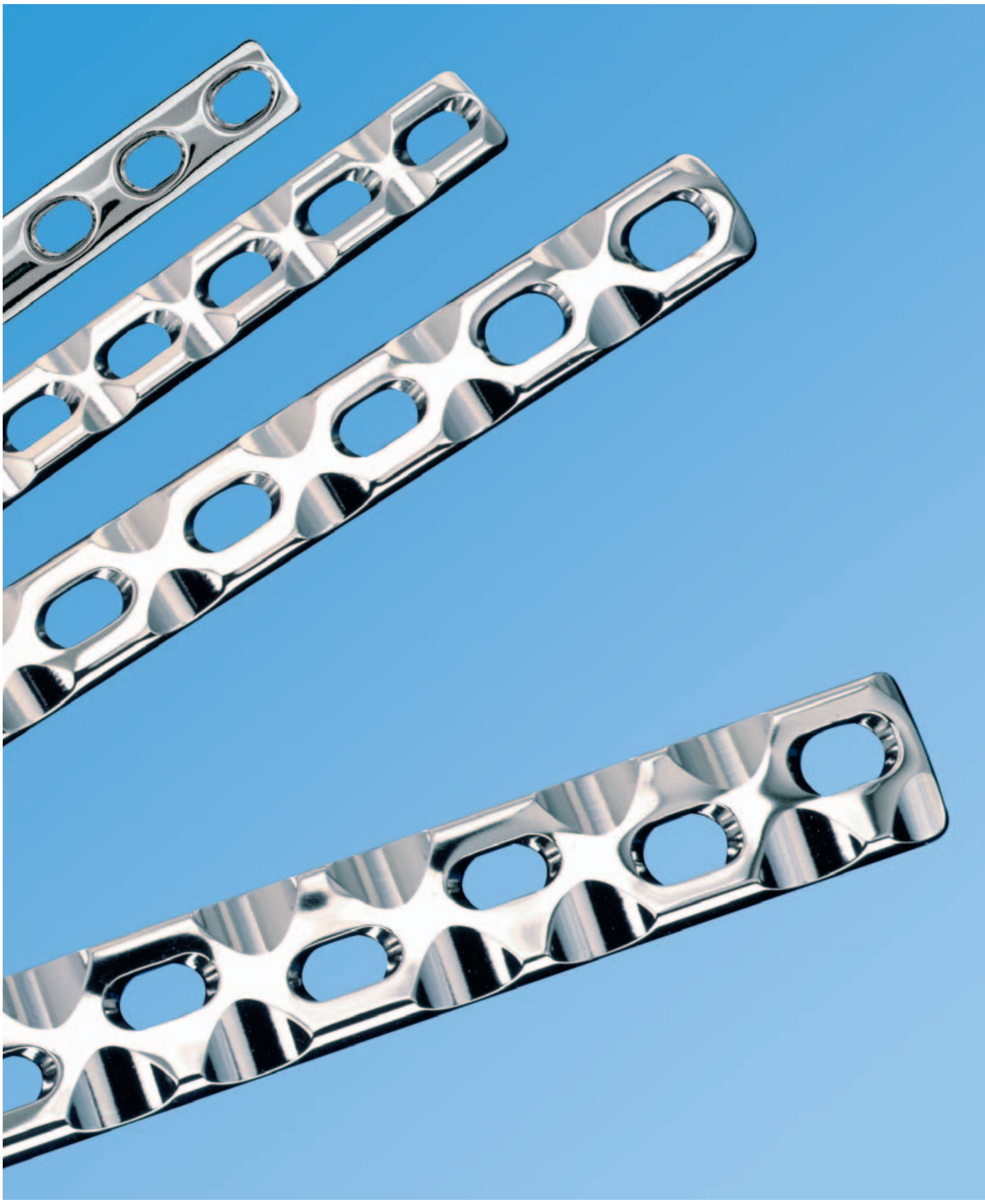
DCP and LC-DCP Systems. Dynamic Compression Plates (DCP) and Dynamic Compression Plates with Limited Bone Contact (LC-DCP).

Technique Guide



SYNTHES®

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 the product. Instruction by a surgeon experienced in handling this product is highly recommended.

Reprocessing, Care and Maintenance of Synthes Instruments
For general guidelines, function control and dismantling of multi-part instruments, please refer to: www.synthes.com/reprocessing

DCP and LC-DCP Systems. Dynamic Compression Plates (DCP) and Dynamic Compression Plates with Limited Bone Contact (LC-DCP).

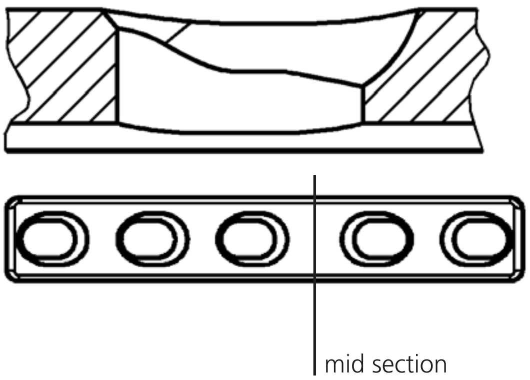
Dynamic Compression Plates are available in dimensions ranging from 1.3 to 4.5 mm, Limited Contact Dynamic Compression Plates range from 2.0 to 4.5 mm.

Plate hole geometries

Non-symmetrical holes

Some Dynamic Compression Plates feature non-symmetrical holes which allow to achieve compression in only one direction. These plates feature a mid section which is placed at the position of fragments to be compressed.

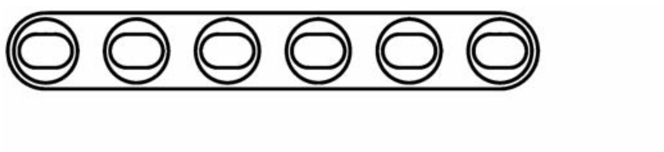
The non-symmetrical DCP holes are shaped like a portion of an inclined and angled cylinder. They possess one compression point at the inclined side and one neutral point in the middle.

