NCB® Proximal Humerus Plating System

Surgical Technique

The right locking option for tough fractures

zimmer
Confidence in your hands®

NCB Plating System – Proximal Humerus Surgical Technique

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Fracture Classifications

Indications for Open Technique (Deltoid Pectoral Incision)

- Neer classification: 2-, 3-, 4-part displaced fractures (anatomical neck, surgical neck, tuberculum majus, tuberculum minus and head splitting).
- AO classification: type 11 A, extracapsular, 2 fragments; type 11 B, partially intracapsular, 3 fragments; type 11 C, – intracapsular.

Zimmer MIS Technique (Anterior/Lateral Deltoid Split Incision)

- Neer classification: 2-part displaced fractures.
- AO classification: type 11 A, extracapsular, 2 fragments.

Preoperative Planning and Patient Positioning

Preoperative Planning

An X-ray of the injured shoulder on the anteroposterior plane is essential for preoperative planning. In addition, a “Y” view, that is to say perpendicular to the anteroposterior view, of the scapula is also required.

A CT scan can also provide information concerning the tuberosities. The use of the X-ray template is recommended for preoperative planning.

Positioning of the Patient

The patient is placed on the operating table in the beachchair position (Fig. 1).

After the patient is in the correct position, the C-arm must be adjusted so as to achieve the widest possible view of the proximal humerus.

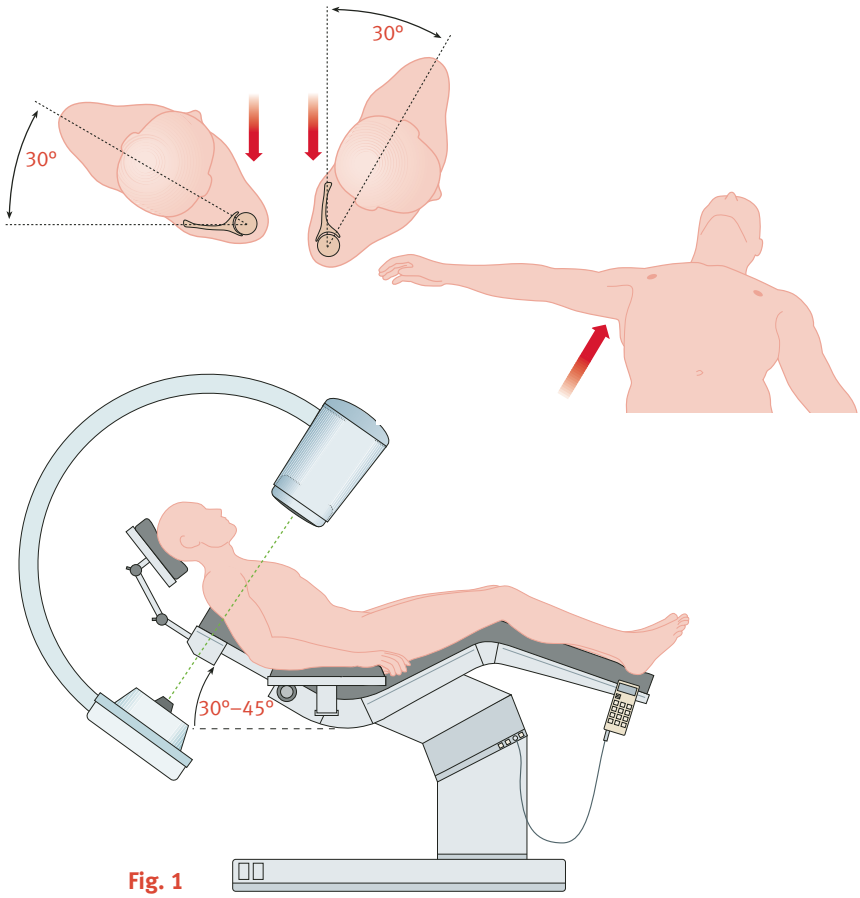


Fig. 1

Open Technique (Deltoid Pectoral Incision)

Deltoid Pectoral Incision

For the open technique deltoid pectoral incision is recommended (Fig. 2).

Important: Care must be taken to avoid damaging the N. axillaris and to keep the blood supply of the bone fragments intact.

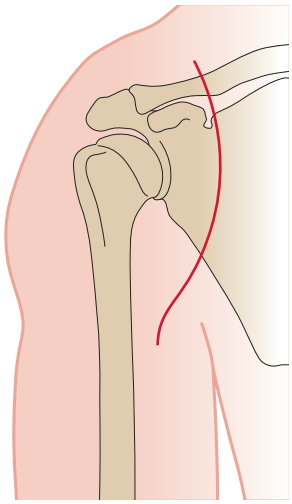


Fig. 2 Deltoid pectoral incision

Reduce the Fracture

Reduce the fracture and confirm the reduction under image intensification.

