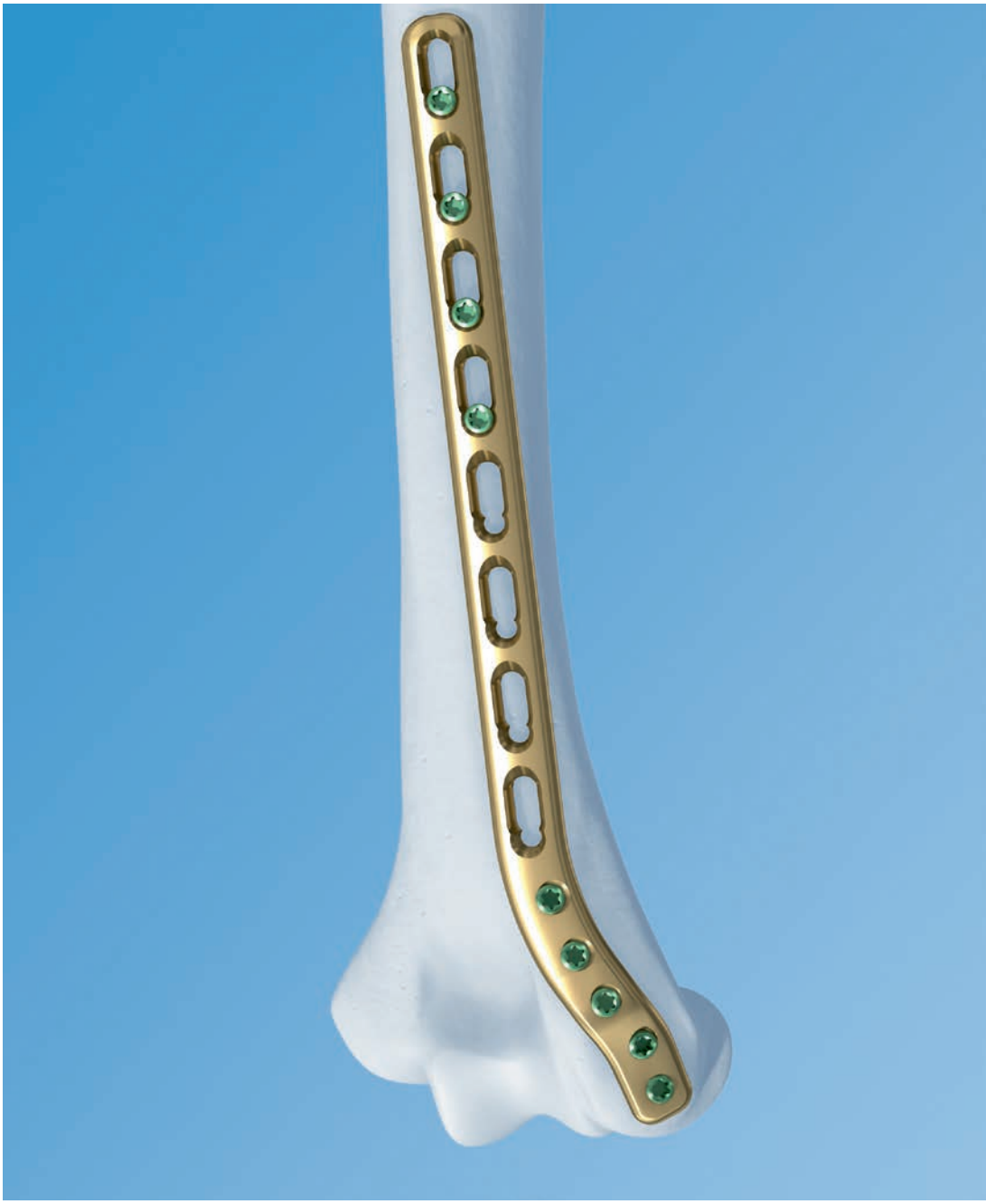
LCP Extra-articular Distal Humerus Plate. The anatomically shaped and angular stable fixation system for extra-articular fractures of the distal humerus.

Surgical Technique



Instruments and implants approved by the AO Foundation.

