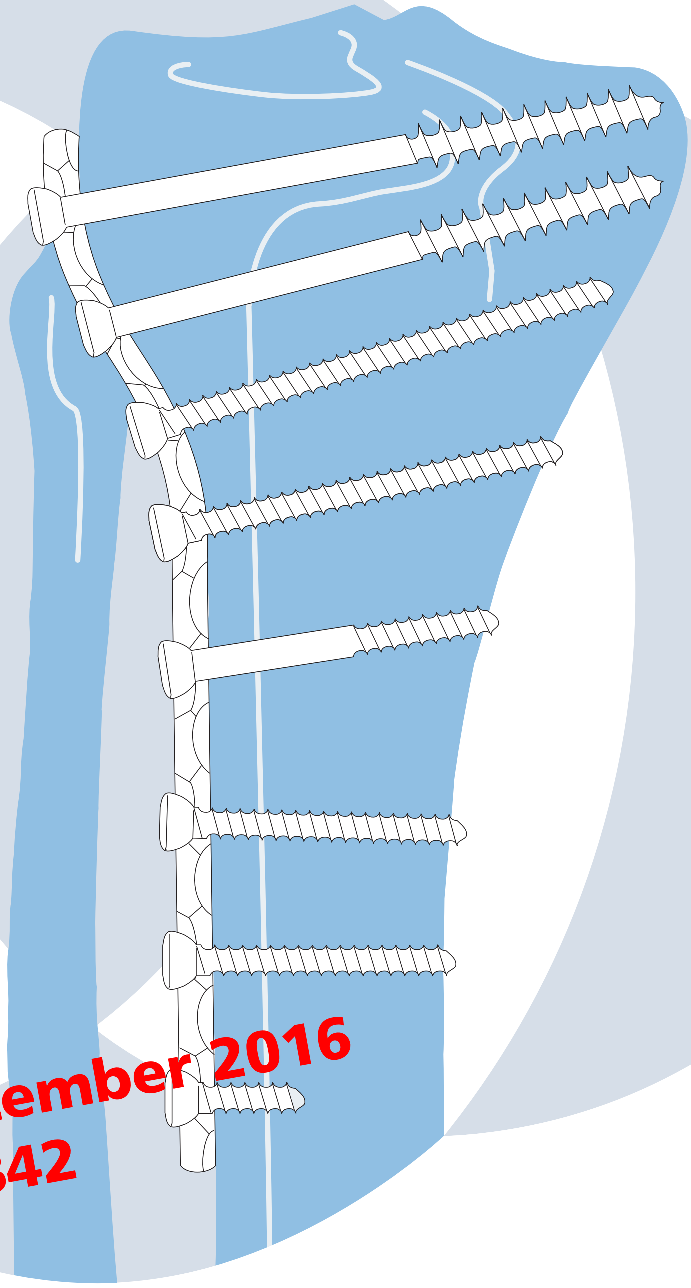
LC-DCP® SYSTEM

Dynamic compression plates
with limited bone contact



Discontinued – December 2016
DSEM/TRM/0517/0842

Instruments and implants approved by the AO Foundation.

~~SURGICAL TECHNIQUE~~

TECHNICAL FEATURES
APPLICATION
CLINICAL CASES

Image intensifier control

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

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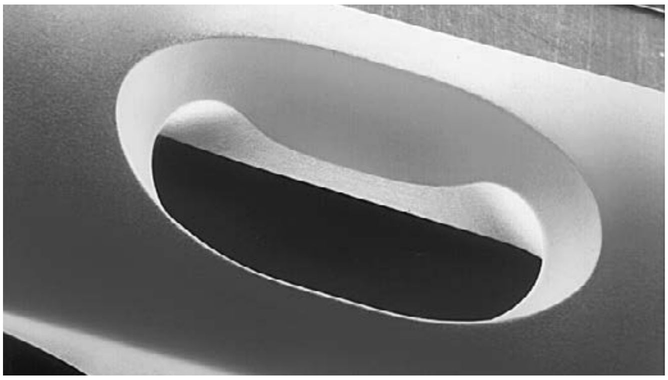
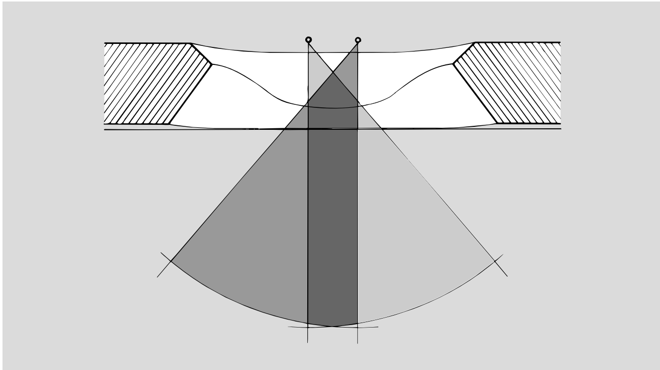
TECHNICAL IMPROVEMENTS IN THE LC-DCP®
(LC-DCP: Limited Contact Dynamic Compression Plate)

PLATE HOLE GEOMETRY

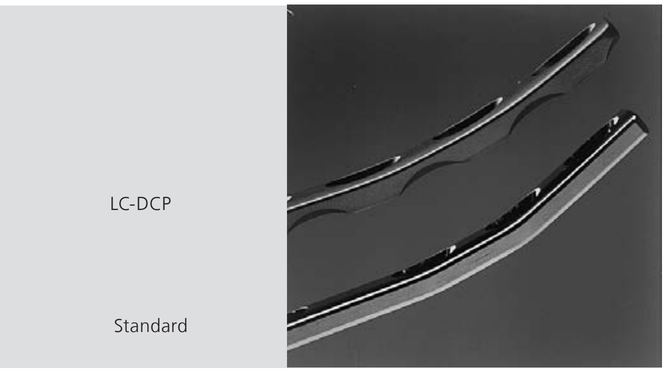


The symmetrical shape of the plate holes enables compression to be achieved in both directions.

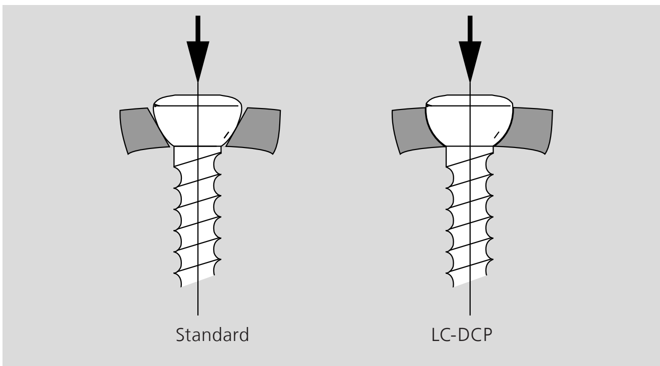


The ability to incline screws at up to 40° to the perpendicular permits an even wider range of applications.

UNIFORM IMPLANT STIFFNESS



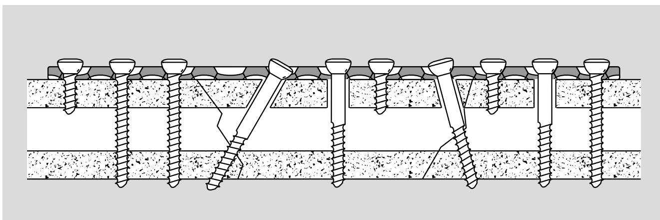
New plate design renders the LC-DCP® uniformly stiff. This facilitates contouring to the bone and reduces stress concentrations.



