



Free-Lock® Femoral Fixation System

Surgical Technique



Zimmer Free-Lock Femoral Fixation System Surgical Technique

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Surgical Technique for Intertrochanteric Fractures of the Femur

Introduction

With the perspective of history, it is interesting to note that, prior to the 1930s, **no methods** were available for immobilization of femoral neck fractures and they often resulted in the death of the patient. Orthopaedics has made considerable and rapid progress in this area. Today's issues focus on the topics of high-angle fixation, rotational stability of the femoral head, indications for use of a compression hip screw, and strength of materials.

High Angle Fixation

The development of high-angle tube/plates provides the surgeon with a wider range of options. For a simple intertrochanteric fracture which is stable and not displaced, the lower angle (135-degree) device is our choice, since only minimal impaction and collapse of fracture fragments generally occur. Also, use of the lower-angle device is an easier, more forgiving procedure. Higher-angle fixation, while more technically demanding, is definitely helpful for treating comminuted fractures where fracture fragments need to impact postoperatively to gain stability. Increasing the neck/shaft angle with high-angle fixation decreases mechanical stress on the implant and increases the tendency for sliding, thereby facilitating the impaction of fracture fragments.

In choosing the angle of fixation, one should keep in mind that it is desirable to achieve 70 to 80 percent of fracture impaction at the time of surgery with good operative technique. Another consideration, apart from the nature of the fracture itself, is the considerable anatomic variation encountered in the natural neck/shaft angle of the femur, which can vary from 135 degrees to as much as 160 degrees.

The *Free-Lock* Femoral Fixation System provides maximum flexibility in angle of fixation with tube/plates of 130, 135, 140, 145, and 150 degrees. Supracondylar tube/plates are also available in 90 and 95-degree versions. While the author has found that either a 135-degree or a 150-degree tube/plate will be adequate for most cases, there are cases where other angles are both convenient and appropriate. While current cost-containment emphasis may restrict hospital inventory of implants, the wide selection available should meet the needs of any group of practitioners.

Rotational Stability

Rotational stability of the femoral head is of paramount concern in fixation of hip fractures. This can be achieved with a keyed system, although in the past the difficulty of aligning the keyway has challenged the surgeon's skills.

The *Free-Lock* System combines the simplified technique of keyless insertion with the option of keying the device at the end of the procedure to prevent rotation of the proximal fragment on the distal fragment. With this new flexibility, the surgeon acquires greater mechanical stability by keying the device while the surgical technique is considerably simplified.

Indications for a Compression Hip Screw

The manufacturer recommends the *Free-Lock* Femoral Fixation System for internal fixation of hip fractures, with application to intracapsular and intertrochanteric fractures, osteotomies, and arthrodeses. The surgeon should recognize that the indications for use of a compression hip screw remain an area of controversy and additional clinical data on broader indications is needed by the orthopaedic profession.

There is, of course, no question about the suitability of a compression hip screw for intertrochanteric fractures. Use for intracapsular fractures has not been proven to be a contraindication, but may be associated with a slightly higher incidence of avascular necrosis of the femoral head when compared to the alternatives of multiple screw on pin fixation. Application of the device for subtrochanteric fractures remains an area for surgical judgment, special caution, and further study.

Strength of the Implant

The search for the ideal surgical alloy will probably never end. With the *Free-Lock* System comes 22-13-5 stainless steel with a yield strength approximately three times that of contemporary 316L stainless steel. There is also improved corrosion resistance over standard stainless steel and up to twice the fatigue life. The technical data on 22-13-5 stainless steel is highly convincing and leads to the question of the degree to which material should influence the surgeon's choice of an implant system. All things being equal—design, function, instrumentation, and technique—a stronger material provides the surgeon with an added margin of safety and security, particularly in the area of prolonged fatigue life.

Patient Positioning and Radiographic Control

The patient is taken to the operating room and given the anesthetic of choice. He is transferred to the fracture table and placed in the supine position. This table enables the surgeon to perform the procedure with a minimum number of assistants and allows accurate placement of the limb both for reduction of the fracture and for obtaining biplanar roentgenograms (Fig 1).

The sacrum is well padded, as is the perineal post. The surgeon and his assistant can manually pull the patient down onto the well-padded post and position both lower limbs in 30 to 40 degrees of abduction.