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Image intensifier control

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

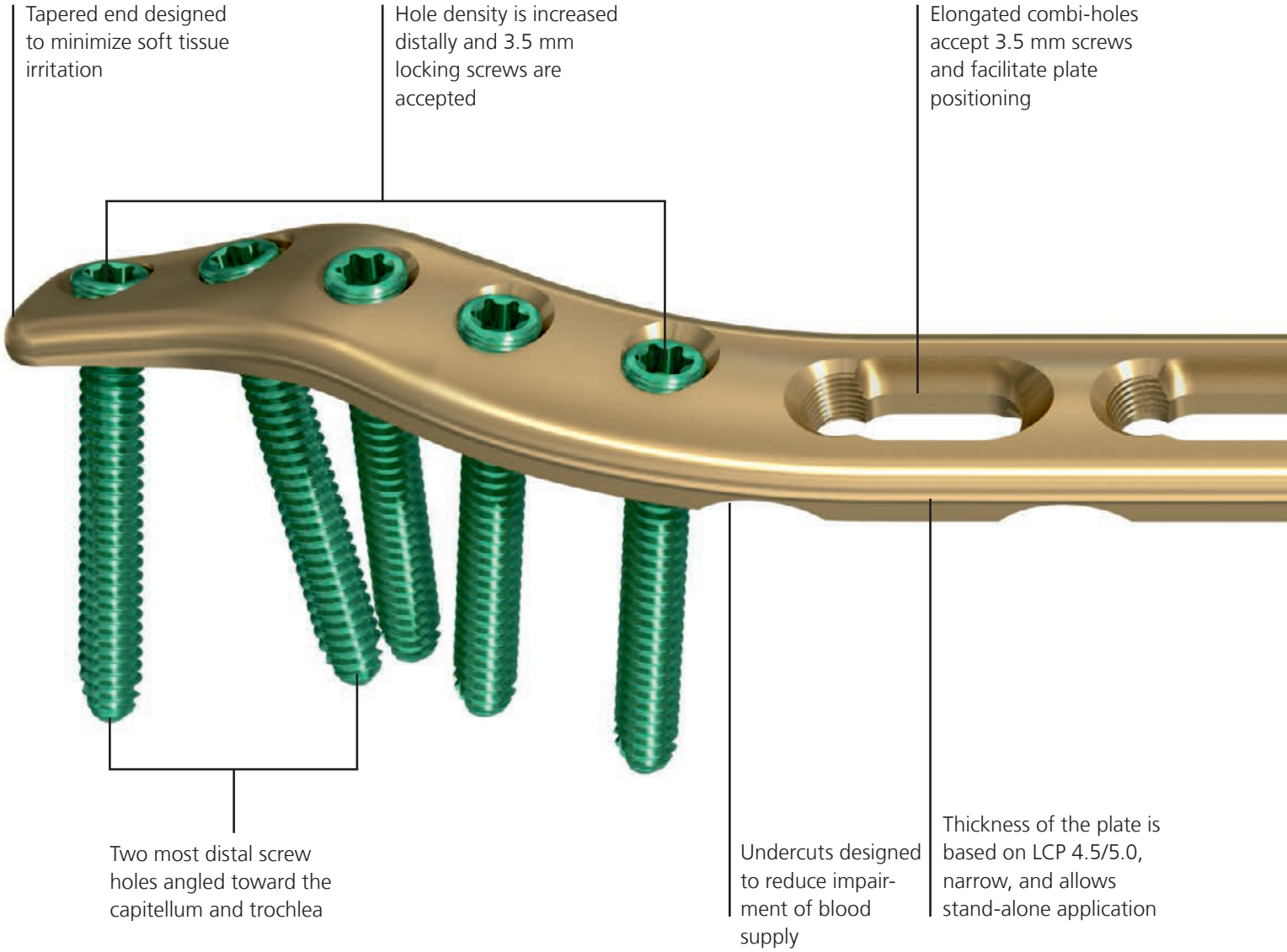
Table of Contents

LCP Extra-articular Distal Humerus Plate. The anatomically shaped and angular stable fixation system for extra-articular fractures of the distal humerus.

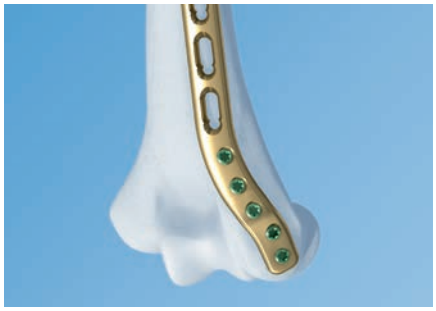
Indications

- Extra-articular fractures of the distal humerus
- Malunions of the distal humerus
- Non-unions of the distal humerus