Screw-head fit is maintained during bending as the plate holes deform minimally during plate shaping.

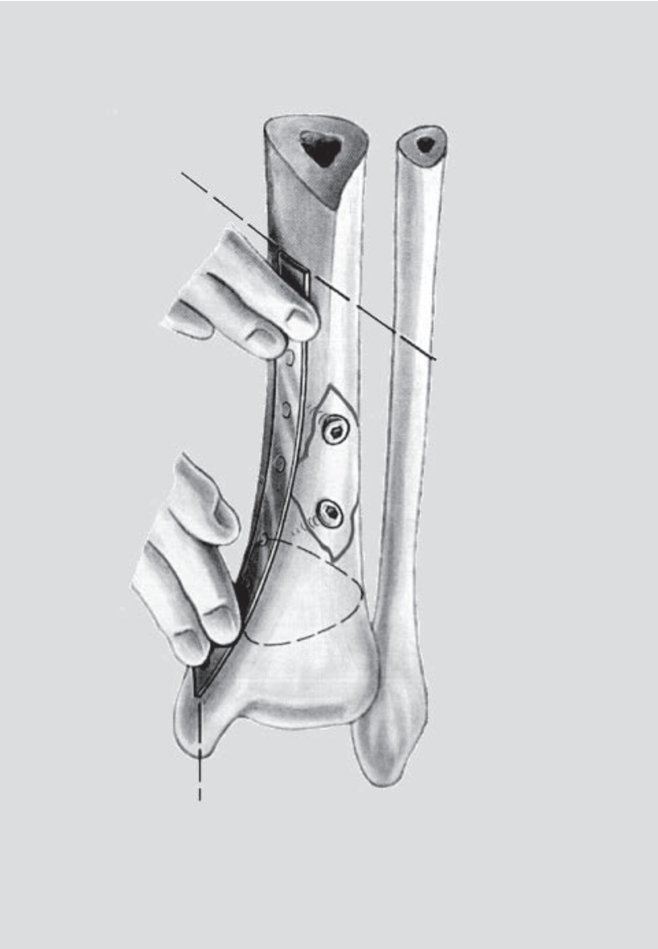
NO MID SECTION

The hole spacing in the LC-DCP is regular. Plate positioning is thus not restricted by the presence of a mid-section. This is of particular advantage in comminuted or segmental fractures.



A double fracture, spanned by the LC-DCP and lag screws through the plate.

PLATE CONTOURING



Treating juxta-articular fractures (distal tibia, tibial plateau, distal femur, distal humerus, radius etc.), good contouring of the plate to the shape of the bone is very important. Only thus can satisfactory reduction and adequate stability be obtained.

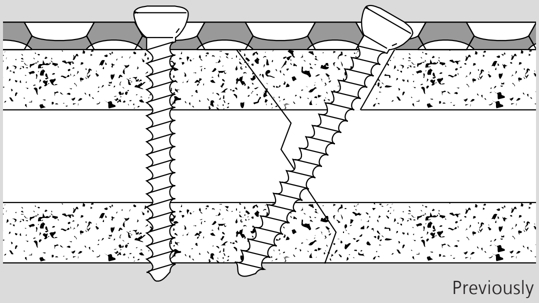
The LC-DCP plates are made of AO Pure Titanium, featuring optimum biocompatibility. Pure Titanium has mechanical properties different from stainless steel. Due to its lower modulus of elasticity, Titanium is more springy. Therefore Titanium plates should be somewhat over-bent to obtain the desired shape.

The design of the LC-DCP plates ensures uniform rigidity, hence a continuous curvature after bending. The plates should not be bent beyond the necessary extent, however. “To-and-fro” bending should particularily be avoided.

Sharp indentations on the plate surface, especially around the plate holes, may impair resistance to fatigue and should be avoided.

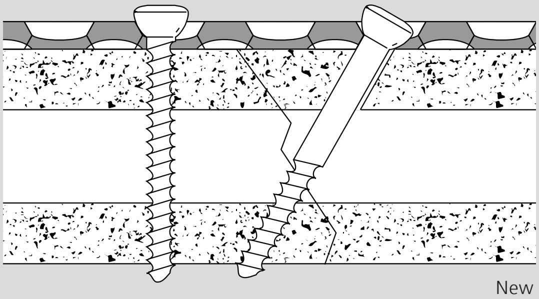
SHAFT SCREW USED AS A LAG SCREW TO ACHIEVE FULL COMPRESSION

Using a fully-threaded cortex screw, only 50% of the possible compression are achieved.
In order to achieve optimum compression, the lag screw must be able to glide freely within the gliding hole. If a cortex screw is used as a lag screw, there is a tendency for the screw-thread to be pressed into the cortex on the compressed fracture side of the screw hole as the screw is tightened. The screw can then no longer glide freely within the gliding hole and the compression effect is impaired.



Previously

The shaft screw achieves optimum compression.
The shaft screw (shown on the right) slides freely through the gliding hole. Optimum compression can thus be achieved.

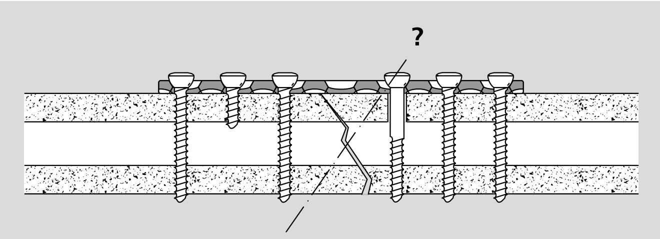


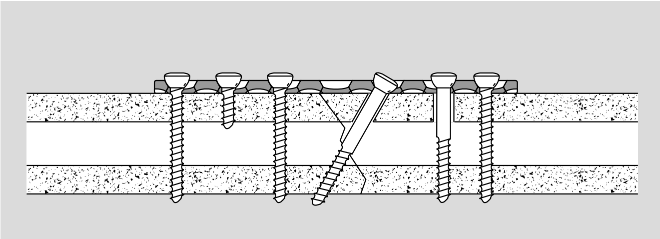
New

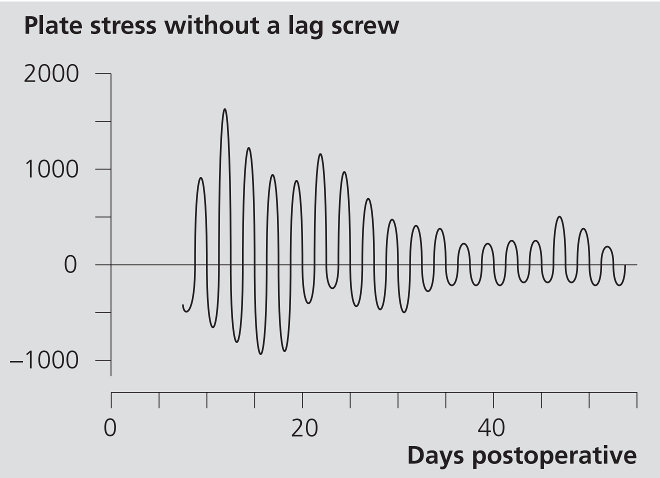
USE OF A LAG SCREW THROUGH THE PLATE ACHIEVES ADDITIONAL STABILITY

In certain circumstances, the use of a plate for fracture compression may be sufficient. In many fractures, however, it is advantageous to insert a lag screw through the plate to increase fracture stability.

