Supracondylar Plates
Supracondylar Plates
Surgical Technique

by
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Nota Bene
The technique description herein is made available to
the healthcare professional to illustrate the author's
suggested treatment for the uncomplicated procedure.
In the final analysis, the preferred treatment is that which
addresses the needs of the specific patient.
Pre-op Planning and Positioning

Supracondylar Fractures and Fractures of the Lower Third of the Femur

The CLASSIC and AMBI Compression Screw with a 90° or 95° angled plate are excellent alternatives to the use of an angled blade plate in the fixation of supracondylar/intracondylar femur fractures. The use of a cannulated lag screw over a guide pin allows for precise and controlled positioning of the implant. Unlike the single piece blade plate, where insertion requires simultaneous three dimensional alignment control, the screw and sideplate design allows flexion/extension alignment to be "dialed in" after the implant is seated, as the plate can be rotated on the screw in the sagittal plane. Finally, the compression screw itself allows for interfragmentary compression of the intercondylar component of the fracture.

Preoperative Planning

Quality anteroposterior and lateral radiographs taken with the extremity in gentle traction are mandatory to assess the fracture. Frequently, oblique views and X-rays of the normal side are helpful to plan fracture reconstruction. Occasionally, a CT scan is necessary to adequately define intra-articular fracture planes.

An intracondylar coronal fracture, which requires sagitally directed lag screws and can compromise or prevent placement of the compression screw, is a strong relative contraindication to the use of a compression screw and plate. Careful preoperative assessment of a complex distal femoral fracture will help assure that the appropriate implant inventory is available at the time of surgery. Also, a thorough understanding of the fracture anatomy will minimize unnecessary soft tissue stripping and allow fracture stabilization to proceed in an organized fashion.

Patient Positioning and Preparation

Place the patient in the supine position on a fluoroscopically compatible table. It is helpful to place a sandbag under the ipsilateral hip to resist the tendency toward external rotation of the extremity. Use of a sterile tourniquet allows a bloodless field during the intra-articular reconstruction with free access to the shaft during supracondylar fixation.

Indications

The CLASSIC™ and AMBI™ supracondylar plates are indicated for several fracture patterns of the distal femur including intercondylar, supracondylar and unicondylar fractures. With all three fracture patterns, The CLASSIC and AMBI supracondylar plates should only be used when a portion of the distal medial condyle is intact to assure good purchase of the lag screw.
Surgical Technique

With the knee flexed 20°, extend a straight lateral incision along the distal thigh anteriorly to the tibial tubercle. Incise the iliobial band, release the vastus lateralis off the linea aspera, and elevate it from the lateral shaft, controlling any perforating vessels. Minimize exposure of the anterior and medial cortices to avoid devitalizing the fracture zone. Make a lateral parapatellar arthrotomy, avoiding injury to the lateral meniscus (Figure 1). An adequate arthrotomy is required to reduce and fix the intercondylar fracture and to appreciate the alignment of the patellofemoral and tibiofemoral joints when inserting the guide pin.

If an intercondylar component of the fracture exists, reduce and temporarily fix it with Kirschner wires or guide pins and pointed bone holding clamps. Exchange the bone clamps and K-wires for cancellous lag screws to achieve interfragmentary compression. Position the screws so that they do not interfere with the subsequent placement of the compression screw and sideplate.
Inserting the Guide Pin

Identification of the correct location and direction of the guide pin is the most important step in reconstructing an anatomically aligned extremity following distal femoral fractures. Since the condyles project posteriorly to the femoral shaft, the guide pin must be inserted in the center of the anterior half of the lateral condyle in order for the plate to align with the shaft in the anteroposterior plane. The entrance site should be no more than 2.0 cm from the tibiofemoral articular surface (Figure 2).