The feet are strapped or taped directly to the foot plates of the traction device. Using manual traction, the injured limb is brought to about 10 degrees of abduction, and the uninjured limb is maximally abducted. Then, while using mechanical traction, both legs are internally rotated so that the feet rest in approximately 45-degrees internal rotation with the knees in slight internal rotation. Further traction is applied to the limb to tighten the hip capsule. The externally rotated neck and shaft are thus distracted distally and brought into internal rotation. To create a barrier between the wound and the nonsterile x-ray equipment, sheets are placed almost vertically, using IV poles for support. Two x-ray machines may be used, the lateral tube passing parallel along the 45-degree angle of the uninjured leg through the opposite acetabulum and ilium. The A/P tube should be overhead. When available, image intensification may be used in a similar manner, positioning the machine between the patient's legs.

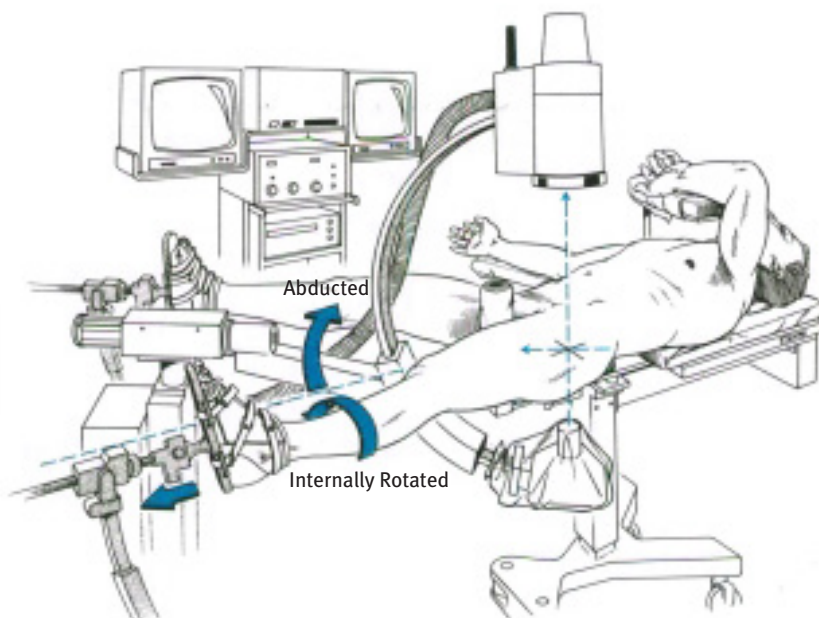


Fig. 1

Surgical Technique

Reduction, Incision, and Exposure

The incision should not be made until the best reduction possible is accomplished. A/P and lateral roentgenograms are obtained and the entire femoral head and acetabulum must be seen in the lateral film. Further manipulation of the fracture may be necessary to obtain the best possible reduction. An anatomic reduction or a slightly over corrected (valgus) reduction should be seen in the A/P film. Occasionally, a slight sag of the fracture may be seen on the lateral view.

The operative site is prepared in the usual manner. The incision is made from the tip of the greater trochanter, extending distally for about 15cm in a longitudinal direction (Fig 2). The incision is carried down through the subcutaneous tissues and the fascia lata is split exposing the underlying vastus lateralis. The muscle is retracted anteriorly and followed posteriorly along the fascia toward the linea aspera. It is incised just anterior to its insertion on the linea aspera, then elevated subperiosteally from the femoral shaft. (In extremely obese patients, the insertion on the intertrochanteric line may be tenotomized as well.) Care should be taken to avoid inadvertent damage to the large vessels that perforate the intermuscular septum posteriorly as this may cause excessive bleeding. The lesser trochanter is then palpated on the interior posterior aspect of the proximal femur and used as a reference point for the insertion of the guide pin.

Guide Pin Placement

The placement of the guide pin is the most critical step of the surgical procedure because the guide pin serves to establish the angle of fixation. Subsequent reaming, tapping, and implant placement are performed with cannulated instrumentation which follows the path established by the guide pin.