Features



Anatomically pre-contoured LCP selection for the distal humerus



LCP Extra-articular Distal Humerus Plate

Primary Indication
- Extra-articular fractures of the distal humerus

Features
- Plate thickness based on LCP 4.5/5.0, narrow
- Designed angles of distal screw holes
- Tapered plate end near the joint

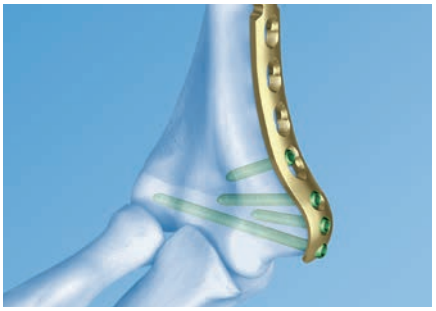
Portfolio
- Plates in six lengths

LCP Distal Humerus Plates

Primary Indication
- Intra-articular fractures of the distal humerus, especially for osteoporotic bone
- Supracondylar fractures of the distal humerus

Features
- 90° plating technique possible
- Small distal screws for multiple fixation options for the distal block
- Position and compression device available
- Aiming block for guided screw insertion

Portfolio
- Dorsolateral plates with or without support
- All plates in five lengths



LCP Metaphyseal Distal Medial Humerus Plate

Primary Indication
- Juxta-articular distal humerus fractures

Features
- Notches on plate shaft
- Tapered plate end near the joint
- Aiming block for guided screw insertion

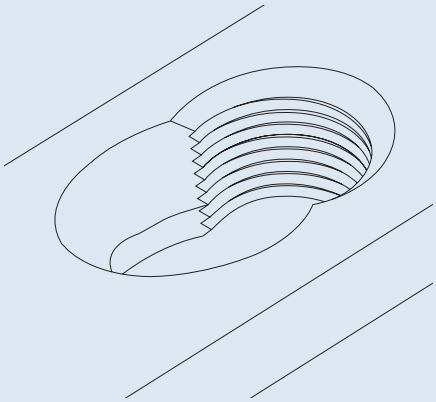
Portfolio
- One plate for left and right
- Plates in five lengths

LCP Locking Compression Plate
Angular stable fixation of fragments regardless of bone quality

Minimised risk of primary and secondary loss of reduction, even under high dynamic loading

Reduced impairment of periosteal blood supply due to the limited plate contact

Good purchase also in osteoporotic bone and in multifragment fractures



LCP combi-hole
Intraoperative choice between compression and angular stable locking

With standard screws:
interfragmental or dynamic-axial compression

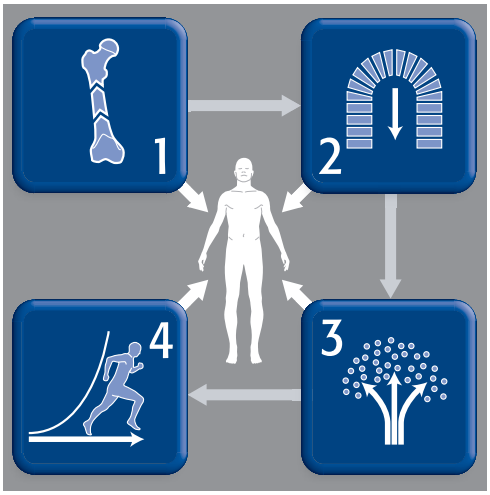
With locking screws:
stable plate-screw connection without loss of reduction, regardless of plate modelling

AO Principles

In 1958, the AO formulated four basic principles, which have become the guidelines for internal fixation[1,2].

Anatomic reduction
Fracture reduction and fixation to restore anatomical relationships.

Early, active mobilization
Early and safe mobilization and rehabilitation of the injured part and the patient as a whole.



Stable fixation
Fracture fixation providing absolute or relative stability, as required by the patient, the injury, and the personality of the fracture.

Preservation of blood supply
Preservation of the blood supply to soft tissues and bone by gentle reduction techniques and careful handling.

[1] Müller ME, Allgöwer M, Schneider R, Willenegger H. Manual of Internal Fixation. 3rd ed. Berlin, Heidelberg, New York: Springer. 1991.
[2] Rüedi TP, Buckley RE, Moran CG. AO Principles of Fracture Management. 2nd ed. Stuttgart, New York: Thieme. 2007.

