post-operatively. Subsequently, active and passive finger exercises should be started with the aim of full extension and flexion within a week.
To remove locking screws, first unlock all screws from the plate; then remove the screws completely from the bone. This prevents rotation of the plate when removing the last locking screw.
# Instruments for correction plates 2.0

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>311.012</td>
<td>Handle, medium, with Mini Quick Coupling</td>
</tr>
<tr>
<td>314.676</td>
<td>Screwdriver Shaft Stardrive 2.0, with Holding Sleeve, length 66 mm, for Mini Quick Coupling</td>
</tr>
<tr>
<td>323.200</td>
<td>Universal Drill Guide 2.0</td>
</tr>
<tr>
<td>319.005</td>
<td>Depth Gauge for Screws Ø 2.0 and 2.4 mm, measuring range up to 40 mm</td>
</tr>
<tr>
<td>310.507</td>
<td>Drill Bit Ø 1.5 mm with marking, length 96/82 mm, 2-flute, for Mini Quick Coupling</td>
</tr>
<tr>
<td>513.140</td>
<td>Drill Bit Ø 2.0 mm, length 67/55 mm, 2-flute, for Mini Quick Coupling</td>
</tr>
</tbody>
</table>

# Additional instruments required for correction plates 1.5/2.0

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>314.667</td>
<td>Screwdriver Shaft 1.5, cruciform, with Holding Sleeve, length 66 mm, with Mini Quick Coupling</td>
</tr>
<tr>
<td>312.140</td>
<td>Double Drill Guide 1.5/1.1</td>
</tr>
<tr>
<td>319.003</td>
<td>Depth Gauge for Screws Ø 1.3 to 1.5 mm, measuring range up to 24 mm</td>
</tr>
<tr>
<td>513.030</td>
<td>Drill Bit Ø 1.1 mm, length 45/33 mm, 2-flute, for Mini Quick Coupling</td>
</tr>
</tbody>
</table>
1  
**Predrill screw hole**

Predrill the holes for the combination screws either neutrally (support) or eccentrically (compression) into the non-thread bearing part of the combination hole using the universal drill guide that is appropriate for the screw diameter.

Cortex screw Ø 2.0 mm: Use the Ø 1.5 mm drill bit for a threaded hole and the Ø 2.0 mm drill bit for a gliding hole.

**Note:** For rotation correction plates 1.5/2.0 use the universal drill guide 1.5/1.1 for Ø 1.5 mm cortex screws. Use the Ø 1.1 mm drill bit for the threaded hole and a Ø 1.5 mm drill bit for the gliding hole.

2  
**Determine screw length**

Determine the screw length using the Ø 2.0 mm depth gauge.

**Note:** Use the Ø 1.5 mm depth gauge for Ø 1.5 mm cortex screws.
3

Pick up screw

Pick up the selected ∅ 2.0 mm cortex screw with the screwdriver shaft Stardrive 2.0 with holding sleeve and the corresponding handle.

Notes
- A self-holding screwdriver (such as 313.842/313.843) Stardrive 2.0 can also be used.
- If using ∅ 1.5 mm cortex screws the cruciform screwdriver shaft with holding sleeve should be used.

4

Insert self-tapping standard screws

Insert the self-tapping standard screws with the screwdriver.
Insert locking screw

**Instruments**

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<td>314.676</td>
<td>Screwdriver Shaft Stardrive 2.0, with Holding Sleeve, length 66 mm, for Mini Quick Coupling</td>
</tr>
<tr>
<td>323.034</td>
<td>LCP Drill Sleeve 2.0, with Scale, for Drill Bits Ø 1.5 mm with marking</td>
</tr>
<tr>
<td>319.005</td>
<td>Depth Gauge for Screws Ø 2.0 and 2.4 mm, measuring range up to 40 mm</td>
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</tbody>
</table>

1

**Use LCP drill sleeve**

Screw and lock the drill sleeve vertically into the thread of the selected hole.
2
**Predrill screw hole**

Predrill the screw hole with the Ø 1.5 mm drill bit through the drill sleeve for locking screws 2.0 mm to the required depth and then read the screw length directly from the drill sleeve scale.