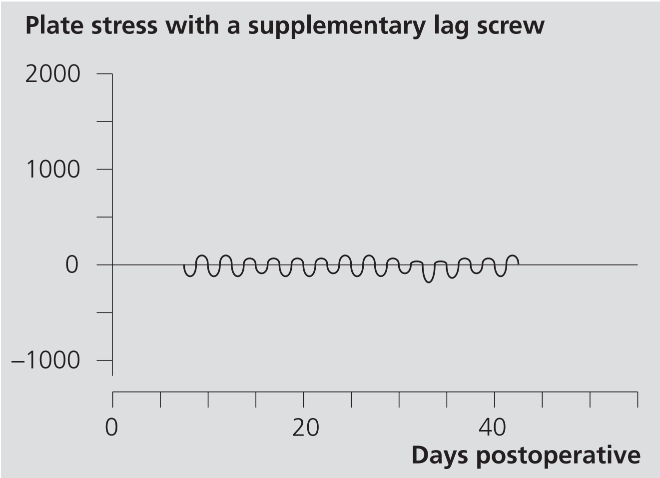
A lag screw is used to achieve additional stability and interfragmentary compression in the far cortex.







If fracture gaps remain, the plate is subjected to high bending stresses.



Reduction in implant stress by using a lag screw through the plate*.

* Source: Klaue K. et al., 1985
Die Entlastung der Osteosyntheseplatte durch interfragmentäre Plattenzugschraube.

NEUTRAL AND COMPRESSION LC-DCP DRILL GUIDES

The instruments for LC-DCP implantation are virtually the same as those used for the DCP®. The new shape of the holes, however, requires different drill guides:

LC-DCP Drill Guide 4.5
- neutral (green) and compression (yellow) position
- for narrow and broad LC-DCP 4.5

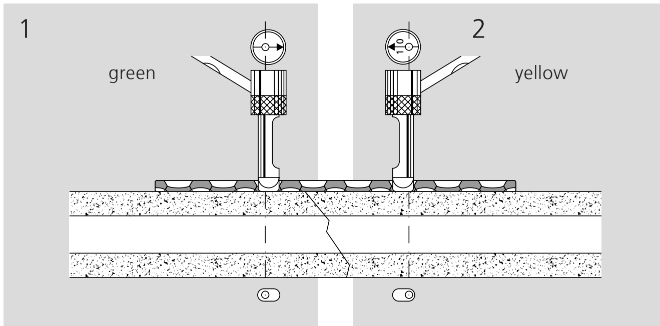
LC-DCP Drill Guide 3.5
- neutral (green) and compression (yellow) position
- for LC-DCP 3.5

The new plate hole is symmetrically shaped. It now possesses one compression point and one neutral point on both sides. The two drill guides bear an arrow enabling correct positioning of the screw.

1 Neutral position
The arrow on the green drill guide must point towards the fracture to enable a screw to be placed in neutral position. Compression cannot be achieved with the green drill guide.

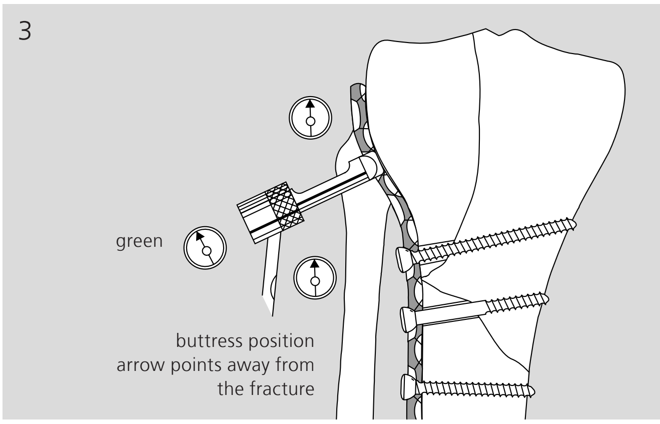
2 Compression
The yellow drill guide enables compression to be achieved. Important: the arrow must always point towards the fracture.

3 Buttress position
Use the green drill guide. A buttress effect is achieved when the arrow points away from the fracture.



neutral postition
arrow points towards the fracture

compression position
arrow points towards the fracture



buttress position
arrow points away from
the fracture

⟨ = symbol for a fracture line

UNIVERSAL DRILL GUIDE 4.5/3.2[1]

The Universal Drill Guide is an alternative to the green/ yellow drill guide for LC-DCP and DCP plates. Due to its spring mechanism, all types of applications are possible: neutral position, compression position, buttress position and especially the positioning of inclined lag screws through the plate.

Universal Drill Guide 4.5/3.2

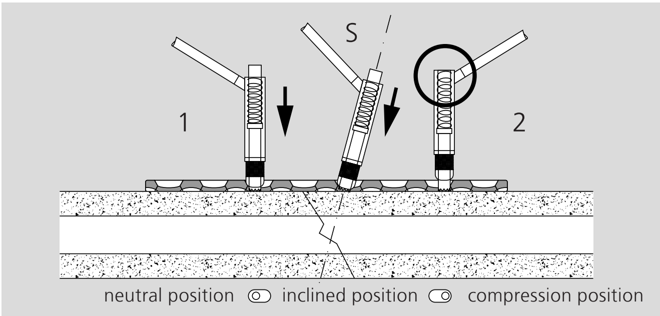
Universal Drill Guide 3.5

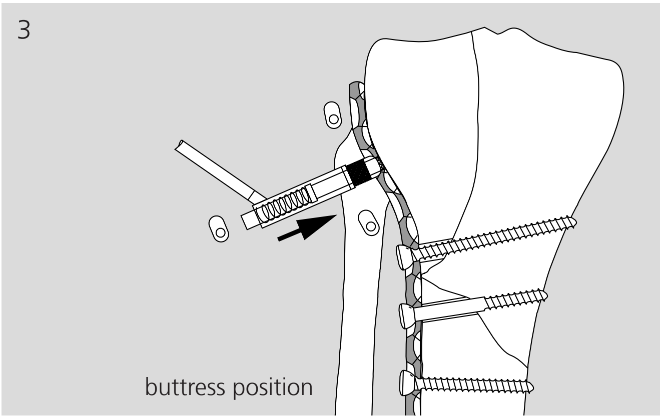
1 Predrilling in neutral position
Depress drill guide (upper part of inner sleeve projects). Position in plate hole **remote from the fracture**.

2 Predrilling in compression position
Do not depress drill guide (upper part is flush). Position in plate hole **remote from the fracture**.

S Predrilling in inclined position
For lag screws through the plate. Depress drill guide (upper part projects).

3 Predrilling in buttress position
Depress drill guide as shown for neutral position (upper part projects). Position in plate hole **adjacent to the fracture**.