The humeral head and tuberosity fragments may be manipulated and temporarily fixed with suture and/or 2mm Kirschner wires. K-wires should be placed where they will not interfere with plate application (Fig. 3).

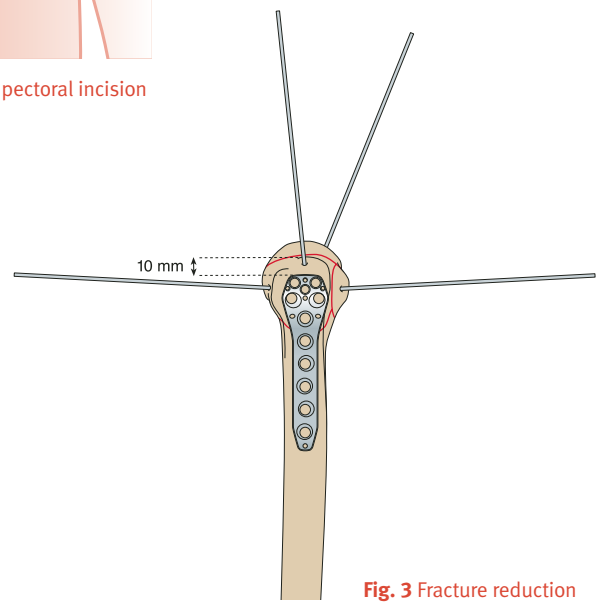


Fig. 3 Fracture reduction

Insert Plate

The plate can be temporarily fixed to the bone with a distal and a proximal 2mm K-wire through the small holes in the plate.

Positioning from A-P view

The plate should be placed approx. 10mm distal to the rotator cuff attachment on the upper edge of the greater tuberosity to avoid postoperative subacrominal impingement (Fig. 4).

Positioning from lateral view

The plate should be centered against the lateral aspect of the greater tuberosity (Fig. 5).

Note: The plate should not be bent since this might disrupt the function of the locking mechanism.

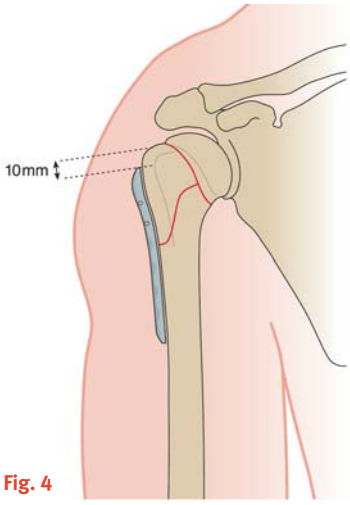


Fig. 4 Plate alignment 10mm distally from the edge of greater tuberosity and centered against the lateral aspect.

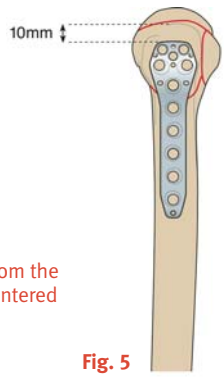


Fig. 5

Bone Spacer (optional)

You may insert bone spacer into the locking holes to avoid periosteum impairment (Fig. 6). Three lengths from 1 to 3mm are available.

Bone Spacer

Color	Bone space
red	1mm
blue	2mm
green	3mm

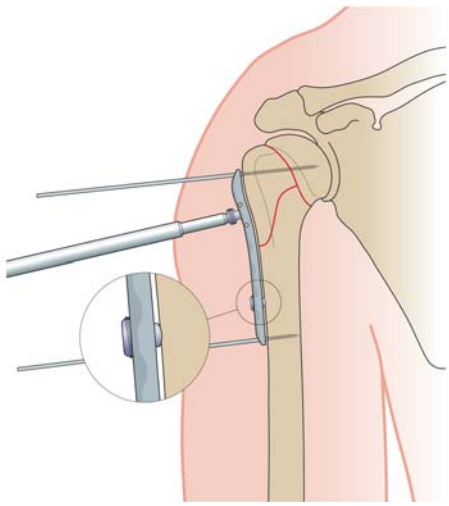


Fig. 6 Bone spacer 2mm (blue) proximally and distally

NCB Screw Insertion

1. Screw Angulation

Up to 30° screw angulation is possible for all plate holes (Fig. 7).