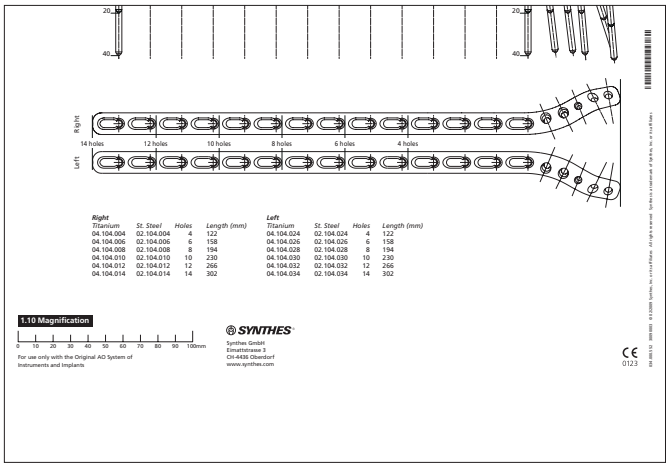
Indications

– Extra-articular fractures of the distal humerus
– Malunions of the distal humerus
– Non-unions of the distal humerus

Note: For information on fixation principles using conventional and locked plating techniques, please refer to the LCP Locking Compression Plate Surgical Technique (DSEM/TRM/0115/0278).

1
Preoperative planning

Complete the preoperative radiographic assessment and prepare the preoperative plan. Use the x-ray template for LCP Extra-articular Distal Humerus Plate (Art. No. 034.000.552 for right and for left humerus) to determine the length of the plate and the position of the screws.



Right				Left			
Titanium	St. Steel	Holes	Length (mm)	Titanium	St. Steel	Holes	Length (mm)
04.104.004	02.104.004	4	122	04.104.024	02.104.024	4	122
04.104.006	02.104.006	6	158	04.104.026	02.104.026	6	158
04.104.008	02.104.008	8	194	04.104.028	02.104.028	8	194
04.104.010	02.104.010	10	230	04.104.030	02.104.030	10	230
04.104.012	02.104.012	12	266	04.104.032	02.104.032	12	266
04.104.014	02.104.014	14	302	04.104.034	02.104.034	14	302

X-ray template for LCP Extra-articular Distal Humerus Plate

2
Position patient

Positioning is by surgeon preference. However, the lateral decubitus position is frequently chosen. The arm is rested on a padded bar allowing elbow flexion of 120°.

3
Approach

Possible approaches include a triceps split approach or a posterolateral approach; where the triceps are elevated off the back of the humerus from lateral to medial. Distally, this is the posterior side of a standard Kocher approach. Proximally, one can identify the radial nerve in the manner described by Gerwin et al.[2]

Precaution: If the plate is long, the radial nerve needs to be elevated off the back of the humerus and the plate placed underneath. Also consider the nerve when inserting screws.

Otherwise, the ulnar nerve rarely needs to be identified by more than palpation and almost never needs to be isolated or elevated with these fractures.

An olecranon osteotomy is not necessary for plate placement.

[2] Gerwin, Michelle, et al. "Alternative Operative Exposures of the Posterior Aspect of the Humeral Diaphysis. With Reference to the Radial Nerve." The Journal of Bone and Joint Surgery 78:1690-5 (1996)

1

Reduce fracture and fix temporarily

Use pointed forceps for temporary fixation in restoring the anatomy. Ensure that forceps will not interfere with subsequent plate placement.

2

Determine plate length

Choose a plate length that offers sufficient fixation proximal to the fracture.

3
Position plate on the bone

Optional instruments	
329.020	Bending Iron for LC-DCP 4.5 and DCP 4.5, length 250 mm
329.300	Bending Press, length 400 mm

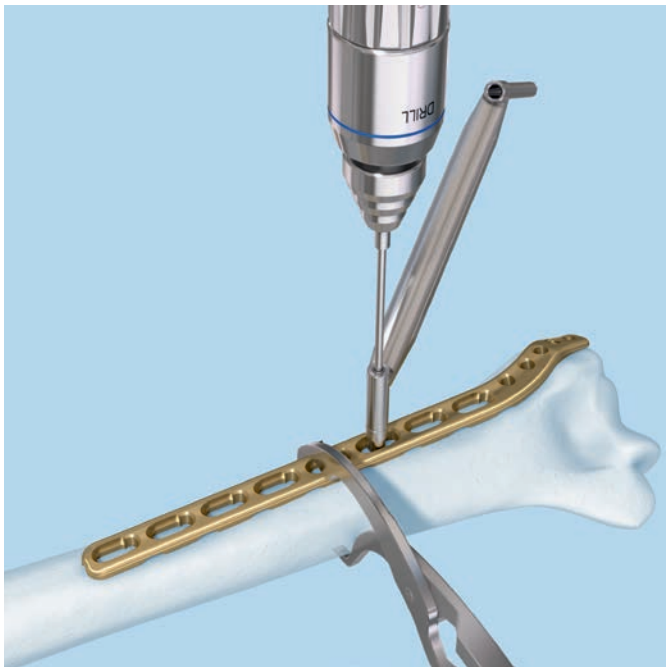
Position the plate so that the shaft portion of the plate is located centrally on the posterior aspect of the bone while the distal end curves along the back of the lateral column. Ensure that the plate is at a safe distance from the olecranon fossa so that complete elbow extension is not impeded.