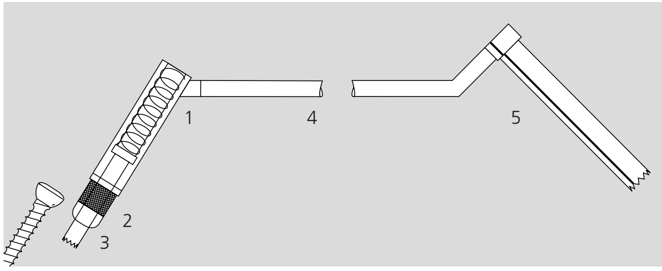


1 Patent pending

USE OF THE LC-DCP

Technical Description

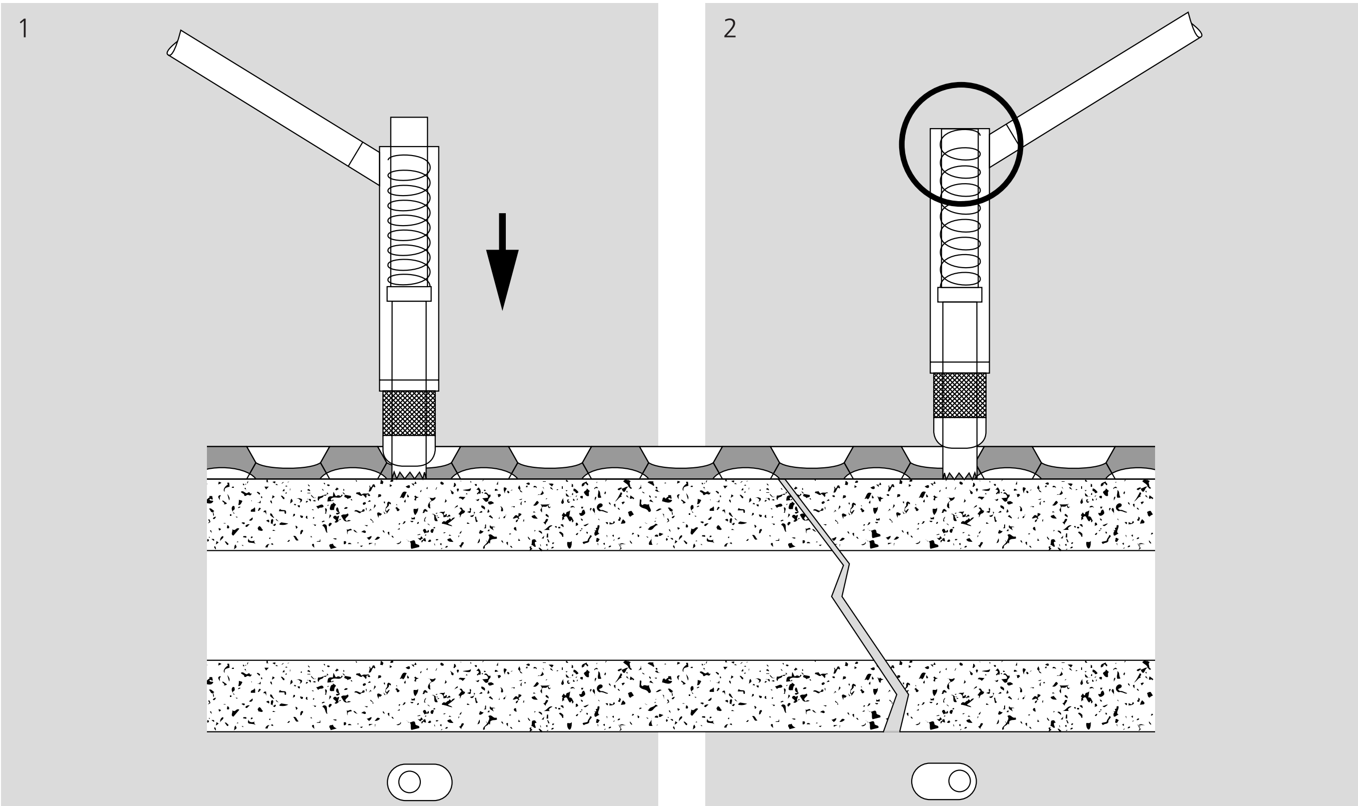
1 Outer sleeve of the universal drill guide 4.5/3.2
2 Hemispheric underside, corresponding to screw-head geometry
3 Inner sleeve, internal diameter 3.2 mm, external diameter 4.5 mm. Equipped with a spring which makes the drill guide suitable for all screw positions.
4 Handle
5 Drill guide/tissue-protecting sleeve for drill bit and tap 4.5 mm dia. for cortex screws 4.5 mm



The drill guide may be dismantled for cleaning purposes.

Drilling in neutral position (1)

Drilling in compression position (2)



1 • Seat the universal drill guide against the hole side remote from the fracture.
• Depress drill guide (upper part of inner sleeve projects).

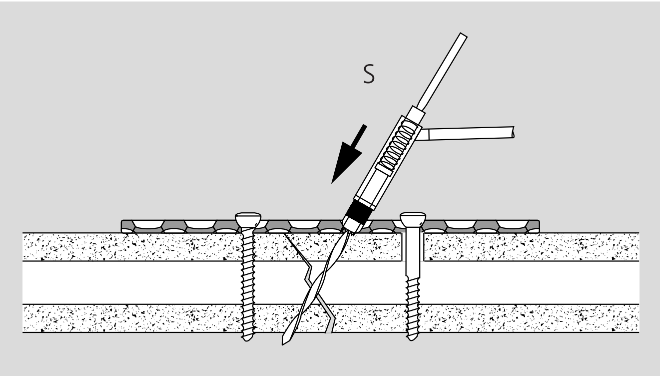
Screw is set in neutral position. No shift between plate and bone occurs.

2 • Seat the universal drill guide against the hole side remote from the fracture.
• Do not depress drill guide.

Screw is set in compression position. A compression path of 1 mm will be achieved upon screw tightening.

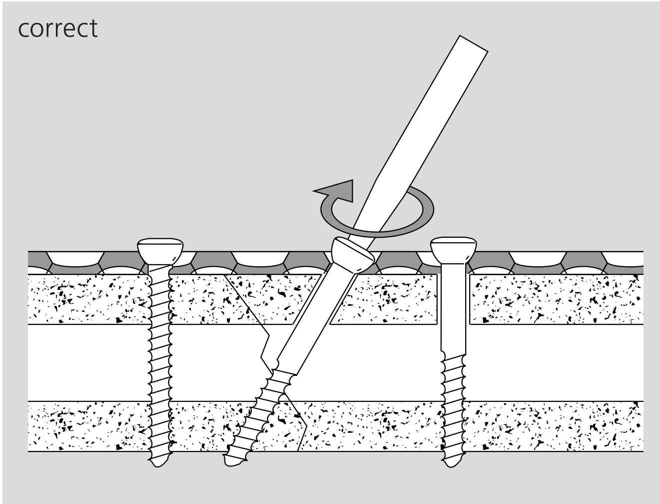
Unlike the DCP, the neutral position of the LC-DCP hole is not in the middle of the plate hole.

Drilling in inclined position (S)



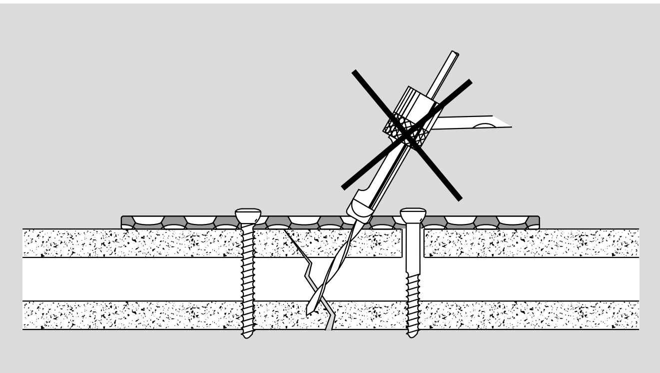
The hemispheric underside of the universal drill guide 4.5/3.2 corresponds to the shape of the screw-head. Place the drill guide in the hole adjacent to the fracture, depress, and set the desired drill angle.

Use of the universal drill guide 4.5/3.2 allows ideal positioning of the head of the inclined lag screw.