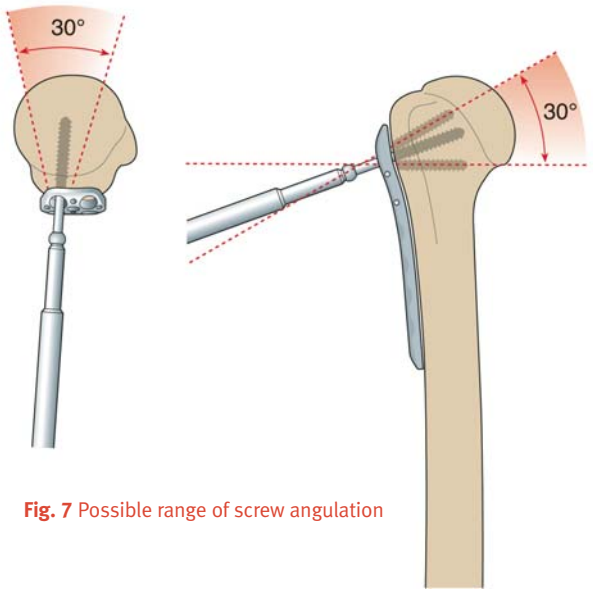


Fig. 7 Possible range of screw angulation

2. Screw and Drill Dimensions

NCB Self-Tapping Screw and drill dimensions

Screw Type	**Screw Type**
Cortical	Cancellous
∅ 4.0mm	∅ 4.5mm
L 20-50mm	L 30-50mm
	

Drill

∅ 3.3mm

3. Insert Screws

The placement of the initial *NCB* Screw depends on the fracture type and the reduction achieved.

For screw insertion use the *NCB* Drill Guide ∅ 3.3mm and the drill bit ∅ 3.3mm (Fig. 8). The Drill Guide allows polyaxial screw placement. A stop is felt at 30° (Fig. 9).

a) Proximal screw setting

When drilling the proximal screw holes, the use of an image intensifier is recommended. Stop approximately 5mm before the subchondral bone.

The screw length is measured with the *NCB* Depth Gauge or with the calibration on the drill bit shaft (Fig. 10). The appropriate screw length is chosen from the screw rack. Insert the Self-Tapping Screw with the *NCB* Torque Screwdriver (Fig. 11). The screw can be used to apply compression if needed. For osteoporotic bone use ∅ 4.5mm *NCB* Cancellous Screws. Repeat procedure to place all proximal bone screws.

Note: Bone screws should be hand tightened only.

Important: When determing the proximal screw length, the probability of bone resorption and screw, compression at the fracture site must be taken into account. Care should be taken to ensure that the screw tip is within an adequate distance away from the subchondral zone.

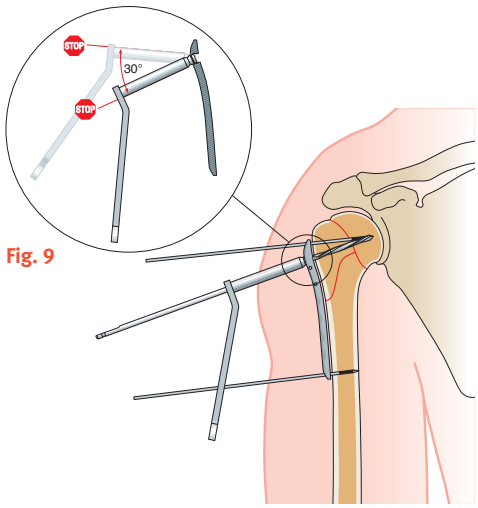


Fig. 9

Fig. 8 Exact screw setting with the drill guide and drill

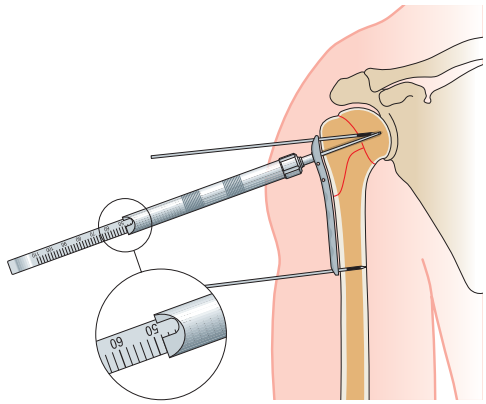


Fig. 10 Measuring screw length with the depth gauge

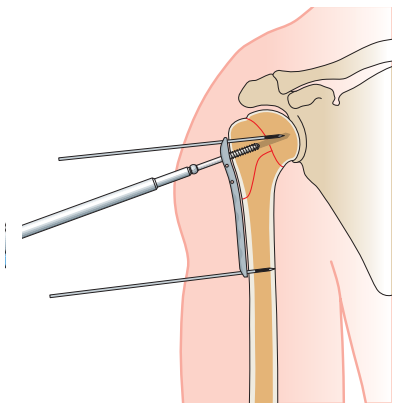


Fig. 11 Insert the Self-Tapping Screw

b) Distal screw insertion
Use the same screw procedure for distal screws as proximally. For optimal fixation, bicortical insertion is recommended (Fig. 12). Place at least 3 screws at the distal end.