The position of the plate should allow distal screw insertion through the lateral flange to reach far into the trochlea.

Due to varying patient anatomy, slight bending may be necessary. Contour plate as needed using the bending irons or the plate-bending press.

4
Preliminary fixation and compression

Instruments	
323.360	Universal Drill Guide 3.5
310.250	Drill Bit ∅ 2.5 mm, length 110/85 mm, 2-flute, for Quick Coupling
311.431	Handle with Quick Coupling
314.030	Screwdriver Shaft, hexagonal, small, ∅ 2.5 mm
314.020	Screwdriver, hexagonal, small, with Holding Sleeve



After reducing the fracture, apply the plate and insert a non-locking screw through the center of the DCU portion of an elongated combi-hole proximal to the fracture.

Use the 2.5 mm drill bit through the 3.5 mm universal drill guide to predrill the bone. For the neutral position, press the drill guide down in the non-threaded hole.

Use the depth gauge to determine screw length.

Select and insert a 3.5 mm cortex screw of appropriate length. Do not completely tighten the screw. Make any final adjustments to plate placement. Manually tighten the screw to maintain the plate placement and compress the plate to the bone.

5
Insert two most distal locking screws

Instruments	
323.027	LCP Drill Sleeve 3.5, for Drill Bits ∅ 2.8 mm
323.055	Centering Sleeve for Kirschner Wire ∅ 1.6 mm, length 70 mm, for Nos. 323.027 and 323.054
292.160	Kirschner Wire ∅ 1.6 mm with trocar tip, length 150 mm, Stainless Steel
323.060	PHILOS Direct Measuring Device for Kirschner Wire ∅ 1.6 mm
310.284	LCP Drill Bit ∅ 2.8 mm with Stop, length 165 mm, 2-flute, for Quick Coupling
314.030	Screwdriver Shaft, hexagonal, small, ∅ 2.5 mm
or	
314.116	Screwdriver Shaft Stardrive 3.5, T15, self-holding, for AO/ASIF Quick Coupling
511.770/773	Torque Limiter, 1.5 Nm
397.705/ 311.431	Handle for Torque Limiter Nos. 511.770 and 511.771/Handle with Quick Coupling

Insert the centering sleeve into the LCP drill sleeve (1).

Insert the LCP drill sleeve assembly into the most distal locking hole until fully seated.

Insert a 1.6 mm Kirschner wire through the centering sleeve and drill to the desired depth.

Verify the Kirschner wire placement under image intensification to determine if final screw placement will be acceptable. This wire should be at or slightly distal to the equator of the capitellum for plate placement to be correct.

Precaution: The Kirschner wire position represents the final position of the locking screw. Confirm that the Kirschner wire does not enter the joint.