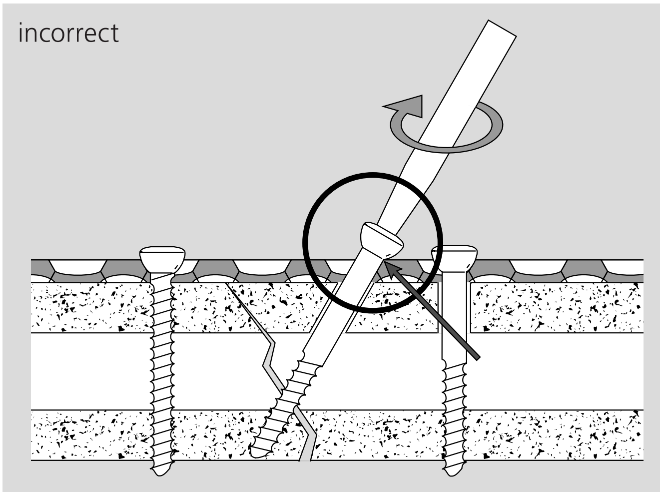


Tightening of the screw subsequent to predrilling, drilling of the gliding hole, and tapping. This does not subject the screw head to additional bending stresses.

Drilling in inclined position:
Neutral and compression drill guide not recommended



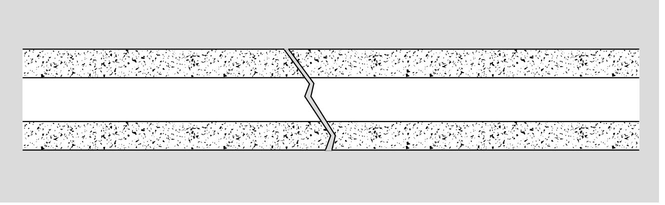
The shape of the underside of the neutral and compression drill guide fits the hole only in a more or less vertical position. Correct positioning of the screw is ensured. Optimum positioning is not guaranteed in the inclined position. There is a danger of the screw-head coming into contact with the upper edge of the hole when being inserted (see figure on the right).



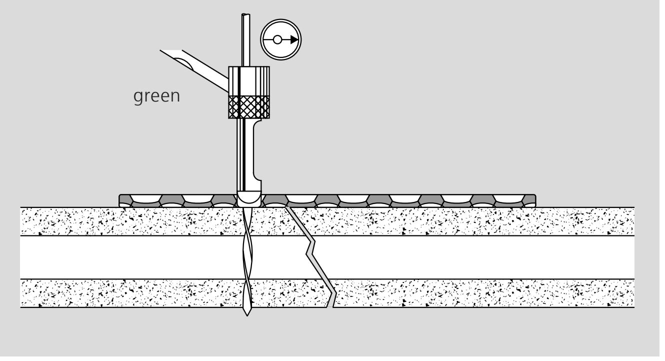
Tightening of the screw in this position, where the head of the screw is in contact with the upper edge of the plate hole, subjects the screw to considerable bending stresses in addition to the normal axial stresses. This may possibly cause screw-head breakage.

COMPRESSION PLATE: SIMPLE FRACTURE

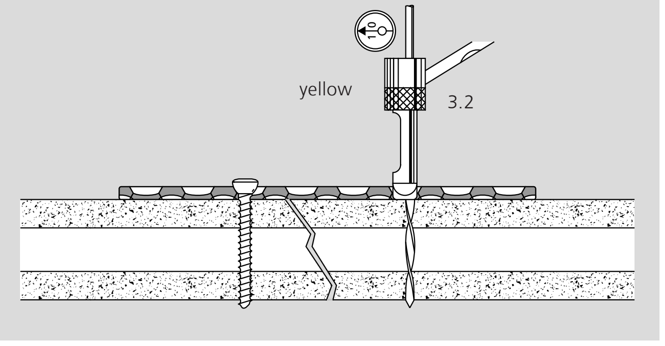
The LC-DCP has regularly spaced holes along the whole of its length, thus the plate position is not dictated by the position of the mid section. When choosing the length of the plate, ensure that enough holes are over both fragments, and that a lag screw can be inserted if necessary.
Illustrations show the procedure with the neutral and compression drill guide.



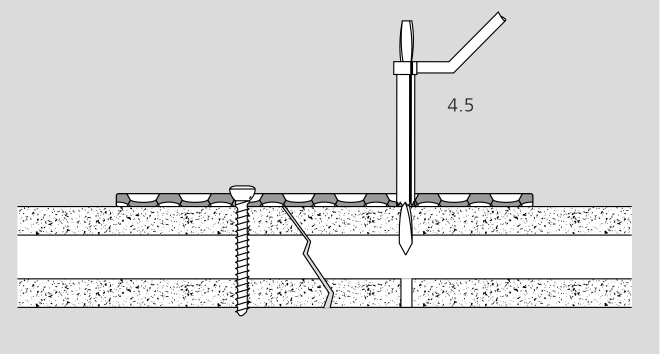
Drill the first hole adjacent to the fracture using a 3.2 mm dia. drill bit with the drill guide in neutral position (green drill guide, arrow pointing towards the fracture). Determine screw length, tap the thread, and insert the screw. The screwdriver should be turned around the **same axis as the screw axis** (i.e. screw and screwdriver in straight line). Lever stresses, which could otherwise lead to screw breakage, are thus avoided.



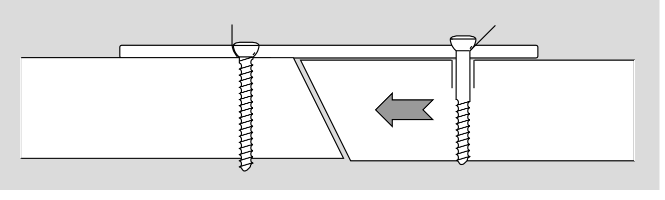
Drill through both cortices into the opposite fragment with 3.2 mm dia. drill bit and yellow drill guide in compression position (arrow points towards the fracture).



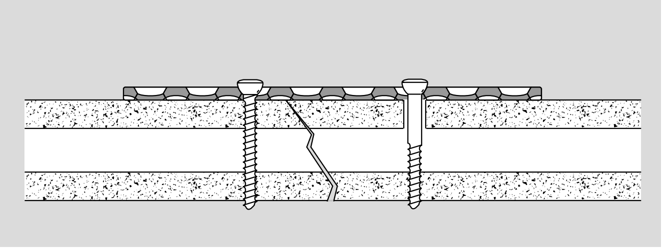
In order to achieve axial compression of the fracture, the screw must shove the bone laterally beneath the plate. The screw is thus subjected to lateral bending forces as well as to axial forces. For this purpose a stronger 4.5 mm shaft screw is recommended. As the shaft has a diameter of 4.5 mm, the near cortex has to be drilled to a diameter of 4.5 mm. (Use the tissue protecting sleeve.)