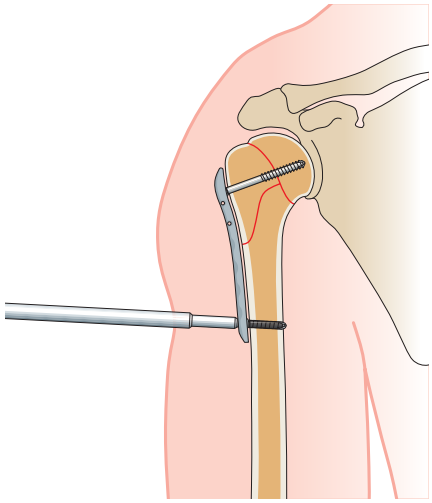


Fig. 12 Insert the distal Self-Tapping Screws

4. Add Locking Screw Cap

To achieve angular stability, set *NCB* Locking Screw Caps at all screws with the Torque Screwdriver until the wrench declutches (clicking sound) (Fig. 13). This applies for all *NCB* Locking Screw Caps (Fig. 14).

Note: Bone spacers can be removed and replaced with *NCB* Screws.

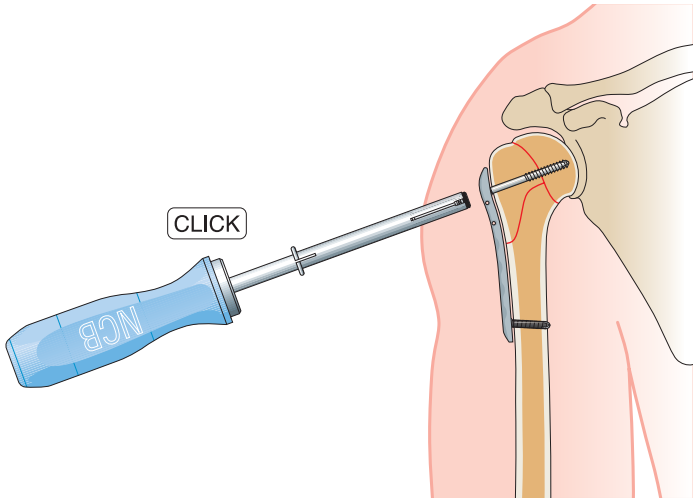


Fig. 13 Locking Screw Cap insertion, tighten until wrench declutches (click sound).

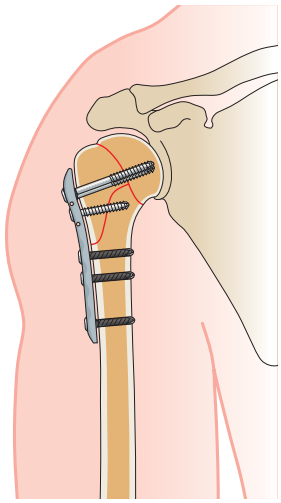


Fig. 14

Alternative Step: Fracture Reduction

1. Insert the plate before fracture reduction (Fig. 15).
2. Place first the distal screw closest to the fracture line (Fig. 16).
3. Tighten the screw and use the plate for fracture reduction (Fig. 17).
4. Place a K-wire at the proximal end of the plate and use the plate-K-wire construct to further reduce the fracture.
5. Finish the osteosynthesis with further screws as described in paragraph "*NCB* Screw Insertion".

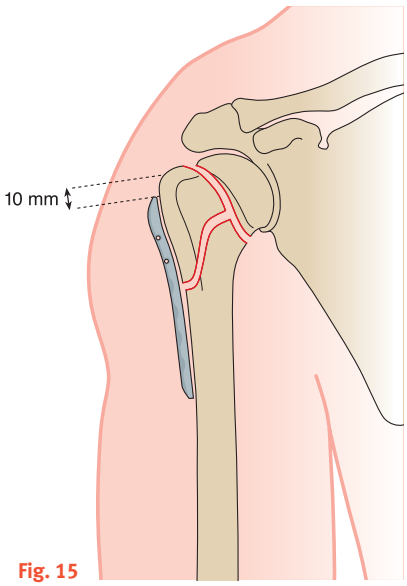


Fig. 15

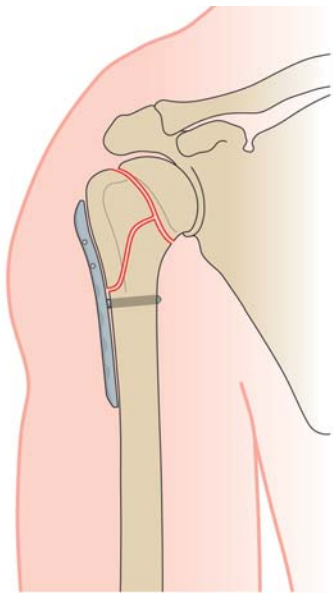


Fig. 16

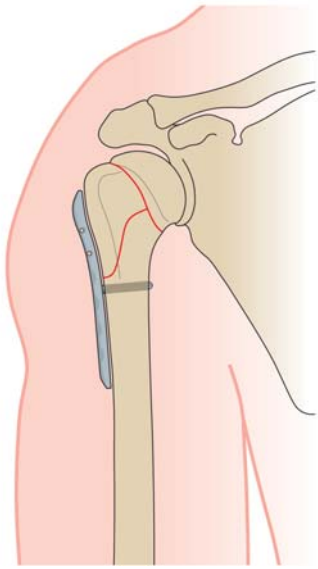


Fig. 17

Proximal ∅ 3.5mm Cortical Screw Placement (optional)

Additionally it is possible to set standard ∅ 3.5mm self-tapping cortical screws in the two top proximal plate holes.