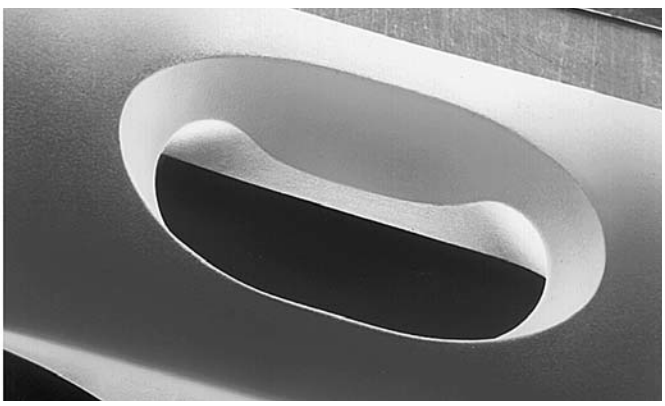


Symmetrical holes

Most 1.3 to 3.5 mm Dynamic Compression Plates have symmetrical holes similar to the LC-DCP hole. The symmetrical shape of the plate holes enables compression to be achieved in both directions, thus plate positioning is not restricted by the presence of a mid-section.

Symmetrically shaped DCP holes possess one compression and one neutral point on both sides. With some small and mini plates, the neutral points meet in the middle.

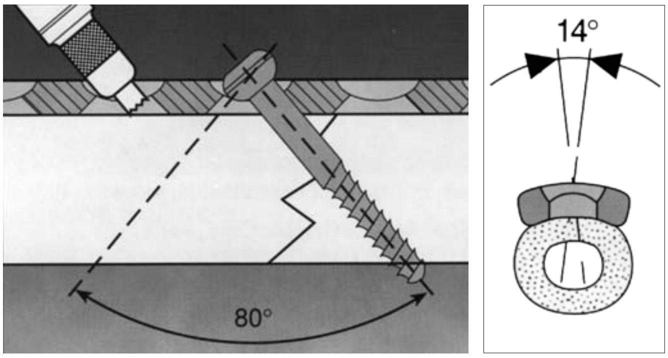




Screw angulations

Non-symmetrical holes
The DCP allows up to 25° longitudinal and 7° transverse screw angulation.

Symmetrical holes
The DCP hole allows up to 50° longitudinal screw angulation for an increased range of applications. LC-DCP holes allow even wider angulations up to 80°. Both plate types allow for 14° transverse screw angulation.



Symmetrical LC-DCP hole

Undercuts

Undercuts of the LC-DCP limit contact between plate and bone, minimizing the risk of tissue necrosis under the plate.

Uniform stiffness (LC-DCP only)

The uniform stiffness of the LC-DCP allows smooth contouring of the plate to the bone. It protects the plate from localized high bending stresses.

LC-DCP

Standard

Indications

Generally LC-DCP may be used for the same indications like the corresponding DCP plates. Specific indications can be found in annex A.

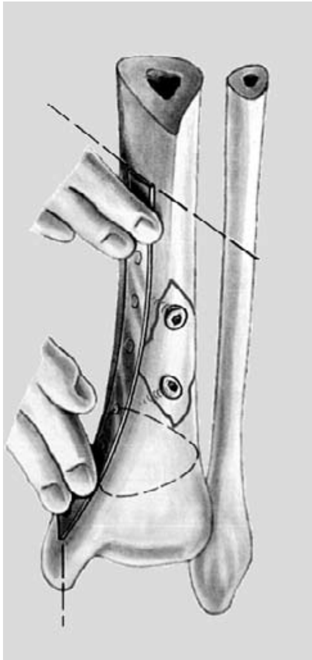
1
Plate contouring

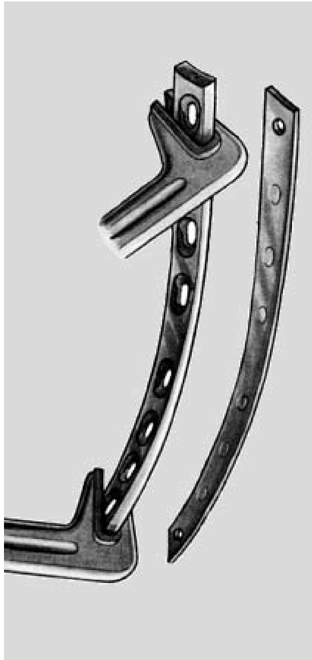
For the treatment of juxta-articular fractures (distal tibia, tibial plateau, distal femur, distal humerus, radius etc.), good plate contouring to the shape of the bone is very important. Only then satisfactory reduction and adequate stability may be achieved.

Pure titanium has mechanical properties differing from stainless steel. Due to its lower modulus of elasticity, titanium is more springy. Therefore, titanium plates should be slightly over-bent to obtain the desired contour.

The design of the LC-DC plate ensures uniform rigidity, hence a continuous curvature after bending. The plates should not be bent beyond the necessary extent.

Use bending pliers or bending irons for plate contouring.



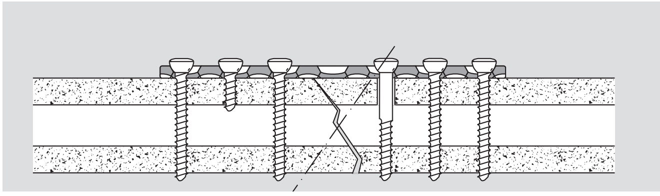


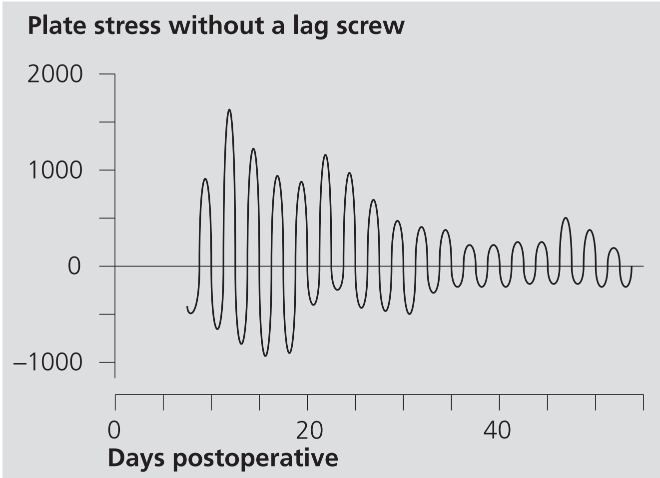
Notes
- Avoid repeated bending.
- Sharp indentations on the plate surface, especially around the plate holes, may impair resistance to fatigue and should be avoided.