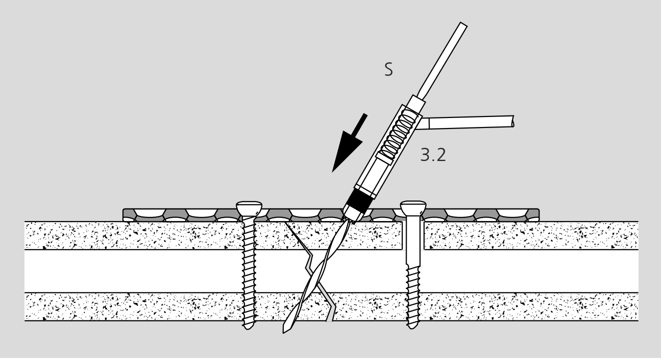
Important: **Whenever possible, the screws for axial compression should be placed in such a way that the apex of the fragment is drawn into the open wedge between plate and bone. This greatly reduces the risk of the fragment slipping.**



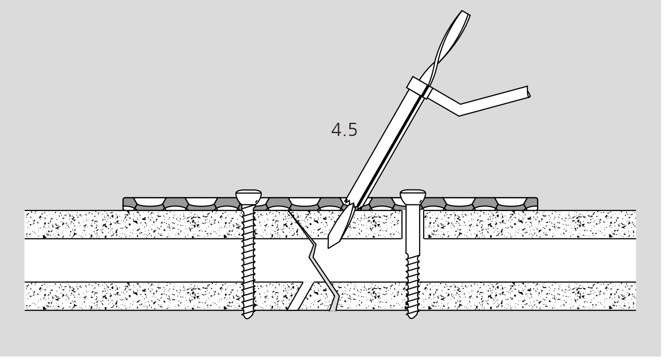
Insertion of a lag screw. This mostly brings about better compression in the near than in the far cortex.



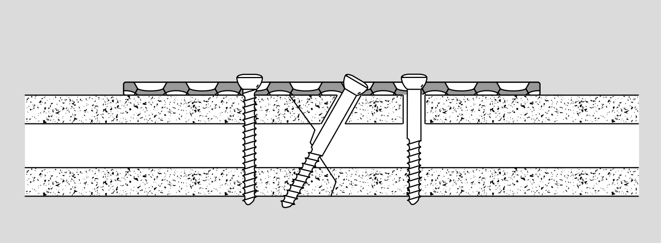
To increase stability in the far cortex, and decrease plate wear, an interfragmentary lag screw is inserted*. Preparing the lag screw: Drill through both cortices with universal drill guide 4.5/3.2 depressed and 3.2 mm dia. drill bit. The hemispheric underside of the universal drill guide 4.5/3.2 permits ideal positioning of the screw-head.



Widen the hole in the near cortex with the 4.5 mm dia. drill bit. Push tissue protecting sleeve upwards, insert the drill bit into the hole, then slide the tissue protecting sleeve down until it touches the plate. When drilling, care should be taken that the course of the glide hole follows exactly that of the 3.2 mm drill hole.

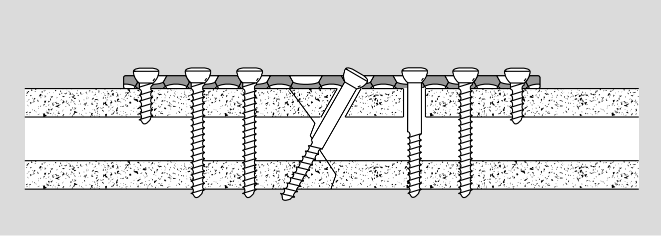


Use of a shaft screw as a lag screw ensures efficient gliding of the screw shaft in the gliding hole resulting in a considerably higher tension effect*. This achieves compression in the far cortex, too.



The remaining screw holes get filled by screws placed in the neutral position apart from the hole directly above the fracture.

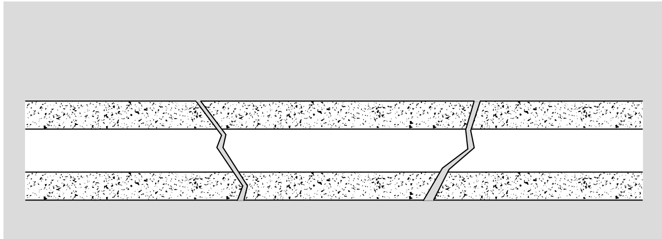
Completion of fracture treatment.



* see pages 4–5

COMPRESSION PLATE: MULTIFRAGMENTARY FRACTURE

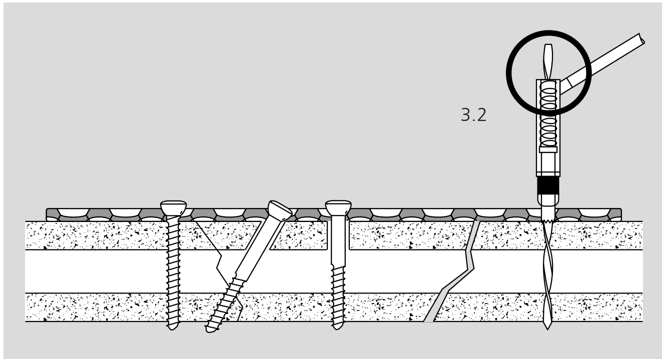
Fractures should be treated consecutively.



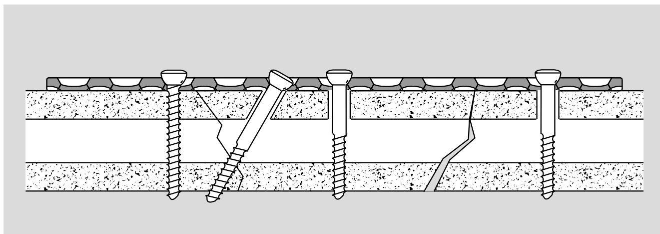
For treatment of the first fracture, follow the previously described example step by step.

Course of treatment of the second fracture using the **universal drill guide 4.5/3.2** to be carried out as follows.

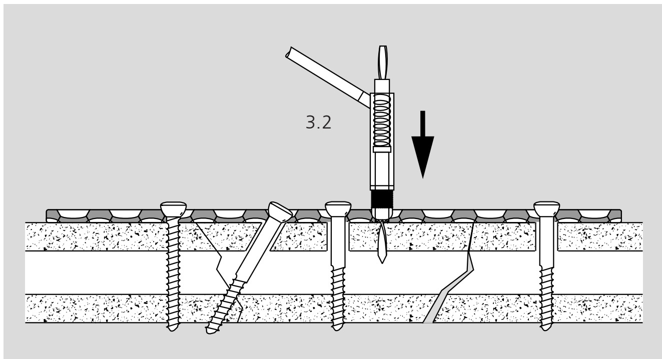
Drill a 3.2 mm dia. hole into the third fragment using the universal drill guide 4.5/3.2 in **compression position.** The drill guide is seated at the side of the hole remote from the fracture without depressing the drill guide (upper part is flush).



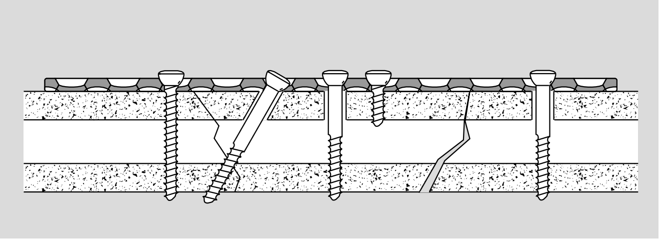
A 4.5 mm dia. gliding hole is then drilled, the screw length measured, and the thread tapped.
A screw is inserted into the hole. Use of a shaft screw is recommended. Mostly higher compression is achieved in the plated cortex than in the part distant from the plate.