1. Drill Screw Holes

Use the standard Double Drill Guide for screws ∅ 2.5/3.5/4.0mm and the drill bit ∅ 2.5mm, with quick coupling to drill the screw hole (Fig. 18).

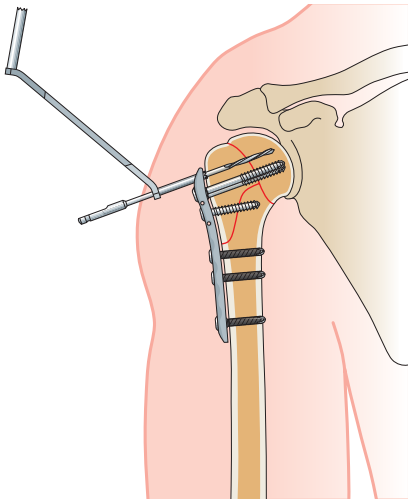


Fig. 18 Drill with drill bit ∅ 2.5mm

2. Measure Screw Length

Measure the appropriate screw length with the standard Depth Gauge, small for screws ∅ 2.7/3.5/4.0mm (Fig. 19).

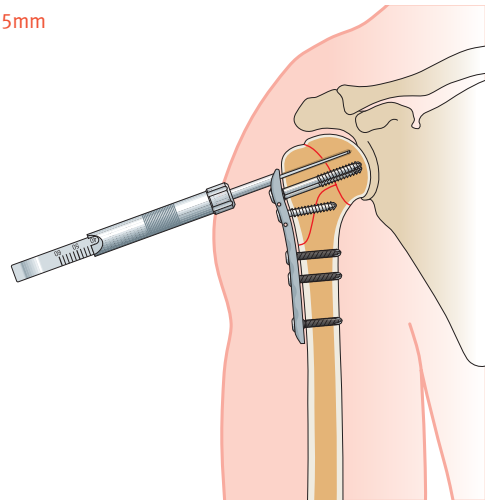


Fig. 19 Measure the appropriate screw length

3. Set the ∅ 3.5mm Screws

Insert the ∅ 3.5mm Self-Tapping cortical Screw with the Hexagonal Screwdriver small, hex 2.5mm (Fig. 20).

Important: When determining the proximal screw length, the probability of bone resorption and compression at the fracture site must be taken into account. Care should be taken to ensure that the screw tip is within an adequate distance away from the subchondral zone.

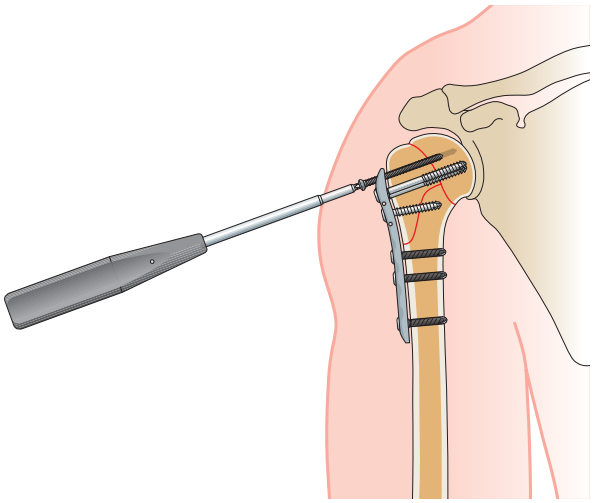


Fig. 20 ∅ 3.5mm Self-Tapping Cortical Screw setting

Tuberculum Minus Plate (optional)

1. Apply Tuberculum Minus Plate

For tuberculum minus fractures it is possible to apply a small bendable tuberculum minus plate with 7 screw holes. The plate is fixed to the bone using ∅ 3.5mm standard Self-Tapping Cortical Screws. The plate can be assembled to the *NCB* Humerus Plate with a prebent U-shaped cerclage wire ∅ 0.8mm through two holes at the side of the *NCB* Plate (Fig. 21).

The same plate can be used for the left and right humerus.