3
**Determine screw length (optional)**

Determine the screw length using the Ø 2.0 mm depth gauge for screws, as shown on page 17.
4
Pick up screw
Pick up the selected screw with the screwdriver shaft Stardrive with holding sleeve and the corresponding handle.

Note: A self-holding screwdriver (such as 313.842/313.843) Stardrive 2.0 can also be used.

5
Insert self-tapping locking screws
Manually insert the locking screws with the screwdriver. Carefully tighten the locking screw, as excessive force is not necessary to effectively lock the screws.
### Plates

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>X46.354</td>
<td>Rotation Correction Plate 1.5/2.0, shaft 4 holes, head 2 holes, length 27 mm</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>X46.355</td>
<td>Rotation Correction Plate 1.5/2.0, shaft 5 holes, head 2 holes, length 32 mm</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>X47.354</td>
<td>LCP Rotation Correction Plate 2.0, shaft 4 holes, head 2 holes, length 34 mm</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>X47.355</td>
<td>LCP Rotation Correction Plate 2.0, shaft 5 holes, head 2 holes, length 40 mm</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

### Locking screws

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>X01.876–900</td>
<td>Locking Screw ø 2.0 mm, self-tapping</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
</tbody>
</table>

### Standard screws

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>X01.356–381</td>
<td>Cortex Screw ø 2.0 mm, self-tapping</td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>X00.806–824</td>
<td>Cortex Screw ø 1.5 mm, self-tapping</td>
<td><img src="image7.png" alt="Image" /></td>
</tr>
</tbody>
</table>

All screws ø 2.0 mm with Stardrive T6 drive.
All screws ø 1.5 mm with cruciform drive.

X=2: Steel (SSt)
X=4: Titanium (plates)
  - Titanium alloy TAN (screws)
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<tr>
<td>311.012</td>
<td>Handle, medium, with Mini Quick Coupling</td>
</tr>
<tr>
<td>311.430</td>
<td>Handle with Quick Coupling, length 110 mm</td>
</tr>
<tr>
<td>314.667</td>
<td>Screwdriver Shaft 1.5, cruciform, with Holding Sleeve, length 66 mm for Mini Quick Coupling</td>
</tr>
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<td>Screwdriver Shaft Stardrive 2.0, with Holding Sleeve, length 66 mm for Mini Quick Coupling</td>
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All listed instruments are part of the LCP Compact Hand.
Bibliography


MRI Information

**Torque, Displacement and Image Artifacts according to ASTM F 2213-06, ASTM F 2052-06e1 and ASTM F2119-07**

Non-clinical testing of worst case scenario in a 3 T MRI system did not reveal any relevant torque or displacement of the construct for an experimentally measured local spatial gradient of the magnetic field of 3.69 T/m. The largest image artifact extended approximately 169 mm from the construct when scanned using the Gradient Echo (GE). Testing was conducted on a 3 T MRI system.

**Radio-Frequency-(RF-)induced heating according to ASTM F2182-11a**

Non-clinical electromagnetic and thermal testing of worst case scenario lead to peak temperature rise of 9.5 °C with an average temperature rise of 6.6 °C (1.5 T) and a peak temperature rise of 5.9 °C (3 T) under MRI Conditions using RF Coils [whole body averaged specific absorption rate (SAR) of 2 W/kg for 6 minutes (1.5 T) and for 15 minutes (3 T)].

**Precautions:** The above mentioned test relies on non-clinical testing. The actual temperature rise in the patient will depend on a variety of factors beyond the SAR and time of RF application. Thus, it is recommended to pay particular attention to the following points:

- It is recommended to thoroughly monitor patients undergoing MR scanning for perceived temperature and/or pain sensations.
- Patients with impaired thermo regulation or temperature sensation should be excluded from MR scanning procedures.
- Generally it is recommended to use a MR system with low field strength in the presence of conductive implants. The employed specific absorption rate (SAR) should be reduced as far as possible.
- Using the ventilation system may further contribute to reduce temperature increase in the body.