2

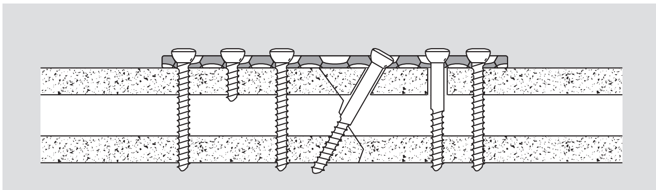
Use of lag screws to achieve additional stability

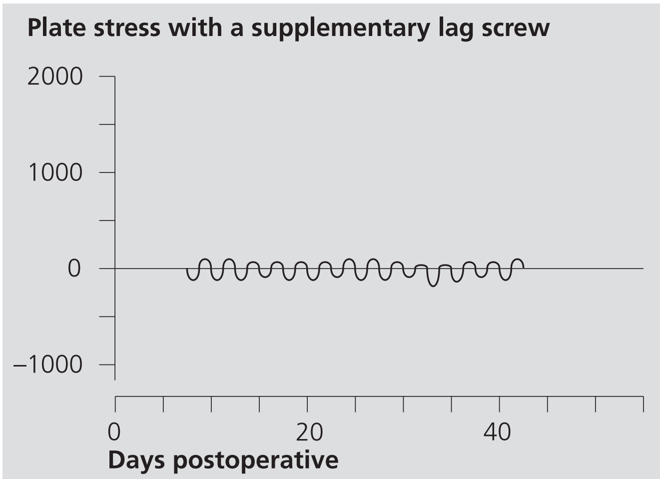
In certain circumstances, the use of a plate for fracture compression may be sufficient. In many fractures, however, it is advantageous to insert a lag screw through the plate to increase fracture stability and to achieve interfragmentary compression in the far cortex. If a fracture gap remains, the plate is subjected to high bending stresses.





Using a lag screw through the plate reduces implant stress.[1]





Reduction in implant stress by using a lag screw through the plate[1].

[1] Klaue K et al. 1982: Die Entlastung der Osteosyntheseplatte durch interfragmentäre Plattenzugschraube. Helv. Chir. Acta 52, 19–23

Drill Guides for DCP and LC-DCP

Different drill guide types are available to perform drilling for DCP and LC-DCP fixation in both neutral and compression mode.

1

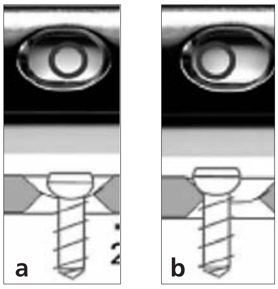
Standard drill guides (DCP, sizes 1.3 – 4.5)

Standard drill guides feature a simple tube to protect soft tissues while drilling. Depending on the positioning of the tube within the hole, neutral or eccentric (compression) drilling can be performed.

Example

a Drilling in neutral position
Position the tube in the middle of the DCP hole.

b Drilling in eccentric position – compression
Position the tube in plate hole remote from the fracture.

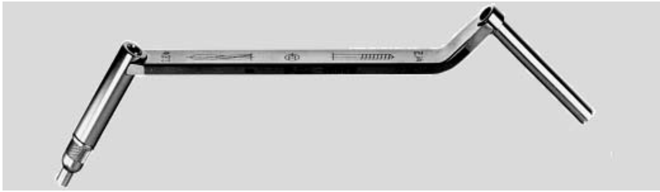


Neutral and eccentric drilling

2

Universal drill guides (DCP and LC-DCP, sizes 1.5–4.5)

Universal drill guides feature one end with a spring-loaded mechanism which facilitates all types of applications: Neutral position, compression position, buttress position (LC-DCP only) and especially the positioning of inclined lag screws through the plate.

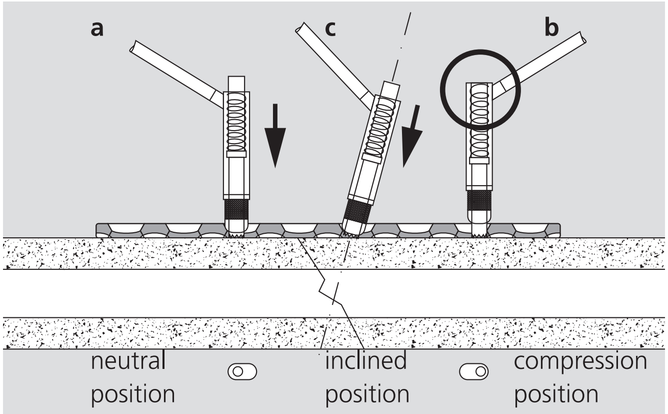


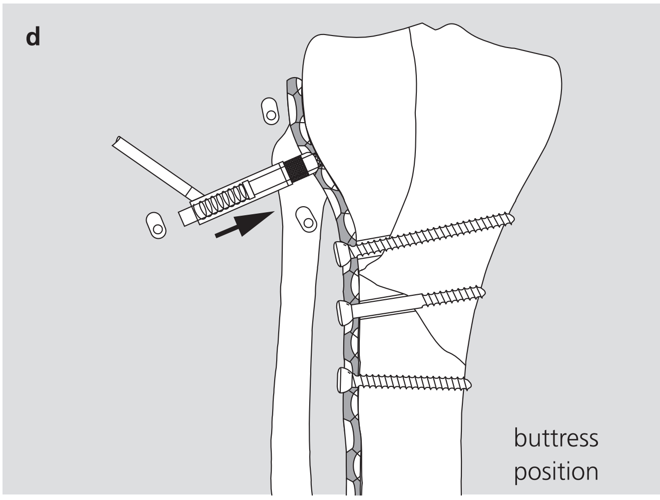
a Neutral position
Depress the drill guide. The upper part of the inner sleeve projects. Position the drill guide in the plate hole which is remote from the fracture (LC-DCP). When used with DC plates the drill guide automatically slides into the correct middle position when depressed.

b Compression position
Do not depress the drill guide. The upper part is flush. Position the drill guide in the plate hole remote from the fracture.

c Inclined position
This technique is used for inserting lag screws through the plate. Place the drill guide in the hole adjacent to the fracture, depress (upper part projects), and set the desired drill angle.

d Buttress position (LC-DCP only)
Depress the drill guide as shown for neutral position (upper part projects). Position the drill guide in the plate hole adjacent to the fracture.





3

LC-DCP drill guides (3.5 and 4.5 LC_DC plates)

The LC-DCP drill guides can be used with LC-DC plates only. They feature dedicated ends for neutral application (green) and for application in compression mode (yellow).

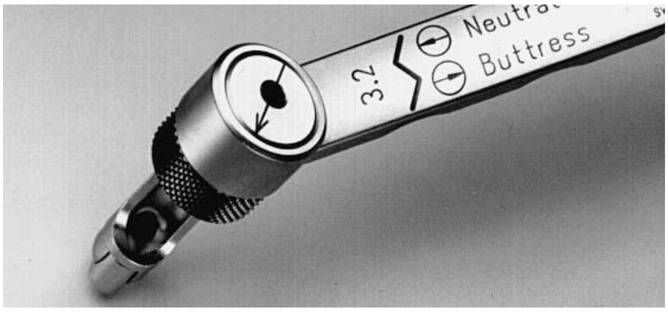
LC-DCP drill guides carry an arrow enabling correct positioning of the screw.