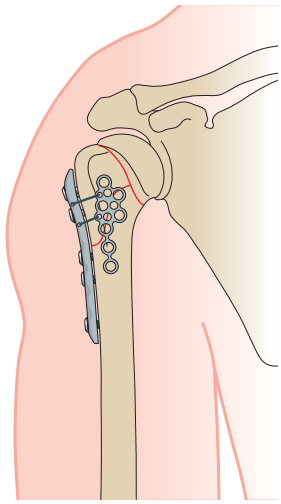


Fig. 21 Apply tuberculum minus plate to the bone

2. Drill Screw Holes

Use the standard Double Drill Guide for screws ∅ 2.5/3.5/4.0mm and the drill bit ∅ 2.5mm, with quick coupling to drill the holes (Fig. 22).

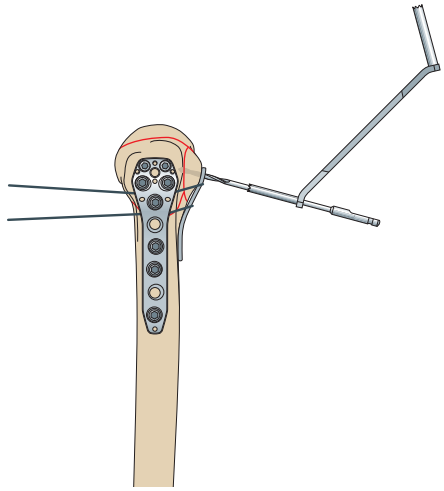


Fig. 22 Drilling with a standard Double-Drill Guide

3. Measure Screw Length and Insert Screws

Measure the appropriate screw length with the standard Depth Gauge, small for screws ∅ 2.7/3.5/4.0mm.

Insert the ∅ 3.5mm Self-Tapping Cortical Screw with the Hexagonal Screwdriver small, hex 2.5mm (Fig. 23).

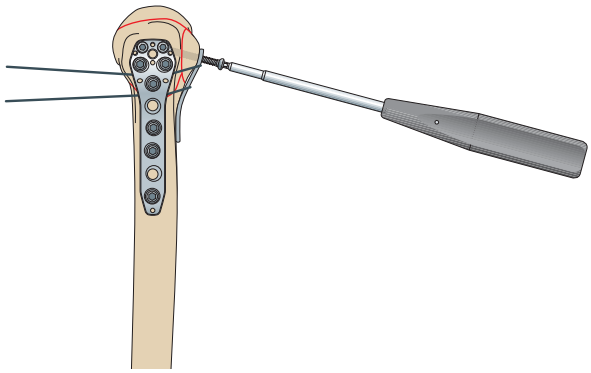


Fig. 23 Tuberculum minus plate screw-setting

4. Twist the Wire

Twist the cerclage wire with the Wire-Bending Forceps and apply some tension to the tuberculum minus plate (Fig. 24).

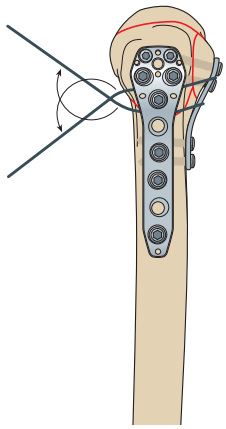


Fig. 24 Standard cerclage wire technique is used

5. Cut the Wire

Cut off the remaining twisted cerclage wire with the Wire Cutter and bend it along the side of the *NCB* Plate (Fig. 25).

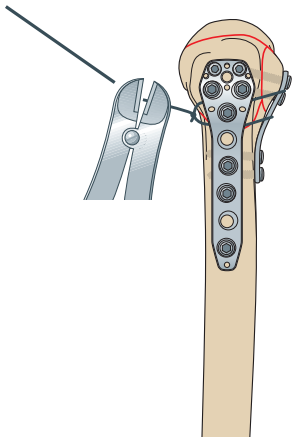
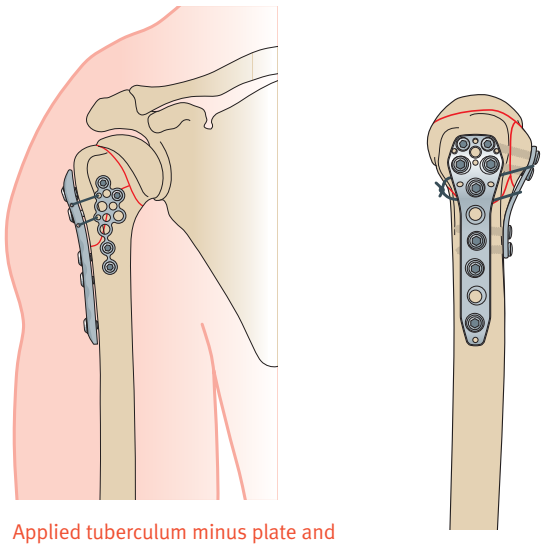


Fig. 25 Cut off the remaining twisted cerclage wire



Applied tuberculum minus plate and final construct

Blind Screw Inserts and Sutures (optional)

NCB Blind Screw Insert

To prevent bone ingrowth into empty screw holes it is possible to use *NCB* Blind Screw Inserts (Fig. 26).