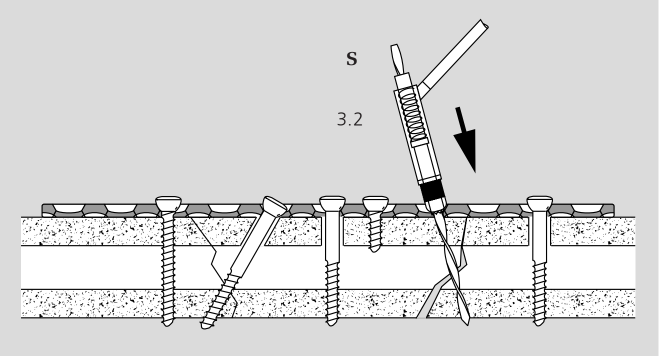
A screw is then inserted into the middle fragment. Prepare the screw hole with a 3.2 mm dia. drill bit and the universal drill guide 4.5/3.2 depressed for **neutral position,** upper part of inner sleeve projecting (possibly choose a short screw).



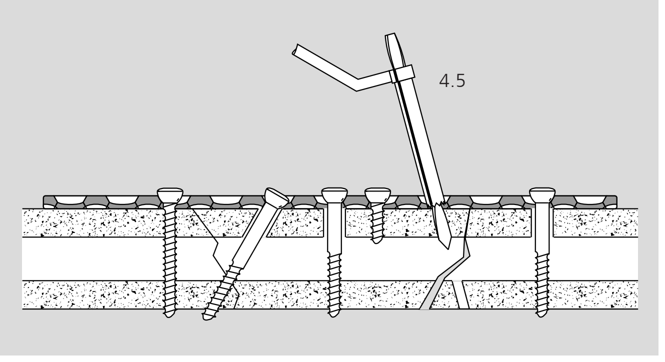
Place the screw.



Prepare lag screw seating with the universal drill guide 4.5/3.2 and the drill bit 3.2 mm dia. Positioning of the universal drill guide 4.5/3.2 adjacent to the fracture, depress drill guide, set drilling angle, drill (if there be the risk of the drill bit colliding with the screw in the vicinity, the drill bit has to be inclined).

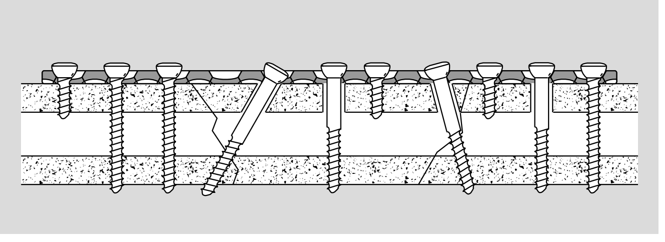


Now the gliding hole is drilled. Widen the near cortex using the drill bit 4.5 mm dia. and the tissue protecting sleeve, too (keep in direction). Measure the screw length and tap the thread.



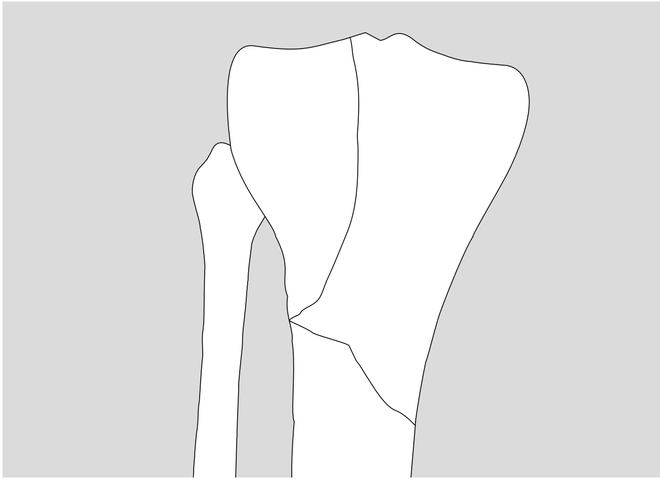
By insertion of a shaft screw as lag screw, additional stability is achieved. Lag and compression screw possibly to be tightened alternately.

The remaining screw holes are filled with neutrally placed screws.

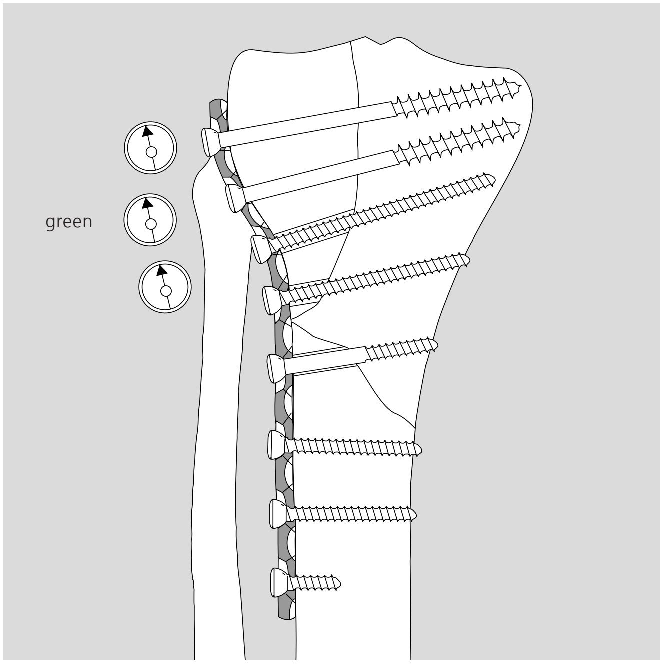


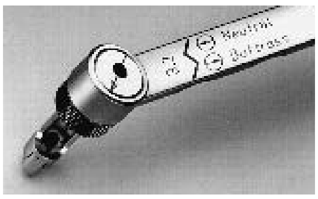
BUTTRESS PLATE

A shear fracture of the lateral part of the tibial head combined with a short oblique fracture. First the distal oblique fracture is treated as in the previously illustrated examples.



All the screw holes in the buttress region are prepared with the universal drill guide 4.5/3.2 or the green (neutral position) drill guide of the LC-DCP drill guide. **Here, the arrow of the drill guide points away from the fracture.** The proximally positioned cancellous bone screws and cortex screws act as lag screws. The thread grips only in the opposite fragment, so that there is compression between the fragments. Use of the green drill guide with the arrow "away from the fracture" prevents the tibial plateau fragment and the plate from slipping. In this situation, the screw-heads are buttressed by the hole edge adjacent to the fracture.

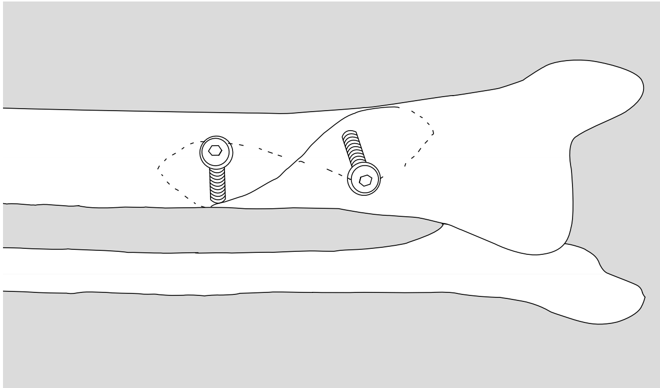




= symbol for a fracture line.

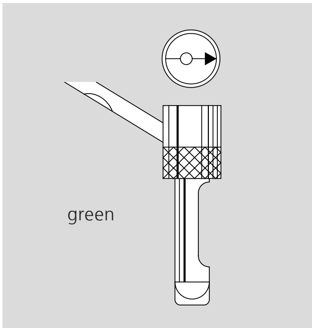
NEUTRALIZATION PLATE (PROTECTING PLATE)

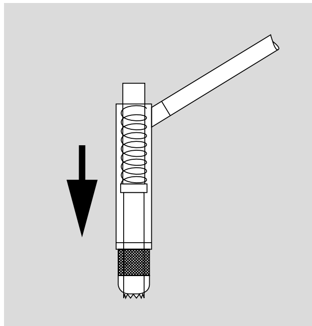
Adapt spiral fracture with two separate lag screws.