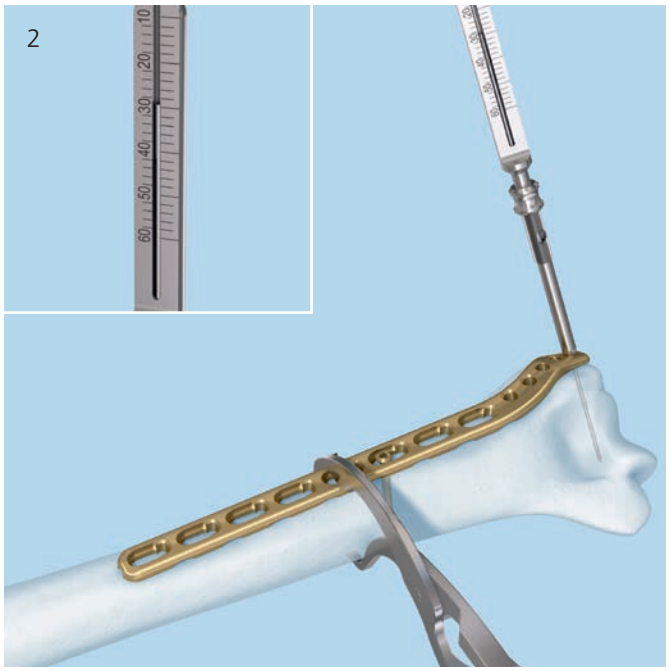
1

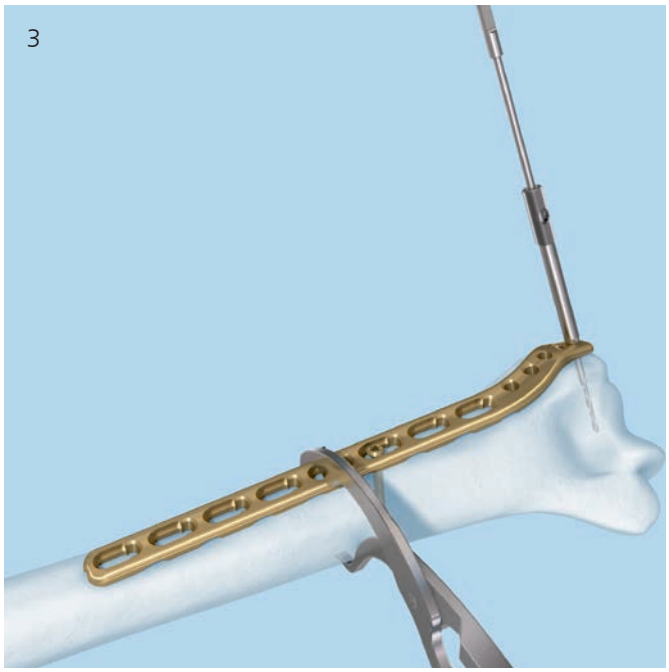
Measure for screw length by sliding the tapered end of the direct measuring device over the Kirschner wire down to the centering sleeve (2).

Remove the direct measuring device, Kirschner wire and 1.6 mm centering sleeve, leaving the threaded drill sleeve in place (3).

- Under image intensification, use the 2.8 mm drill bit to pre-drill for the screw.

Remove the threaded drill sleeve.





Select a locking screw with the appropriate length.

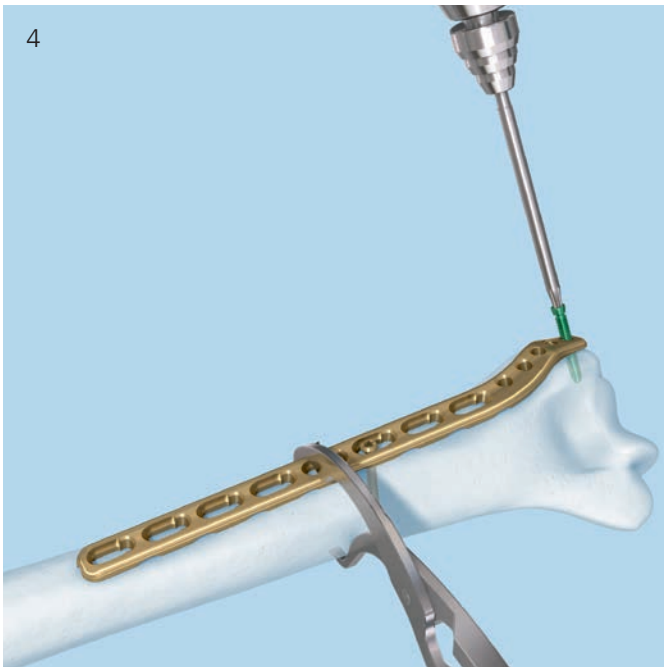
Insert the locking screw with the appropriate screwdriver shaft (hexagonal or Stardrive recess) mounted on the 1.5 Nm torque limiter (4).

Insert the screw manually or by power until a click is heard. If a power tool is used, reduce speed when screwing the head of the locking screw into the plate.