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

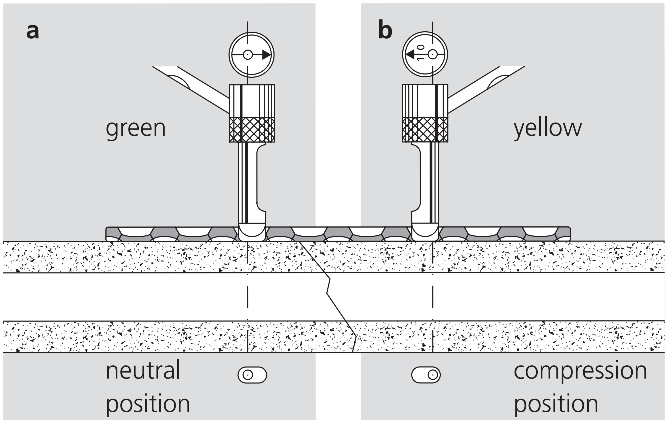
b Compression
Use the yellow drill guide to achieve compression. The arrow on the yellow drill guide must point towards the fracture.

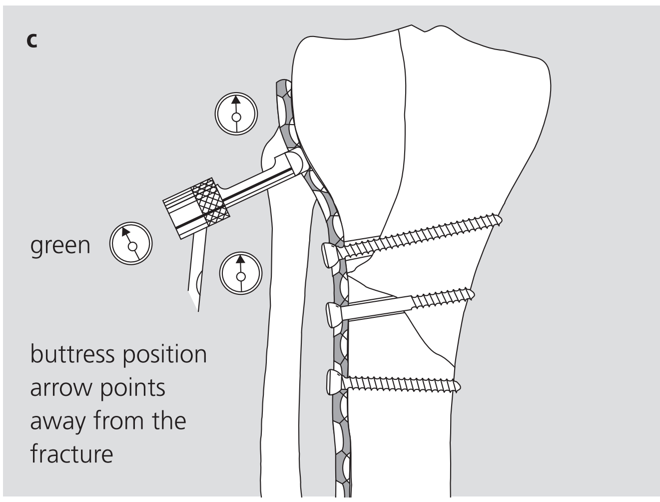
c Buttress position
Use the green drill guide. A buttress effect is achieved when the arrow points away from the fracture.

Important: Pre-drilling in inclined position
Pre-drilling in inclined position with LC-DCP drill guides is not recommended because correct positioning of the screw cannot be ensured. LC-DCP drill guides are designed to only fit the hole in a more or less vertical position. For pre-drilling in inclined position use the universal drill guide instead (refer to 2c).



= symbol for a fracture line





Compression Plate: Simple Fracture

Note: For drill bits for threaded and gliding holes and taps for the individual screw sizes see "Screws, Drills and Taps" on page 20 ff.

Choose a plate of the appropriate length. Ensure that there are enough plate holes over both fragments and that a lag screw can be inserted if necessary.

Illustrations show the procedure with the neutral and compression drill guide of the LC-DCP drill guide using a 3.5 and 4.5 LC-DC plate.

1

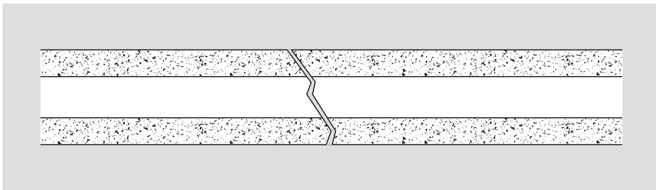
Drill first hole adjacent to fracture

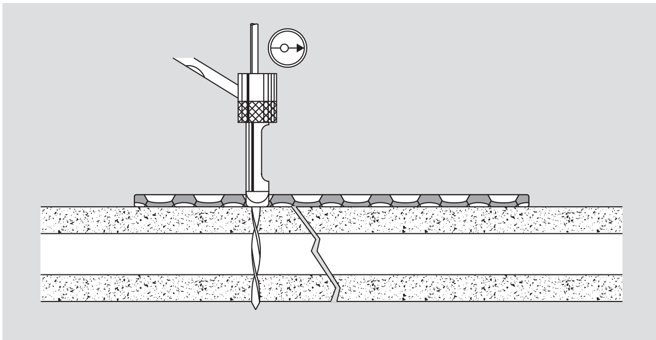
Use an appropriately sized drill bit for threaded holes and drill the first hole adjacent to the fracture. Use the green drill guide in neutral position with the arrow pointing towards the fracture. Alternatively, use the universal drill guide in depressed mode (upper part projects) and place it in the hole remote from the fracture.

Determine screw length, tap the thread, and insert the screw.

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.

Alternative: When using a shaft screw with an unthreaded portion below the head, overdrill the near cortex using a tissue protecting sleeve or standard drill guide and an appropriately sized drill bit for gliding holes.

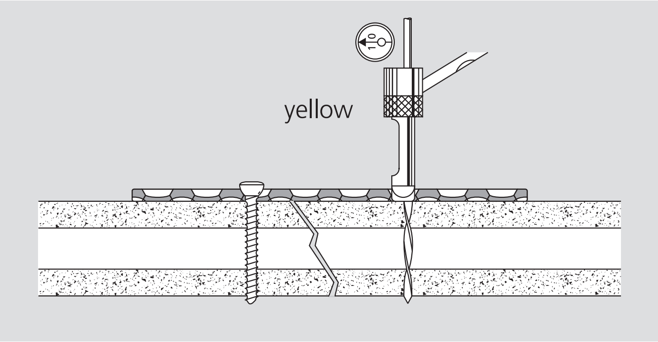


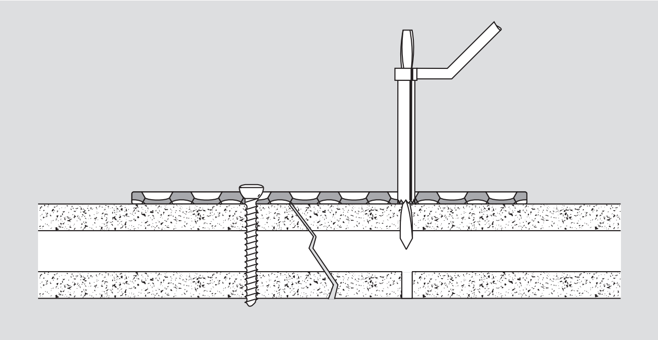


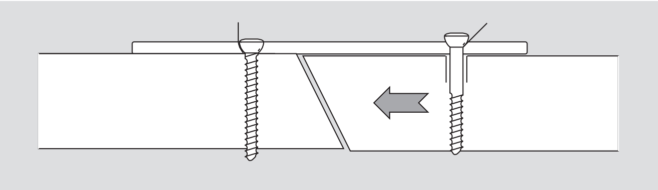
2
Drill second hole

Drill through both cortices into the opposite fragment with the yellow drill guide in compression position (arrow points towards the fracture). Alternatively, use the universal drill guide placing it in the hole remote from the fracture. Do not depress it (upper part stands flush).