Note: Hand tighten only.

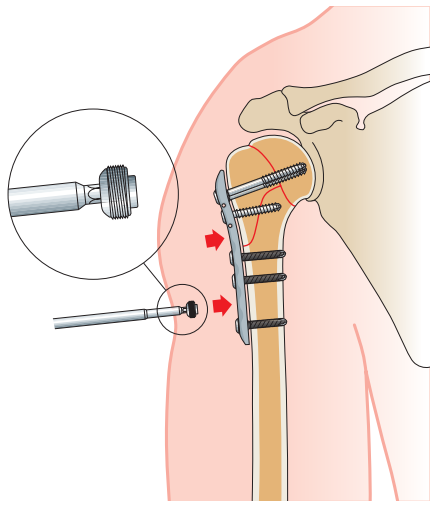


Fig. 26 *NCB* Blind Screw Inserts

Sutures

Oblique holes ∅ 2mm can be used for sutures and reattachment of the rotator cuff (Fig. 27).

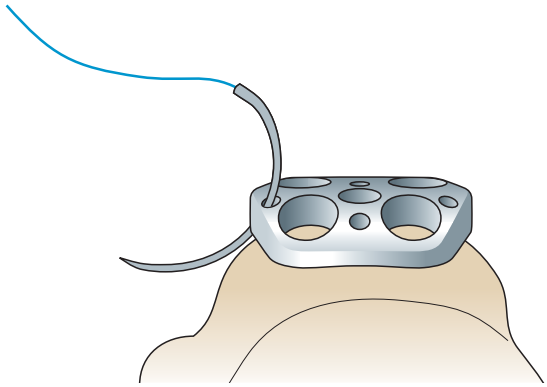


Fig. 27 Oblique holes 2mm for sutures proximally

Zimmer MIS Technique (Anterior/Lateral Deltoid Split Incision)

High Anterior/Lateral Deltoid Split Incision

A high anterior/lateral deltoid split incision is recommended (Fig. 28).

Important: Care must be taken to avoid damaging the axillary nerve and to keep the blood supply of the bone fragments intact.

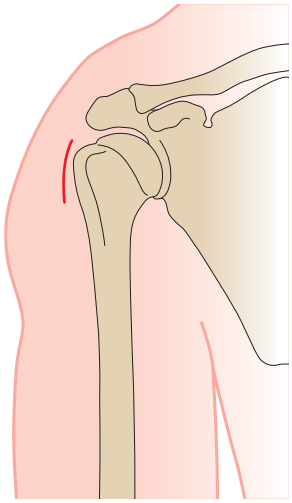


Fig. 28

1. Reduce the Fracture

Reduce the fracture and check correct reduction under image intensification.

The humeral head and tuberosity fragments may be manipulated and temporary fixed with 2mm Kirschner wires. K-wires should be placed where they will not interfere with the plate application.

Targeting Device

Plate Hole Numbering System

To target the correct plate holes there is a numbering system on the targeting module (Figs 29 & 30).

Fig. 29

Targeting for screw holes with the numbers:
1–2–4–5–6–7–8

Turn for the number:
3 (Fig. 31)

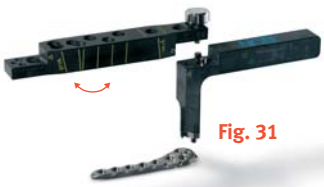


Fig. 31

Note: The plate should not be bent since this might disrupt the function of the locking mechanism.

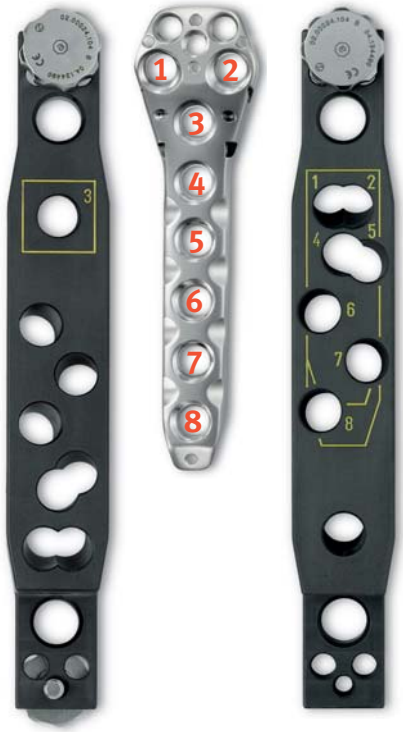


Fig. 30 *NCB* screw hole numbering system

Insert the Plate

1. Assemble the MIS radiolucent targeting device

Assemble the radiolucent handle to the proximal end of the plate. Use a 3.5mm hexagonal screwdriver to tighten moderatly the fixation screw.