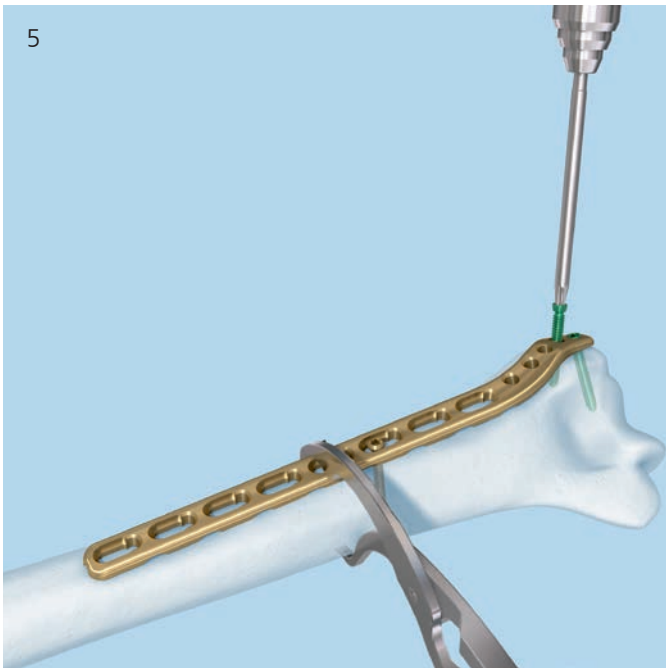
Repeat this process for the second most distal locking screw (5).

Note: If additional compression of the distal fragment to the plate is needed, insert a 4.0 mm cancellous screw prior to inserting the locking screws. This screw may be inserted into one of the proximal locking holes in the head of the plate (but not one of the two most distal holes). After fixation with locking screws through the remaining holes, this screw can be replaced with a locking screw.

4



5



6
Insert locking screws

Instruments	
323.027	LCP Drill Sleeve 3.5, for Drill Bits ∅ 2.8 mm
310.284	LCP Drill Bit ∅ 2.8 mm with Stop, length 165 mm, 2-flute, for Quick Coupling
319.010	Depth Gauge for Screws ∅ 2.7 to 4.0 mm, measuring range up to 60 mm
314.030	Screwdriver Shaft, hexagonal, small, ∅ 2.5 mm
or	
314.116	Screwdriver Shaft Stardrive 3.5, T15, self-holding, for AO/ASIF Quick Coupling
511.770/773	Torque Limiter, 1.5 Nm
397.705/ 311.431	Handle for Torque Limiter Nos. 511.770 and 511.771/Handle with Quick Coupling

Insert locking screws into the remaining head holes.

Determine where locking screws will be used in the shaft portion of the plate. Working from the fracture up the shaft, insert locking screws into the desired holes until desired fixation is achieved.

Insert the LCP drill sleeve into the locking portion of the combi-hole until fully seated (1).

Use the 2.8 mm drill bit to drill to the desired depth (2).

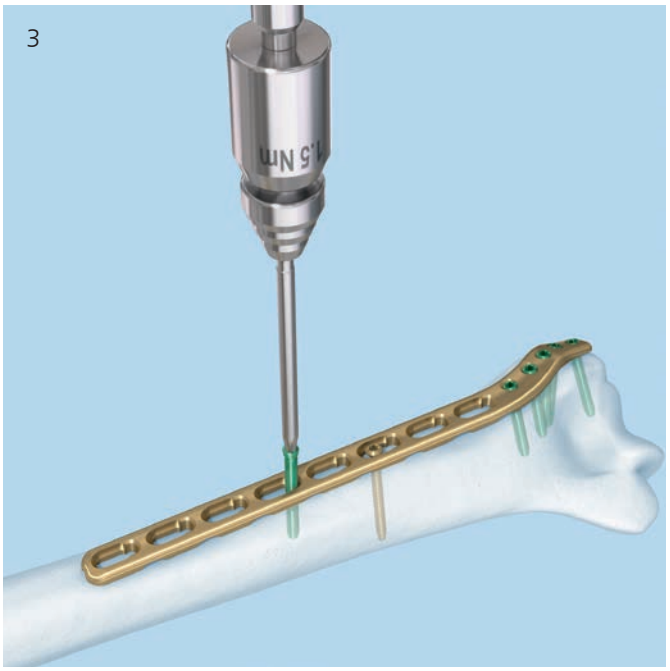
Remove the drill guide.

Use the depth gauge to determine screw length.

Select a locking screw with the appropriate length.

Insert the locking screw with the appropriate screwdriver shaft (Hexagonal or Stardrive recess) mounted on the 1.5 Nm torque limiter (3).

Insert the screw manually or by power until a click is heard. If a power tool is used, reduce speed when screwing the head of the locking screw into the plate.