Determine screw length, tap the thread, and insert the screw.







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.

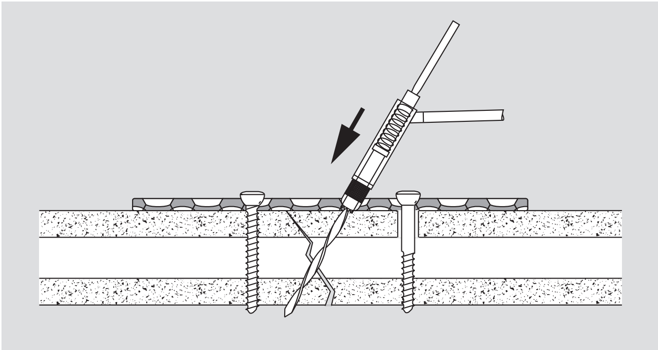
Alternative: When using a shaft screw with an unthreaded portion below the head, overdrill the near cortex using a tissue protecting sleeve or standard drill guide and an appropriately sized drill bit for gliding holes.

3

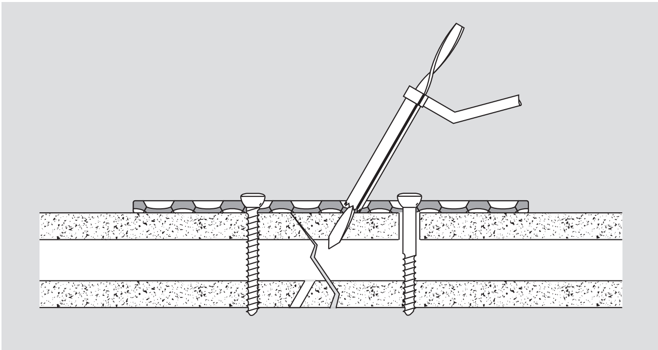
Insert interfragmentary lag screw

To increase stability in the far cortex and to decrease plate wear, insert an interfragmentary lag screw.

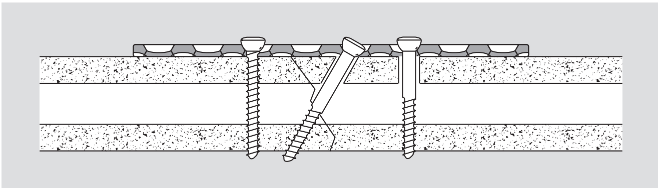
Drill through both cortices with an universal drill guide in depressed mode (inner sleeve projects) and an appropriately sized drill bit for threaded holes. The hemispheric underside of the universal drill guide permits ideal positioning of the screw head.



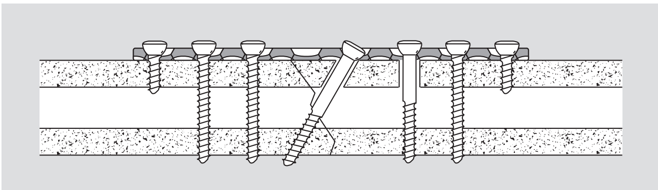
Widen the hole in the near cortex with a drill bit for gliding holes. Push the tissue protecting sleeve upwards, insert the drill bit into the hole, then slide the tissue protecting sleeve down until it touches the plate. When drilling, care should be taken that the course of the gliding hole follows exactly that of the previous drill hole.



As an alternative to a regular cortex screw a shaft screw, used as a lag screw, may be inserted. This ensures efficient gliding of the screw shaft in the gliding hole resulting in a considerably higher tension effect. Like this in the far cortex tension is achieved, too.

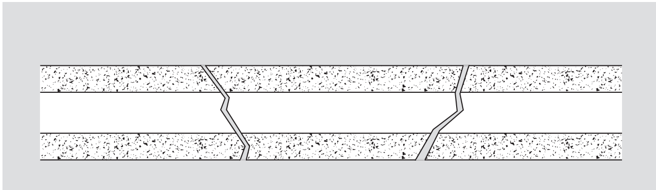


In the remaining screw holes insert screws in neutral position apart from the hole directly above the fracture.



Compression Plate:
Multifragmentary Fracture

Note: For drill bits for threaded and gliding holes and taps for the individual screw sizes see “Screws, Drills and Taps” on page 20.



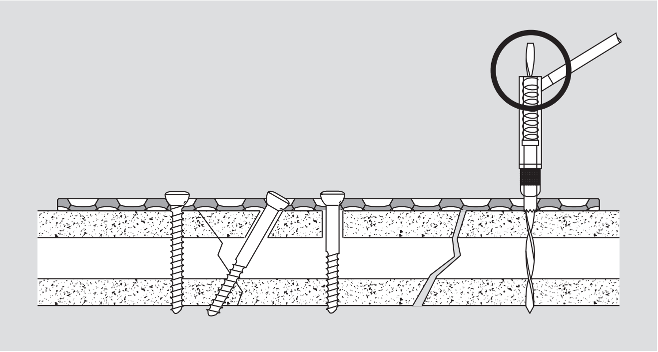
Fractures should be treated consecutively.