If a drill track is established through a point on the lateral femoral cortex opposite the lesser trochanter and aimed proximally and medially at 135 degrees, a guide pin can be passed directly into the center of the femoral neck and head (Fig. 3). If the surgeon decides to use a 135-degree tube/plate, the entry port should be established at this point opposite the lesser trochanter.

Likewise, a drill track established 2 cm below this point is appropriate for a 150 degree tube/plate. A guide pin inserted at this point and aimed proximally and medially at 150 degrees will pass along the calcar femorale into the femoral head.

A guide pin passed along the anterior aspect of the femoral neck may be visualized on image intensification and serve as a further guide to pin placement along the lateral cortex as well as assisting in the determination of the angle of anteversion or retroversion of the femoral neck.

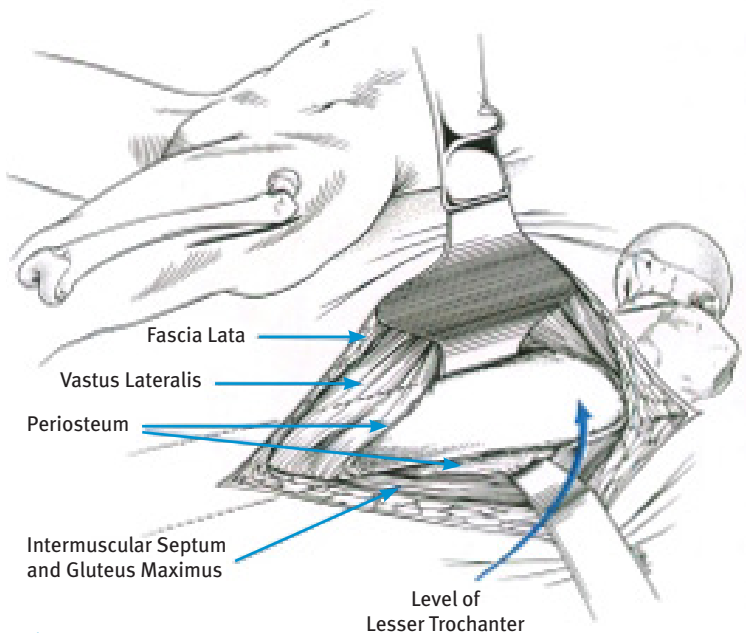


Fig. 2

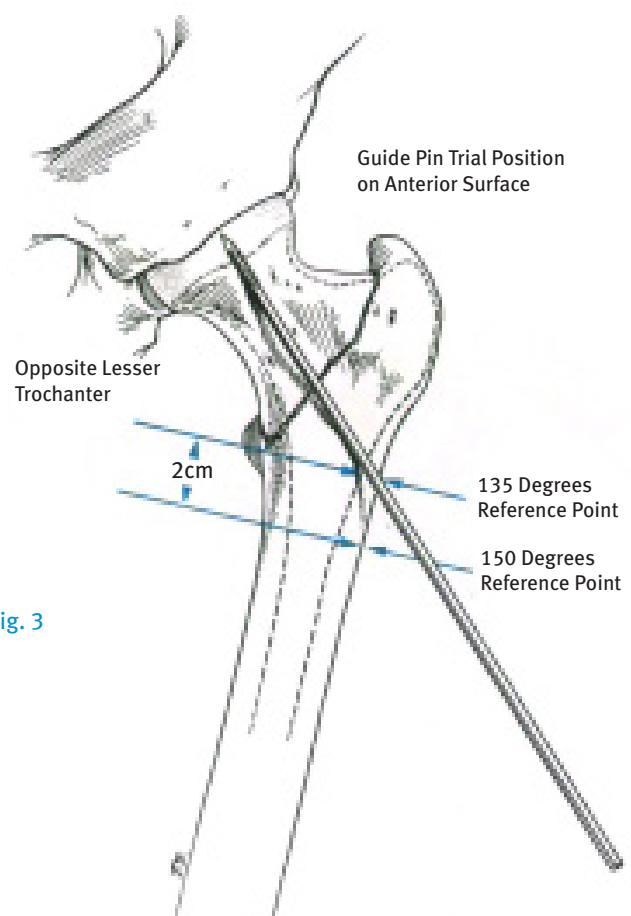


Fig. 3

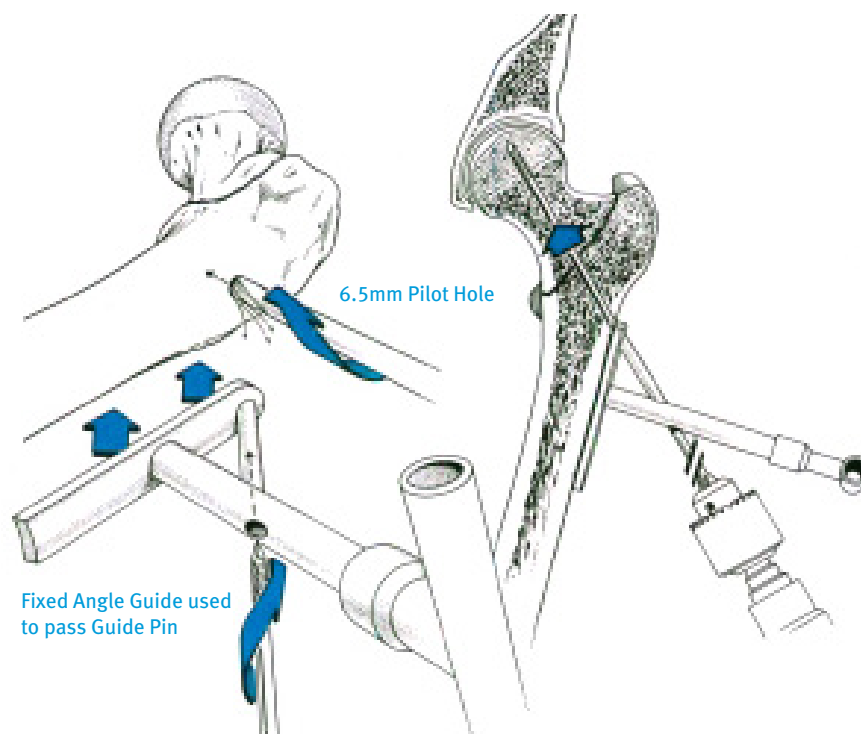


Fig. 4

Through the appropriate reference point, a pilot hole may be made with a countersink or drill bit approximately 6.5mm (1/4 inch) in diameter. One of the five Fixed Angle Guides (130, 135, 140, 145, or 150 degrees) or the 1146-10 Variable Angle Guide is used to pass the guide pin at the desired angle (Fig. 4). In many patients the guide pin can be directly drilled into bone without prior drilling of a pilot hole.

At this point, anteroposterior and lateral roentgenograms or image intensification verify correct placement of the guide pin. If image intensification is available, the pin position may be verified during its insertion. The guide pin should be inserted until well purchased in the subchondral bone of the femoral head, extending to within 3mm to 6mm of the joint space. There is no need to drill the guide pin into the joint space or the acetabular cortex as this may, in fact, damage the joint.

Determining Guide Pin Depth

Using the Guide Pin Depth Gauge, a direct reading of the depth of the guide pin is obtained (Fig. 5). This measurement is often called the “pilot length.” This is a true measurement of the length of pin within the bone. The length of lag screw tap depth and ream depth to be used should be selected from this measurement. This will ensure adequate overlap between the tube/plate and lag screw.