7

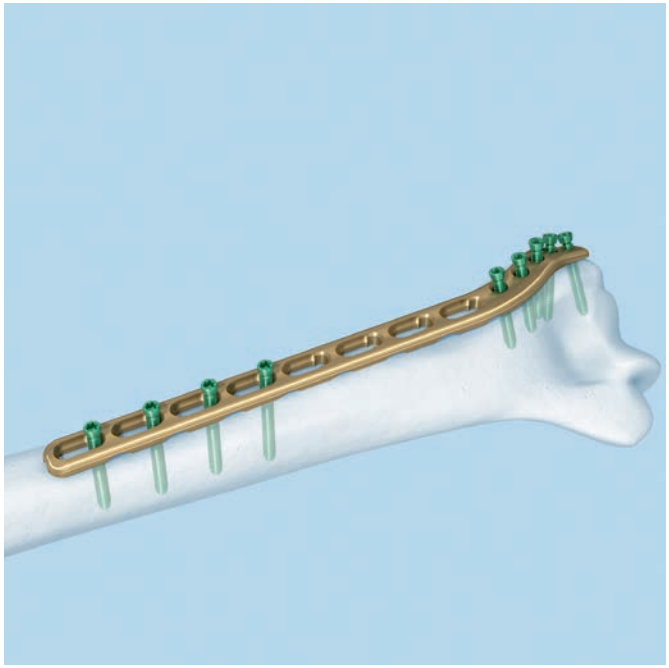
Insert bone graft (optional)

If desired, fill any bone defect with autogenous bone graft or bone graft substitute. When using bone graft substitute, follow the manufacturer's directions for use.

Implant Removal

Instruments

314.030	Screwdriver Shaft, hexagonal, small, ∅ 2.5 mm
or	
314.116	Screwdriver Shaft Stardrive 3.5, T15, self-holding, for AO/ASIF Quick Coupling
309.520	Extraction Screw, conical, for Screws ∅ 2.7, 3.5 and 4.0 mm
309.521	Extraction Screw for Screws ∅ 3.5 mm
311.430	Handle with Quick Coupling, length 110 mm
311.440	T- Handle with Quick Coupling



Implant removal

Unlock all screws from the plate, then remove the screws completely from the bone. This prevents simultaneous rotation of the plate when unlocking the last locking screw. If a screw cannot be removed with the screwdriver (e.g. if the hexagonal or Stardrive recess of the locking screw is damaged or if the screw is stuck in the plate), use the T-Handle with Quick-Coupling (311.440) to insert the conical Extraction Screw (309.520 or 309.521) into the screw head, and unscrew the screw in a counter-clockwise direction.

Implants

LCP Extra-articular Distal Humerus Plates

Right	Left	Holes	Length (mm)
0X.104.004	0X.104.024	4	122
0X.104.006	0X.104.026	6	158
0X.104.008	0X.104.028	8	194
0X.104.010	0X.104.030	10	230
0X.104.012	0X.104.032	12	266
0X.104.014	0X.104.034	14	302

All plates are also available sterile packed.
For sterile implants add suffix "S" to article number.

X=2: stainless steel
X=4: titanium

Screws used with the LCP Extra-articular Distal Humerus Plate

⬢ *X12.102–124	Locking Screw Stardrive ∅ 3.5 mm, length 12–60 mm, self-tapping	
⬢ *X13.012–060	Locking Screw ∅ 3.5 mm, length 14–60 mm, self-tapping	
⬢ **X04.814–860	Cortex Screw ∅ 3.5 mm, length 12–60 mm, self-tapping,	

All screws are also available sterile packed. For sterile implants add suffix "S" to article number.
X=2: Stainless Steel
*X=4: TAN
**X=4: TiCP

⬢ Stardrive
⬢ Hexagonal

Instruments

The LCP Extra-articular Distal Humerus Plate is compatible with 3.5 LCP instruments and standard small-fragment instruments. In addition to the 3.5 LCP instruments, this instrument is also required:

323.055	Centering Sleeve for Kirschner Wire ∅ 1.6 mm, length 70 mm, for Nos. 323.027 and 323.054	

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Levy JC "An alternative method of osteosynthesis for distal humeral shaft fractures." J Orthop Trauma. 2005 Jan; 19(1):43-7

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McCormack R.G. "Fixation of fractures of the shaft of the humerus by dynamic compression plate or intramedullary nail. A prospective, randomised trial." J Bone Joint Surg Br. 2000 Sep; 82(7):1085-6

Müller ME, Allgöwer M, Schneider R, Willenegger H (1995) Manual of Internal Fixation. 3rd, expanded and completely revised ed. 1991. Berlin, Heidelberg, New York:Springer

Schemitsch EH "Biomechanical evaluation of methods of internal fixation of the distal humerus." J Orthop Trauma. 1994 Dec; 8(6):468-75

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.

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