1
Treat first fracture

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

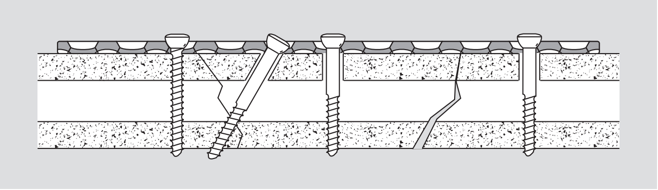
2

Treat second fracture

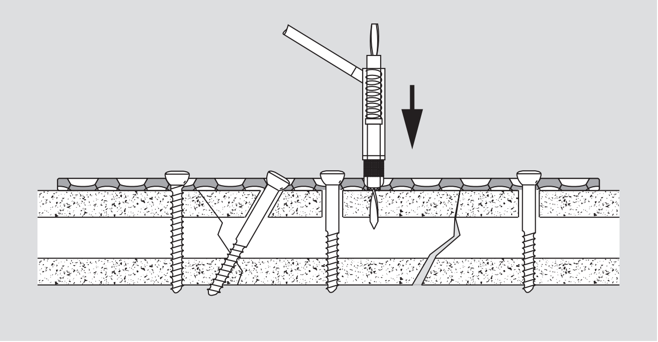


Treat the second fracture using the universal drill guide. Drill a hole into the third fragment using the universal drill guide in compression position and a drill bit for threaded holes. Seat the drill guide at the side of the hole remote from the fracture without depressing the drill guide (upper part is flush).

Drill a gliding hole, measure screw length and tap the thread.

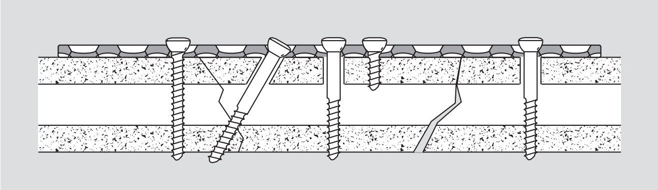


Insert a screw into the hole. The use of a shaft screw is recommended.

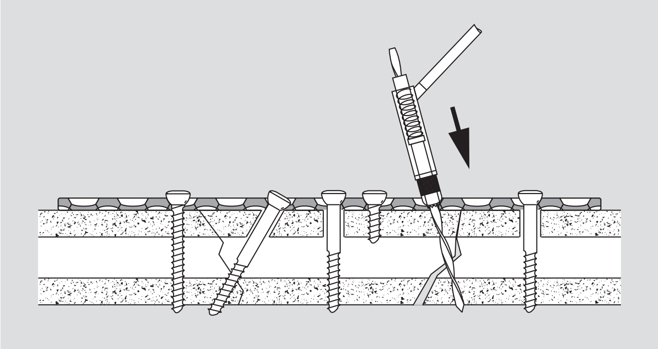


Next insert a screw into the middle fragment. Prepare the screw hole with a drill bit for threaded holes and the universal drill guide depressed for neutral position (upper part of inner sleeve projecting).

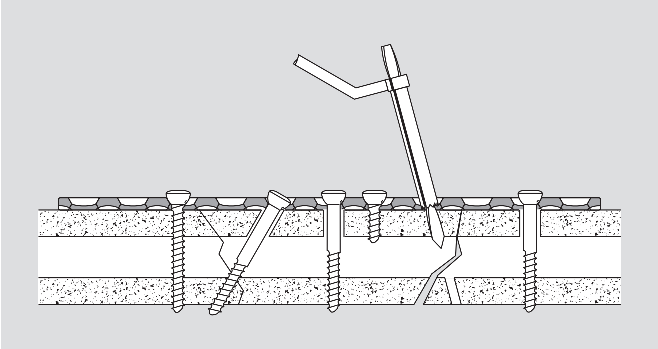
Place the screw.



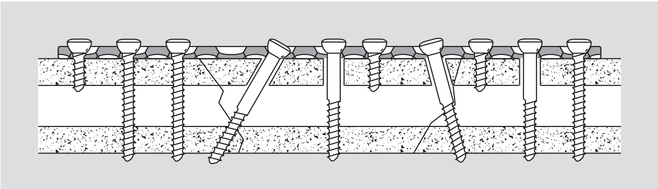
Prepare seating for the lag screw with the universal drill guide and a drill bit for threaded screws. Position the universal drill guide adjacent to the fracture, depress the drill guide (inner sleeve projects), set drilling angle and drill. If there is the risk of the drill bit colliding with the screw in the vicinity, the drill bit has to be inclined.



Drill the gliding hole. Widen the near cortex using an appropriately sized drill bit for gliding holes and the tissue protecting sleeve. Measure the screw length and tap the thread.

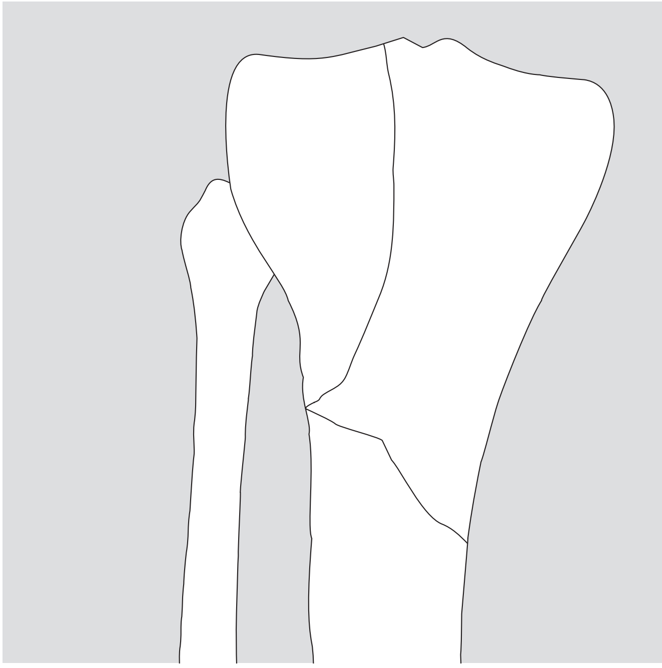


By inserting a shaft screw as lag screw, additional stability is achieved. Tighten lag and compression screws alternately. The remaining screw holes are filled with neutrally placed screws.



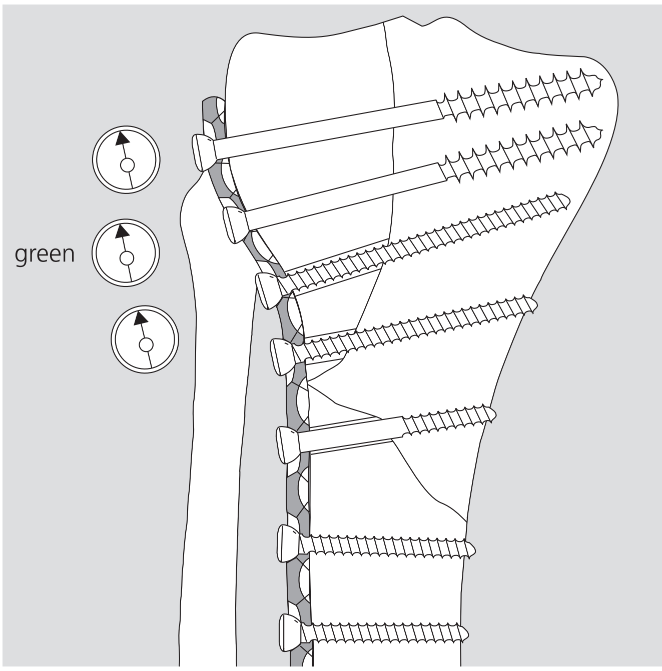
Buttress Plate

Note: Required drill bits for threaded and gliding holes and taps for the individual screw sizes can be found in the chapter "Screws, Drills and Taps" (refer to page 20 ff).