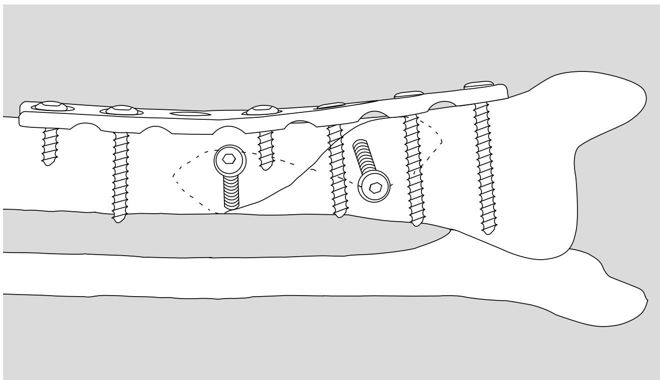
Position plate to bridge fracture using LC-DCP drill guide or universal drill guide 4.5/3.2.
LC-DCP drill guide (green): arrow points towards the fracture.

Universal drill guide: seat at hole edge remote from the fracture, depress outer sleeve, upper part projects for neutral position.





To complete fracture treatment, determine screw lengths and insert screws after having tapped the threads.



Warning: **This description is not sufficient for an immediate application of the instrumentation. An instruction by an experienced surgeon in handling this instrumentation is highly recommended.**

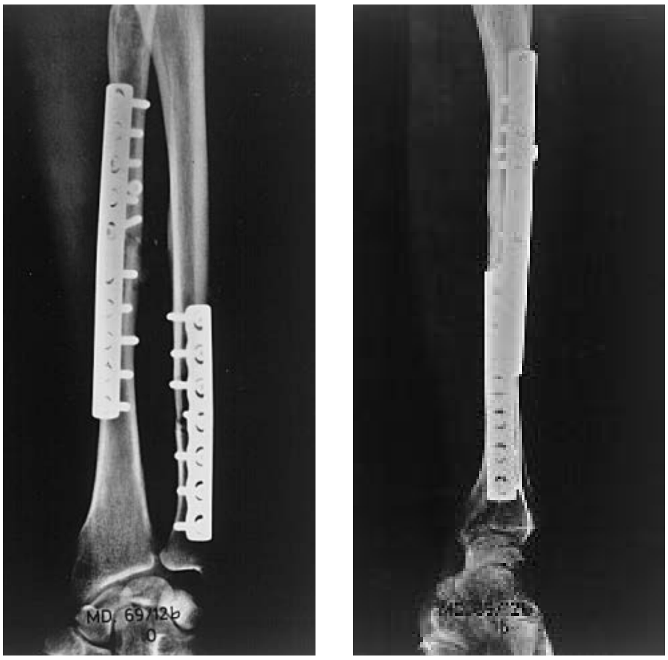
Subject to alterations.

CLINICAL INDICATIONS

Indications for the LC-DCP are the same as those for the DCP.

This second-degree compound fracture of the forearm of a polytraumatised patient was treated postprimarily. The LC-DCP 3.5 and DCP 3.5 respectively stabilised the fractures. At the same time, autologous bone grafting with cancellous bone was performed on the bone defect in the radius. The X-rays showing healing of the fractures were taken eight months after internal fixation.

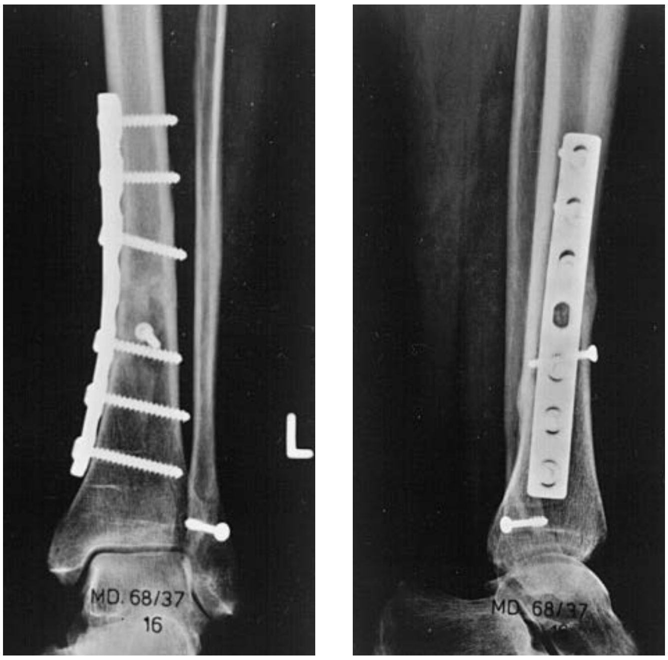
Fractures before treatment



immediately postoperatively

34 weeks postoperatively

Fractures before treatment

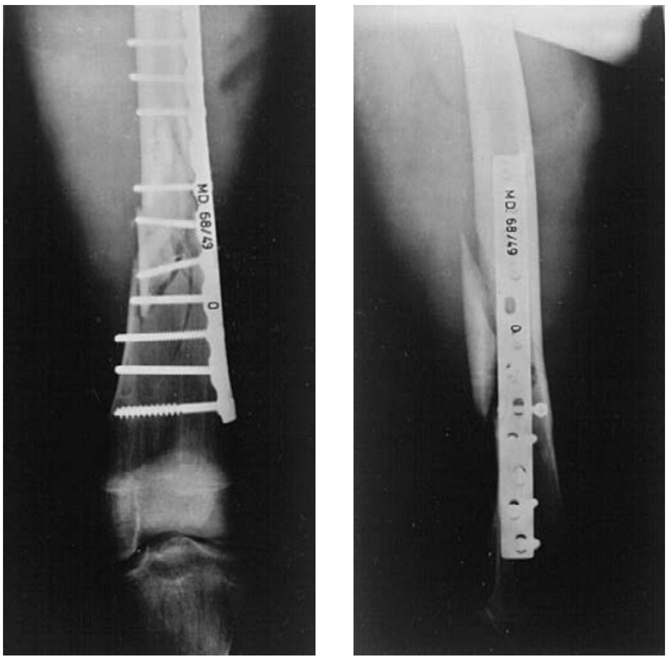


16 weeks postoperatively

This lower leg torsion fracture was fixed with a narrow LC-DCP 4.5 with 7 holes. The shaft screw was used as a plate lag screw.

Fractures before treatment

In the presence of epiphyseal cartilage, this femoral fracture caused by a skiing accident was treated using a broad LC-DCP 4.5. The function of the 12-hole plate was to bridge the comminuted zone. The final X-rays were taken shortly before plate removal.



immediately postoperatively

48 weeks postoperatively

This 93 year old female patient fractured her femoral shaft by slipping on a patch of ice. Primary internal fixation of the wedge-shaped torsion fracture was carried out with a narrow LC-DCP 4.5 with 12 holes. The lag screw inserted obliquely through the plate acts as a shaft screw.

Fresh fractures

immediately postoperatively

Synthes GmbH
Eimattstrasse 3
4436 Oberdorf
Switzerland
Tel: +41 61 965 61 11
Fax: +41 61 965 66 00
www.depuysynthes.com

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