Use the 90° or 95° Supracondylar Pin Guide with the Quick Connect T-Handle to direct the 3.2 mm Tip Threaded Guide Pin for high supracondylar fractures, or simple fractures where an anatomic reduction can be achieved directly and held with guide pins. Attach the Quick Connect T-Handle to the Supracondylar Pin Guide and place it against the lateral condyle and the distal femoral shaft. Insert the guide pin (Figure 3).
For many supracondylar fractures, particularly low fractures and fractures with metaphyseal comminution, it is necessary to apply the plate to the condylar fragment before reducing the supracondylar fracture. In these situations, the reconstructed joint surfaces serve as guides for the direction of the guide pin. The 95° angled plate applied with the screw parallel to the joint line will reestablish appropriate valgus alignment of the knee.

Place one guide pin (1) across the distal tibiofemoral joint line and a second guide pin (2) to mark the slope of the patellofemoral joint (Figure 4). With the guide pin located at the proper entrance site, align the third guide pin parallel to the first guide pin in the A-P plane and parallel to the second guide pin (3) in the transverse plane and drill it across the condyles (Figure 5).

The position and direction of the guide pin should be confirmed radiographically before reaming and inserting the screw. Because the widest part of the medial condyle is posterior to the path of the guide pin, a pin that is at the medial cortex will appear 5 to 10 mm short on an A-P radiograph (Figure 6). Palpate the tip of the guide pin to confirm proper penetration, and determine the lag screw length with the Percutaneous Direct Measuring Gauge (Figure 7).
Reaming and Tapping the Condyles

The 90° and 95° supracondylar plates have barrels that are 5 mm shorter than the standard barrels. Therefore, when preparing the Power Combination Reamer, 5 mm should be added to the length setting indicated on the Percutaneous Direct Measuring Gauge. Reaming should be stopped when the notch indicators on the barrel reamer for the CHS Compression Hip Screw short barrel/supracondylar plates reach the lateral cortex (Figure 8).

Adding 5 mm to the length setting ensures proper reaming for the entire length of the lag screw while stopping at the short barrel notch indicator prevents over-reaming for the plate barrel. However, the lag screw should match the length determined by the Percutaneous Direct Measuring Gauge.

If desired, prior to lag screw insertion, the Lag Screw Tap can be used in younger individuals (Figure 9).
Inserting the Lag Screw and Plate (Options A, B, & C):

**Option A:**
CLASSIC Plate with the CLASSIC Insertion Wrench (Figures 10-12)

Assemble the appropriate CLASSIC plate and lag screw onto the CLASSIC Insertion Wrench. Screw the Lag Screw Retaining Rod into the distal end of the lag screw until a firm connection is obtained. Slip the AMBI/CLASSIC Centering Sleeve onto the CLASSIC Insertion Wrench. Place the entire assembly over the guide pin and introduce it into the reamed hole (Figure 10). DO NOT USE THE WRENCH AS A LEVER.

Use image intensification to advance the lag screw into the cancellous bone of the femoral condyle. In osteoporotic bone, it is beneficial to engage one thread of the lag screw in the cortical bone of the medial condyle. Be aware of the slope of the medial condyle so as not to overpenetrate.

The handle of the CLASSIC Insertion Wrench must be perpendicular to the position of the femur to ensure proper keying of the lag screw and plate barrel. Verify the position of the screw and its depth using image intensification in both planes. Remove the AMBI/CLASSIC Centering Sleeve and advance the sideplate onto the lag screw shaft (Figure 11).

The Plate Tamper should be used to fully seat the plate (Figure 12). Unscrew the Lag Screw Retaining Rod and remove the CLASSIC Insertion Wrench from the back of the lag screw. Then, remove the 3.2 mm Tip Threaded Guide Pin.
Option B:
AMBI Plate with the AMBI Insertion Wrench (Figures 13-16)

Press the tips of the AMBI Clip together (Figure 13). Assemble the AMBI Clip, plate, and lag screw onto the AMBI Insertion Wrench. For a keyless system, the AMBI Clip may be omitted. Screw the Lag Screw Retaining Rod into the distal end of the lag screw until a firm connection is obtained. Slip the AMBI/CLASSIC Centering Sleeve onto the AMBI Insertion Wrench. Place the entire assembly over the guide pin and introduce it into the reamed hole (Figure 14). DO NOT USE THE WRENCH AS A LEVER.