2. Inserting Plate

Insert the plate through the high anterior/lateral deltoid split incision subcutaneously along the proximal humerus (Fig. 32).

Note: Aim to get bone contact immediately. Insert the plate underneath the subdeltoid bursa. **Care must be taken to avoid damaging the axillary nerve and the vascularization of the fragments.**

3. Position Plate to Bone

Positioning from A-P view

The plate should be placed approx. 10 mm distal to the rotator cuff attachment on the upper edge of the greater tuberosity to avoid postoperative subacrominal impingement (Fig. 33).

Positioning from lateral view

The plate should be centered against the lateral aspect of the greater tuberosity (Fig. 34).

4. Assemble the Targeting Module

Attach the targeting module to the handle with the hole numbering 1–2–4–5–6–7–8 on the lateral side (Fig. 35). Fit the yellow arrowhead markings together for proper assembly (Fig. 36).

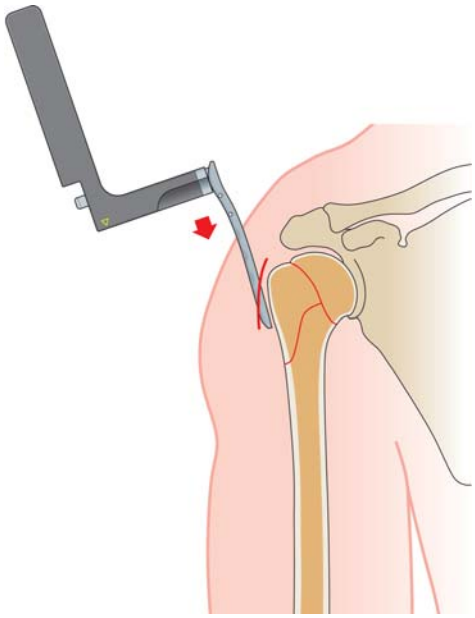
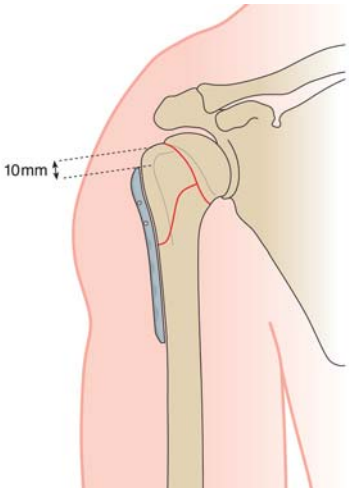


Fig. 32 Insert the plate



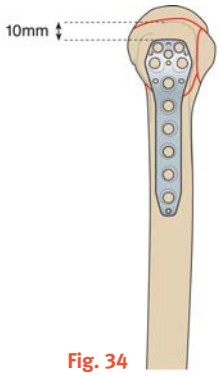


Fig. 34

Fig. 33 Plate alignment 10mm distal of edge greater tuberosity and center against the lateral aspect

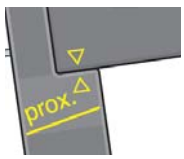


Fig. 36 Yellow arrowhead markings

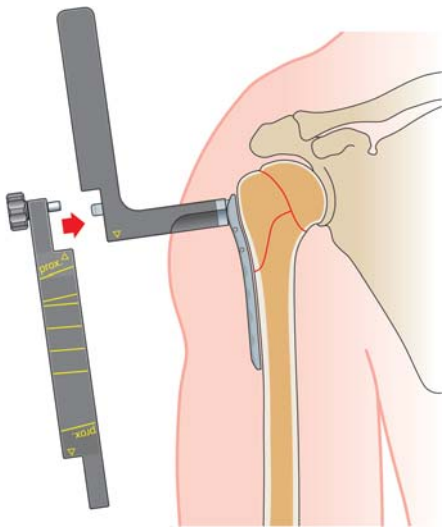


Fig. 35 Assemble the targeting modul

NCB Cannulated Screw Insertion

1. General Remarks

The placement of the initial *NCB* Screw depends on the fracture type and the reduction achieved. It is recommended to start with the distal screw ∅ 4.5mm.

Two cannulated screw types are offered with the *NCB* Plating System. Cancellous *NCB* Screws preferably for the epi- and metaphysis as well as *NCB* Cortical Screws which are ideal for placement in the diaphysis. Both screw types are self-drilling and self-tapping. The screws can be precisely placed over K-wires. A tissue protection sleeve assembly is used for guidance. A cannulated drill bit can be used to predrill strong cortical bone.

Note: Use the cannulated screws only after inserting ∅ 1.6mm, L 190mm K-wires.

MIS Technique
NCB Self-Drilling Screw and Drill Dimensions

Screw Type	**Screw Type**
Cortical	Cancellous
∅ 4.0mm	∅ 4.5mm
L 20-50mm	L 30-50mm
	

Drill

∅ 3.3mm

K-wire

∅ 1.6mm

L 190mm