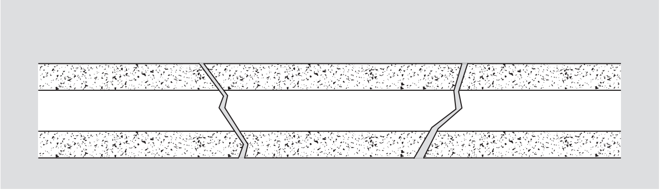
The buttress plate technique is shown using the example of a shear fracture of the lateral part of the tibial head combined with a short oblique fracture.

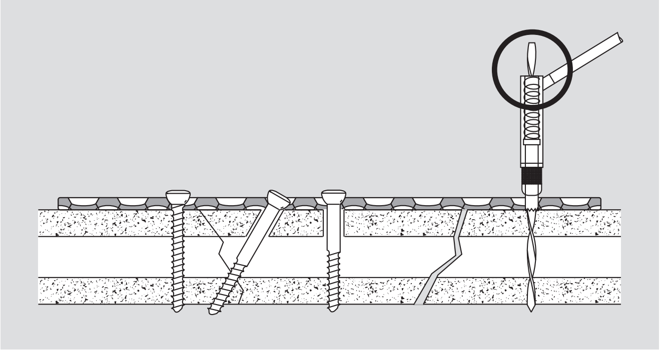
First the distal oblique fracture is treated as in the previously illustrated examples.

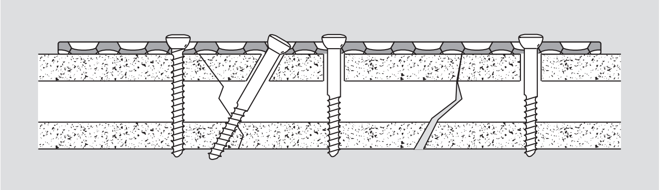


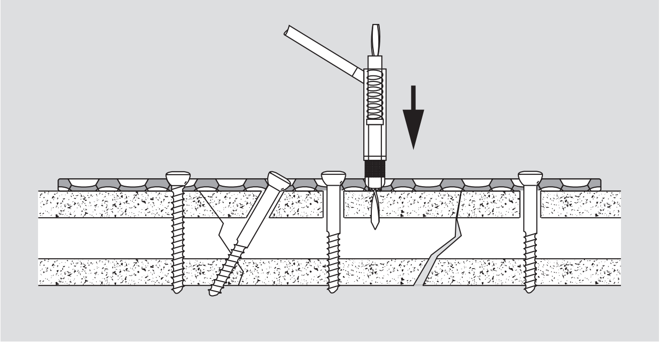
All the screw holes in the buttress region are prepared with the universal drill guide or the green drill guide (neutral position) of the LC-DCP drill guide.

The arrow of the drill guide must point 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. The use of the green drill guide with the arrow pointing 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.



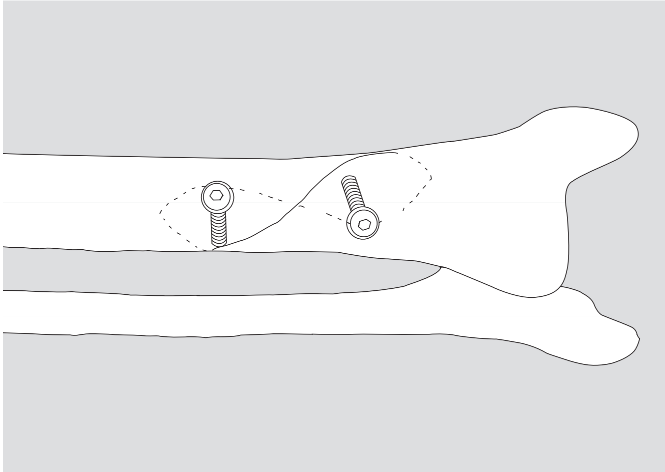






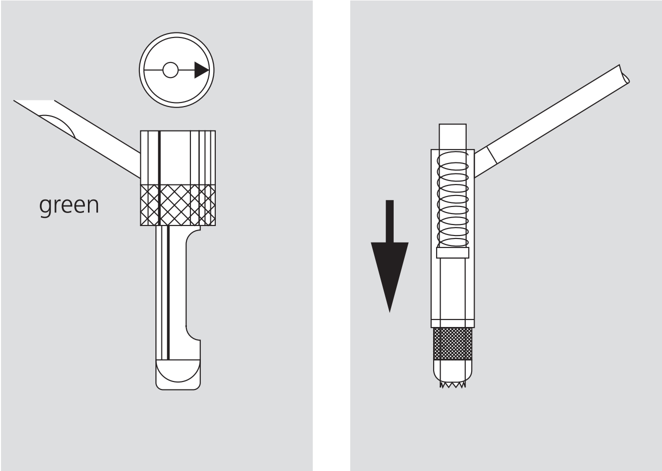
Neutralization Plate (Protecting Plate)

Adapt spiral fracture with two separate lag screws.

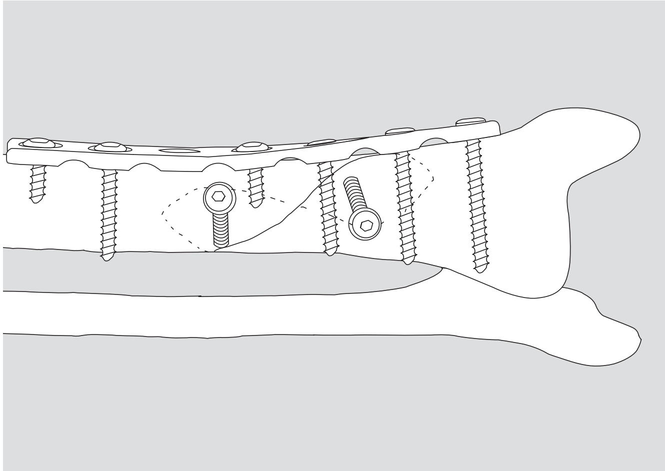


Position the plate to bridge the fracture using the LC-DCP drill guide (3.5 and 4.5 screws only) or the universal drill guide.