Use image intensification to advance the lag screw into the cancellous bone of the femoral condyle. Also, the handle of the AMBI Insertion Wrench must be perpendicular to the position of the femur to ensure proper keying of the lag screw and plate barrel if the AMBI keyed application is being used.

In osteoporotic bone, it is beneficial to engage one thread of the lag screw in the cortical bone of the medial condyle. Be aware of the slope of the medial condyle so as not to overpenetrate. Remove the AMBI/CLASSIC Centering Sleeve and advance the sideplate onto the lag screw shaft.
If the keyed technique is selected, align the longitudinal line on the barrel and the longitudinal line on the AMBI Insertion Wrench (Figure 15). This alignment allows the AMBI Clip to enter the plate. Finger pressure should be used to introduce the Clip into the barrel. If difficulty in introducing the Clip is encountered, a slight readjustment of the screw-barrel relationship should allow easy insertion. Push the cylindrical AMBI Clip Inserter manually down the shaft of the AMBI Insertion Wrench to fully seat the Clip (Figure 16). This should be accomplished by a firm tap using fingers until the Clip snaps into place. Using an instrument or a mallet to accomplish the last task may result in destruction of the Clip and will not help to seat it.

The Plate Tamper should be used to fully seat the plate (see Figure 12, page 27). Unscrew the Lag Screw Retaining Rod and remove the AMBI Insertion Wrench from the back of the lag screw. Then, remove the 3.2 mm Tip Threaded Guide Pin.

Option C:
CLASSIC or AMBI Plate with the Insertion/Removal Wrench & Cannulated Barrel Guide (Figures 17-21)

Insert the threaded portion of the Cannulated Barrel Guide into the cannulated portion so that it emerges at the end with flats (Figure 17). Screw the assembled Cannulated Barrel Guide into the distal end of the appropriate lag screw. Slide the Centering Sleeve onto the Insertion/Removal Wrench. Next, insert the entire Cannulated Barrel Guide assembly into the Insertion/Removal Wrench until the connection point between the lag screw and the Cannulated Barrel Guide is flush with the end of the Wrench (Figure 18). Place the entire assembly over the guide wire and introduce it into the reamed hole. DO NOT USE THE WRENCH AS A LEVER.
Inserting the Guide Pin

Use image intensification to advance the lag screw into the cancellous bone of the femoral condyle. In osteoporotic bone, it is beneficial to engage one thread of the lag screw in the cortical bone of the medial condyle. Be aware of the slope of the medial condyle so as not to overpenetrate. Also, when using a keyed application, the handle of the Insertion/Removal Wrench must be perpendicular to the position of the femur to ensure proper alignment of the plate and lag screw (Figure 19).

Remove the Insertion/Removal Wrench and Centering Sleeve and insert the appropriate plate over the guide pin and Cannulated Barrel Guide (Figure 20). The Cannulated Plate Tamper should be used to fully seat the plate (Figure 21). Unscrew the Cannulated Barrel Guide and remove. Then, remove the 3.2 mm Tip Threaded Guide Pin.

Attaching the Plate

At this point, if the supracondylar fracture has not yet been fully reduced, rotate the plate to align it properly to the condyles in the sagittal (flexion/extension) plane. Fluoroscopy can be used to confirm appropriate plate position and exclude a flexion or hyperextension malalignment (Figure 22). Occasionally, a small notch has to be made just proximal to the barrel in the femoral condyle to allow the plate to lie flush with the anterolateral face of the bone.

Intercondylar fracture compression can be accomplished by means of the Compression Screw. The standard 19 mm screw is usually used (Figure 23).
Caution should be used when carrying out the compression. The compressing screw exerts a powerful force that must be correlated with the quality of bone. Placement of the compressing screw should be considered mandatory when a supracondylar plate is used. This will help prevent potential disengagement of the screw-plate assembly.