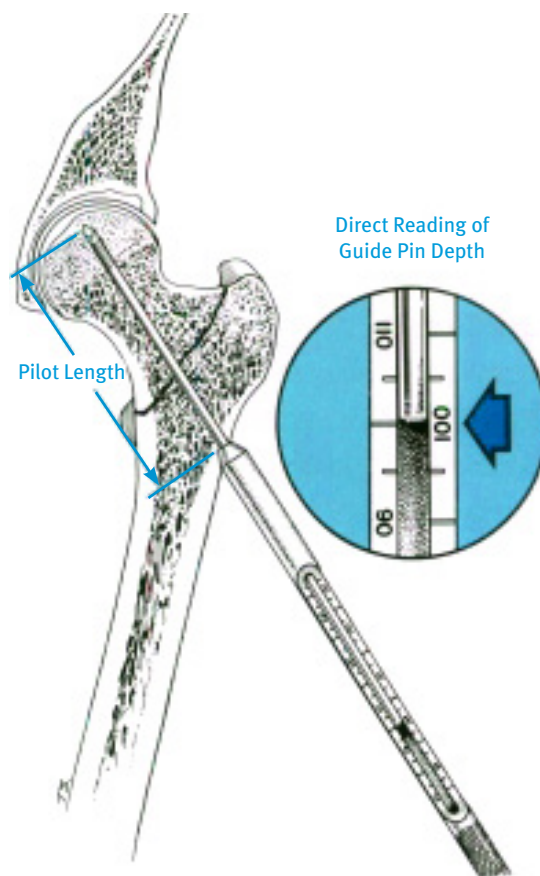


Fig. 5

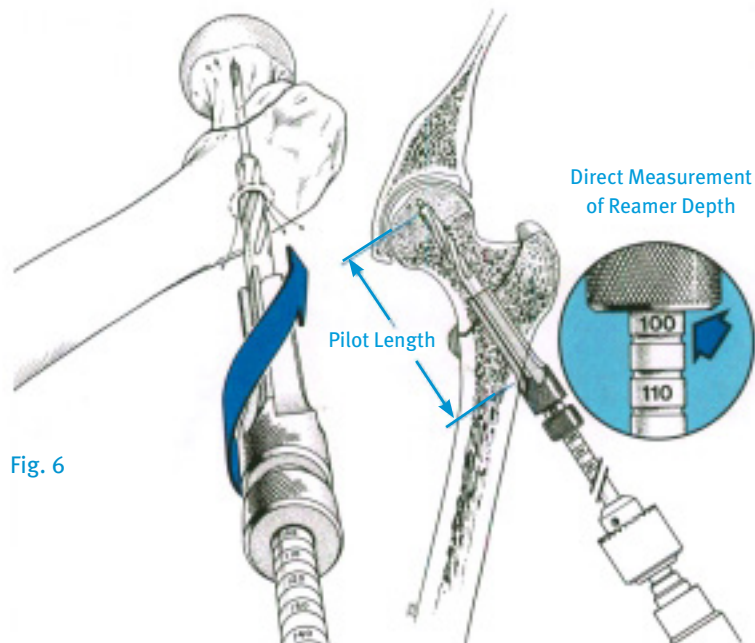


Fig. 6

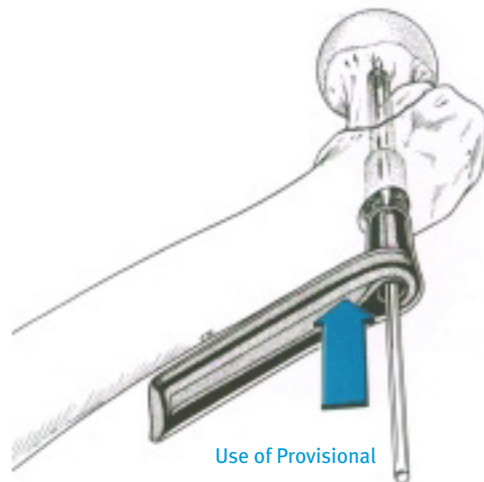
Reaming the Lag Screw Channel

To prepare the lag screw channel, the Lag Screw Reamer is assembled with either the Short or Long Barrel Reamer Sleeve (Fig. 6). This instrument is essentially a “triple reamer” since it reams dimensions for the lag screw and tube, and also countersinks the lateral cortex for optimal tube/plate placement. The reamer shaft is calibrated for direct measurement of the distance from the tip of the reamer shaft to the countersink portion of the reamer head. Prior to drilling with the reamer, the guide pin should be further inserted to the level of subchondral bone to prevent its withdrawal with the reamer. Reaming should be performed under image intensification to prevent unintended guide pin advancement.

If the surgeon is working with the good, healthy bone stock of a younger patient, it is advisable to set the reamer to ream to the true pilot length or exact length of the lag screw to be used. This will make it easier to tap and drive the lag screw. **Only** in elderly osteoporotic patients, should the surgeon choose to ream the channel shorter than the selected length of the lag screw, as this may enhance screw purchase in the bone. If the guide pin is inadvertently removed with the reamer following completion of reaming, it may be reinserted by placing a lag screw with the threads and shaft reversed into the reamed channel. The guide pin is then reinserted through the cannulation and tapped in place.