When using the green drill guide of the LC-DCP drill guide the arrow must point towards the fracture.
When using the universal drill guide seat it at the hole edge remote from the fracture, depress the outer sleeve so that the upper part projects for neutral position.



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



Annex A: Synthes DCP and LC-DCP Systems and Plate Lines

This technique guide applies to the below Synthes DCP and LC-DCP systems and plate lines which include but are not limited to the following indications:

Mini Fragment System 1.5, 2.0, 2.7
- Fractures of the middle and distal phalanges and tarsals
- Fractures of the metacarpals and metatarsals
- Osteotomies and arthrodeses on the hand and foot
- Fractures of the distal radius (double-plate technique)

Compact Hand 1.0, 1.3, 1.5, 2.0, 2.4
Implant sizes 1.0/1.3:
- Fixation of small fragments
- Fractures of the distal and intermediate phalanges
- Avulsion fractures

Implant sizes 1.5:
- Fractures of the phalanges and metacarpals
- Capturing of fragments with lag screw technique

Implant sizes 2.0/2.4:
- Fractures of the phalanges and metacarpals
- Capturing of fragments with lag screw technique

LC-DCP/DCP 3.5 Straight Plate
- Fractures and osteotomies of small bones such as radius, ulna, clavicula, fibula

LC-DCP/DCP 4.5 Straight Plate, DCP 4.5 T-Plate/ T-Buttress Plate/L-Plate
- Fractures and osteotomies of large bones such as femur, tibia and humerus

Semi-Tubular Plate 4.5
- Fractures and osteotomies of smaller sized bones such as humerus, radius, ulna, clavicula, fibula, tibia and pelvis

Condylar Buttress Plate 4.5
- Buttressing of multifragmentary distal femur fractures
- Supracondylar fractures
- Intra-articular and extra-articular condylar fractures
- Malunions and nonunions of the distal femur
- Periprosthetic fractures

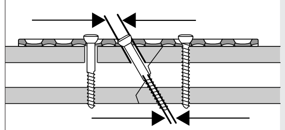
Lateral Tibial Head Buttress Plate 4.5
- Indicated for the stabilization of fractures of the proximal tibia. These include proximal shaft fractures, metaphyseal fractures, intra-articular fractures, periprosthetic fractures

As Synthes offers a wide variety of DC and LC-DC plates, a correspondingly large variety of indications is covered. For exact indications of the various plates please refer to the AO Principles of Fracture Management[1], courses offered by AO (www.aofoundation.org), and the corresponding professional literature.

[1] Rüedi TP, Buckley RE, Moran CG (2007) AO Principles of Fracture Management. 2nd expanded ed. 2002. Stuttgart, New York: Thieme

Cortex Screws for Minifragments
Screws – drills – taps

SYNTHES®

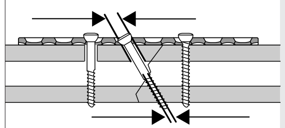
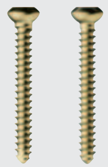
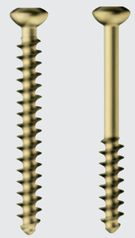
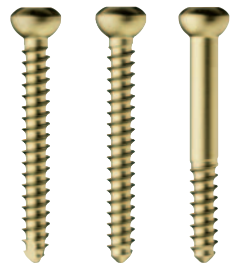
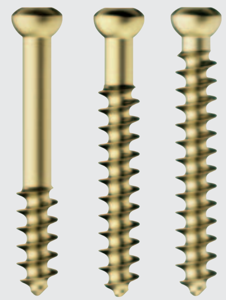
Screw recess	Cruciform 1.0 mm	Cruciform 1.3 mm	Cruci-form 1.5/2.0 mm	Hex 1.5 mm	Cruci-form 1.5/ 2.0 mm	Star-drive T6	Hex 1.5 mm	Cruci-form 2.4 mm	Stardrive T8	Hex 2.5 mm	Stardrive T8
Screw type	∅ **1.0 mm**	∅ **1.3 mm**	∅ **1.5 mm**		∅ **2.0 mm**			∅ **2.4 mm**		∅ **2.7 mm**	
self-tapping	●	●	●		●	●	●	●	●	●	●
not self-tapping			●	●	●					●	
Gliding hole  **Threaded hole**											
Drill Bit for gliding hole	∅ **1.0 mm**	∅ **1.3 mm**	∅ **1.5 mm**		∅ **2.0 mm**			∅ **2.4 mm**		∅ **2.7 mm**	
Drill Bit for threaded hole	∅ **0.8 mm**	∅ **1.0 mm**	∅ **1.1 mm**		∅ **1.5 mm**			∅ **1.8 mm**		∅ **2.0 mm**	
Tap 		∅ **1.3 mm**	∅ **1.5 mm**		∅ **2.0 mm**			∅ **2.4 mm**		∅ **2.7 mm**	

The screws are available in steel and titanium.

Sterilizable paper – max. 134 °C

Cortex Screws, Cancellous Bone Screws and Shaft Screws for Small and Large Fragments

Screws – drills – taps

Screw recess	Hex 2.5 mm	Hex 2.5 mm	Hex 2.5 mm	Hex 3.5 mm	Hex 3.5 mm
Screw type	**∅ 2.7 mm**	**∅ 3.5 mm**	**∅ 4.0 mm**	**∅ 4.5 mm**	**∅ 6.5 mm**
Cortical bone					
– self-tapping	●	●		●	
– non-self-tapping	●	●		●	
– Shaft screw		●		●	
Cancellous bone screws					
– Full thread			●		●
– Long thread					●
– Short thread			●		●
Gliding hole  **Threaded hole**					
Drill Bit for gliding hole	**∅ 2.7 mm**	**∅ 3.5 mm**		**∅ 4.5 mm**	**∅ 4.5 mm**
Drill Bit for threaded hole	**∅ 2.0 mm**	**∅ 2.5 mm**	**∅ 2.5 mm**	**∅ 3.2 mm**	**∅ 3.2 mm**
Tap 	**∅ 2.7 mm**	**∅ 3.5 mm**	**∅ 4.0 mm**	**∅ 4.5 mm**	**∅ 6.5 mm**

The screws are available in steel and titanium.

Sterilizable paper – max. 134 °C

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