The most distal hole in the 90° and 95° plates is designed to accept a 6.5 mm Cancellous Screw or a 6.5 mm Cannulated Screw for purchase into the metaphyseal bone of the distal femur. Inserting the most distal screw in the plate prevents subsequent plate flexion/extension, and definitively fixes in all three planes the relationship between the distal articular block and the plate.

To insert a cannulated screw, snap the black 2.4 mm Pin Guide into the Combination Drill Guide. Place the Pin Guide into the distal slot and insert a 2.4 mm Guide Pin toward the fragment (Figure 24). Use the instruments from the Cannulated Screw Set to implant the appropriate 6.5 mm Cannulated Screw. (Refer to 6.5 mm Cannulated Screw Surgical Technique, 7118-0355.)

If the guide pin was inserted at the appropriate position and parallel to the joint surfaces, reducing the plate and attached condyles to the intact shaft will restore anatomic alignment to flexion/extension and varus/valgus even in the most complex fracture patterns. Confirm appropriate rotational reduction before clamping the Plate Clamp to the shaft (Figure 25).
Special Features of the Plate

The oval “autocompression” holes of the plate will allow for up to 2 mm of compression of the supracondylar fracture. To achieve compression, place the eccentric gold end of the Combination Drill Guide in the first compression slot proximal to the fracture with the arrow pointing toward the fracture and drill through the guide using a 3.5 mm Twist Drill (Figure 26). Determine the appropriate cortical bone screw length using the Bone Screw Length Gauge (Figure 27).

Place a 4.5 mm self-tapping cortical screw in the slot. The screw will engage through the proximal part of the slot, away from the fracture (Figure 28). As the screw is seated, it abuts the inclined sides of the slot, forcing the plate, and the attached distal fragment, slightly proximally until resisted by the compressed fracture (Figure 29). The insertion of this first bone screw will produce approximately 1 mm of compression. For an additional 1 mm of compression, repeat this step in the compression slot proximal to the first one. Slightly loosen the first eccentrically placed screw after the second screw abuts the slot, but before it is fully seated to allow the additional compression. Following seating of the second screw, retighten the first screw.

Figure 26
Figure 27

Figure 28
Figure 29

3.5 mm Twist Drill
Bone Screw Length Gauge
When using plates with eight or more slots typical for supracondylar fractures, the geometry of the most proximal slot allows compression of nearly 5.5 mm.

Drill for the remaining screws using the green (neutral) end of the Combination Drill Guide (Figure 30). Determine appropriate cortical screw length using the Bone Screw Length Gauge. Insert the screw using the Self-Holding Hex Screwdriver (Figure 31). This Screwdriver will attach directly to a power source or one of the two Quick Connect Adapters for quick initial insertion. Final tightening can be achieved manually with the Hex Screwdriver. A 4.5 mm Bone Screw Tap is available, but only necessary in extremely hard cortical bone.

Closure

Obtain final X-rays to confirm appropriate screw length and position. Consider placing a large wound suction drain. Lay the vastus lateralis back into its anatomic position and carefully repair the fascia lata and joint capsule. Following routine closure and dressings, briefly immobilize the knee in flexion before initiating early motion.
Removing the Implants

The most important step in the removal of a compression hip or supracondylar screw is the determination of the manufacturer who produced that particular implant. Although constructs from different manufacturers may look similar, most instruments for insertion and removal are not interchangeable.

Open the original incision in the manner previously described. Remove the compression screw, then the cortical screws. Lift the plate from the femoral shaft and disengage it from the lag screw. Use the Lag Screw Trephine to remove the tissue and bone formed behind the distal portion of the lag screw (Figure 32). Connect the Insertion/Removal Wrench to the base of the lag screw. Attach it by means of the Retaining Rod for the Insertion/Removal Wrench. Use a counterclockwise motion combined with a pulling motion to accomplish the removal of the lag screw.
CLASSIC Compression Hip Screw
Supracondylar Plates

Barrel Length: 1.0” (25.4 mm)