Use of Provisionals (Optional)

At this point, the surgeon may choose to check the angle of fixation and approximate fit of the implant with the color-coded plastic tube/plate provisionals (Fig. 7). Since all *Free-Lock* Hip Fixation implants are packaged presterile, use of the provisionals is preferable to opening more than one implant package if an adjustment is required.



Use of Provisional

Fig. 7

Tapping the Lag Screw Channel (Optional)

After reaming the Cannulated Bone Tap (Cat. No. 1180-70) with Centering Collar is passed over the guide pin to pre-tap a channel for the lag screw threads (Fig. 8). Place the Centering Collar into the center of the seamed tube channel to maintain an on-center tap position. The calibrations on the bone tap are true measurements of the distance from the tip of the tap to the rear of the centering collar.*

Determining Lag Screw Length

For a typical case in which a standard tube/plate is used, the distance reamed and tapped is the same as the pilot length, the lag screw length may be 10mm less than the pilot length for low-angle plates (130, 135, 140 degrees). High angle plates (145, 150 degrees) may use a lag screw equal to 5mm less than the pilot length. Short tube/plates require a lag screw 5mm longer than the pilot length for low-angle plates (130, 135, 140 degrees). High-angle short tube/plates require a lag screw 10mm longer than the pilot length.

NOTE: Under all circumstances, a minimum of 22mm of overlap must be maintained between the tube/plate and lag screw to ensure that binding between the two components is minimized.

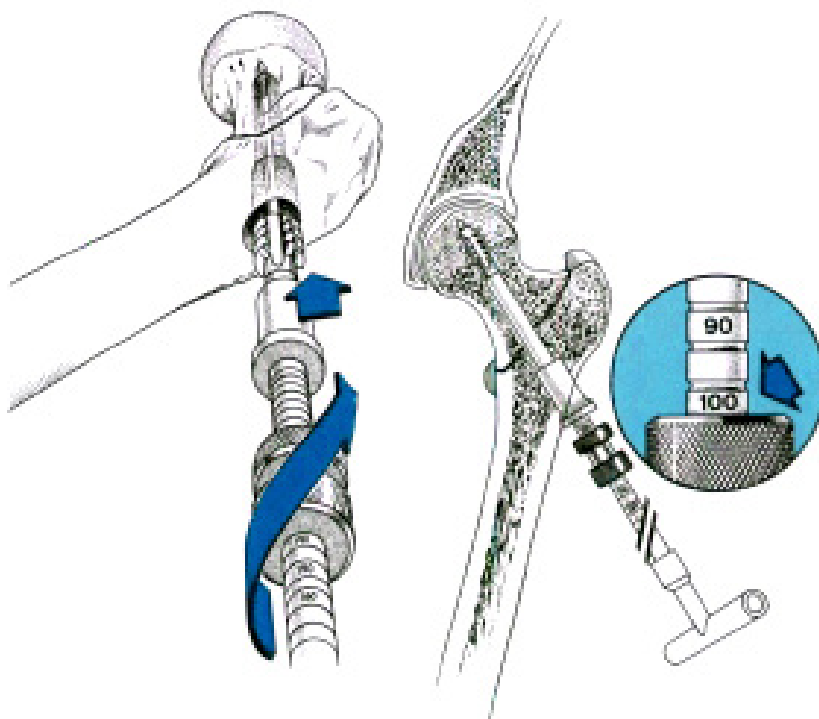
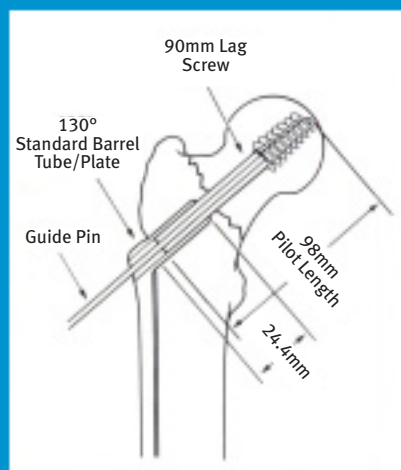