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AMBI/CLASSIC/IMHS Standard Lag Screws
Thread Diameter: 1/2" (12.7 mm)
Thread Length: 21.0 mm
Root Diameter: 9.0 mm

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NOTE: Do not use AMBI/CLASSIC 55, 60, or 65 mm lag screws with IMHS. These sizes are too short to work effectively with this device.
### AMBI/CLASSIC Super Lag Screws

- **Thread Diameter:** 9/16" (14.3 mm)
- **Thread Length:** 21.0 mm
- **Root Diameter:** 9.0 mm

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### 6.5 mm Cannulated Screws

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### Compression Screws

- **Hex Diameter:** 3.5 mm

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### 4.5 mm Self-Tapping Cortical Bone Screws

- **Head Diameter:** 8.0 mm
- **Major Thread Diameter:** 4.5 mm
- **Root Diameter:** 3.2 mm

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IMHS™ Centering Sleeve

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Quick Connect Adapter
(for use with Hall, Jacobs, or Stryker power)

Cat. No. 7111-0020

Quick-Connect Adapter
(for use with Synthes power)

Cat. No. 7111-0022

Perforation Drill

Cat. No. 11-0021

Quick Connect T-Handle

Cat. No. 7111-5045

Percutaneous Direct Measuring Gauge

Cat. No. 11-0026

Tip Threaded Guide Pin, 3.2 mm

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Guide Pin Placement Instrument
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Power Combination Reamer
11-0023

Lag Screw Tap
7111-0014

CLASSIC Insertion Wrench
Cat. No. 11-0054

AMBI Insertion Wrench
Cat. No. 11-0022

Replacement Retaining Rod for AMBI/CLASSIC Insertion Wrenches
Cat. No. 7111-0024

AMBI/CLASSIC Wrench Centering Sleeve
Cat. No. 11-0029
Plate Tamper  
Cat. No. 11-0020

Insertion/Removal Wrench  
Cat. No. 11-5061

Replacement Retaining Rod for Insertion/Removal Wrench  
Cat. No. 7111-5062

Cannulated Barrel Guide  
Cat. No. 7111-0060

Insertion/Removal Wrench Centering Sleeve  
Cat. No. 7111-0030

Cannulated Plate Tamper  
11-0903

Plate Clamp  
Cat. No. 21-0204

Combination Drill Guide  
3.5 mm  
Cat. No. 11-0075

Pin Guide  
2.4 mm  
Cat. No. 7111-0105
Guide Pin
2.4 mm
Cat. No. 41-0236

Twist Drill
3.5 mm
Cat. No. 7111-0045

Bone Screw Tap for 4.5 mm
Self-Tapping Screws
Cat. No. 11-0077

Bone Screw Tap for 4.5 mm
Nonself-Tapping Screws
Cat. No. 7111-0070

Bone Screw Length Gauge
Cat. No. 41-3500

Screw Pickup
Cat. No. 7111-5085

Self-Holding Hex Screwdriver
Cat. No. 7111-0026

Hex Screwdriver
Cat. No. 11-5035
Supracondylar Pin Guides

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<th>Cat. No.</th>
<th>Angle</th>
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<td>11-0018</td>
<td>90°</td>
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<td>11-0019</td>
<td>95°</td>
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Long Slot Drill Guide
Cat. No. 11-5043

Drill Sleeve
3.5 mm
Cat. No. 7111-0123

Twist Drill
4.5 mm
Cat. No. 7111-0027

Obturator
Cat. No. 11-6500

Lag Screw Trephine
Cat. No. 11-0926

CHS Supracondylar Templates
(Not shown)
Cat. No. 7118-0720
Catalog Information – Instrument Trays

Sterilization Tray
Cat. No. 7111-5090

Standard Tray Insert
Cat. No. 7111-5070

AMBI/CLASSIC Instrument Tray
Cat. No. 7111-5091

Screw Caddy
Cat. No. 7111-5097

Bone Screw Caddy (optional)
Cat. No. 7111-0137

Trial Tray (optional)
Cat. No. 7111-5032