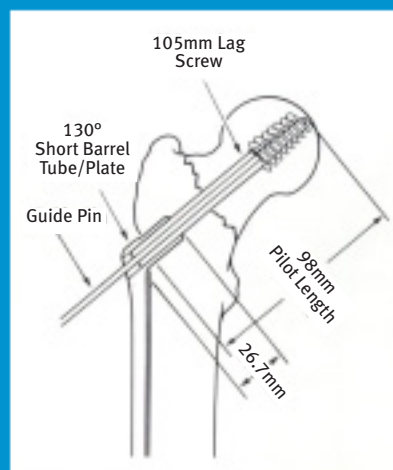
Fig. 8

* The 1199-05 Bone Tap and the 1199-14 Large Bone Tap are designed to measure from the tip of the tap to the rear of the locking assembly

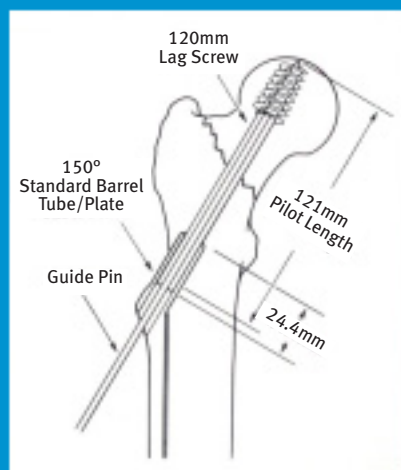
Guidelines in Determining Lag Screw Length



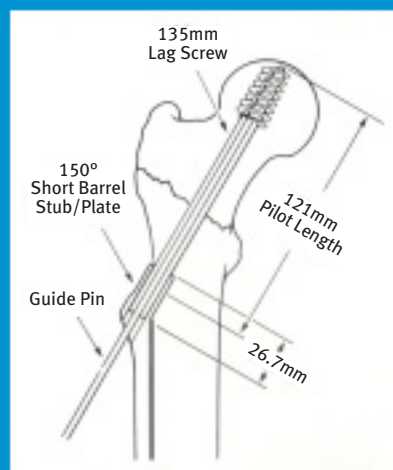
① ② 130° Standard Tube/Plate



④ 130° Short Barrel Tube/Plate



① ③ 150° Standard Barrel Tube/Plate



⑤ 150° Short Barrel Stub/Plate

Angle

Tube Style	130°	135°	140°	145°	150°
Standard	① ②	① ②	① ②	① ③	① ③
Short	④	④	④	⑤	⑤

- ① Typical case, use same lag screw length as pilot length.
- ② May use lag screw 10mm less than pilot length.
- ③ May use lag screw 5mm less than pilot length.
- ④ Should use lag screw 5mm more than pilot length.
- ⑤ Should use lag screw 10mm more than pilot length.

Target minimum overlap of lag screws and tube/plate is 22mm.

When pilot length is between the available incremental values, go to the next **highest** reading. This will be the correct pilot length.

NOTE: Any differences in ream or tap depth, or large degrees of anticipated impaction should be taken into account.

Insertion in the Collapsed Mode

The appropriate length lag screw is assembled into the selected tube/plate in a collapsed position and placed onto the cannulated Lag Screw Inserter. The inserter is placed over the guide pin and into the channel prepared in the lateral cortex (Fig. 9).

The Lag Screw Inserter engages a slot on the base of the screw and has ridges which prevent relative migration of the inserter head (Fig. 10). The screw is first turned in a counterclockwise direction until a click is felt indicating that the screw threads match the tapped hole. The inserter is then turned clockwise to advance the lag screw to the desired depth. After several turns have been made with the lag screw, the side plate may be slid into place on the lateral cortex over the shaft of the lag screw and may also be clamped to the shaft of the femur, if desired. An angled bone clamp such as a Verbrugge clamp facilitates use of other instruments since it will not intrude into the surgeon's work space.

The lag screw is then inserted to its appropriate position. The T-handle of the Lag Screw Inserter should be parallel to the neck/shaft of the femur when the screw is completely inserted.

Keying the Implant

We advocate keying the implant for added rotational stability, especially with the use of low-angle plates and fractures which may not impact adequately to allow a keyless approach (intracapsular or subtrochanteric fractures).

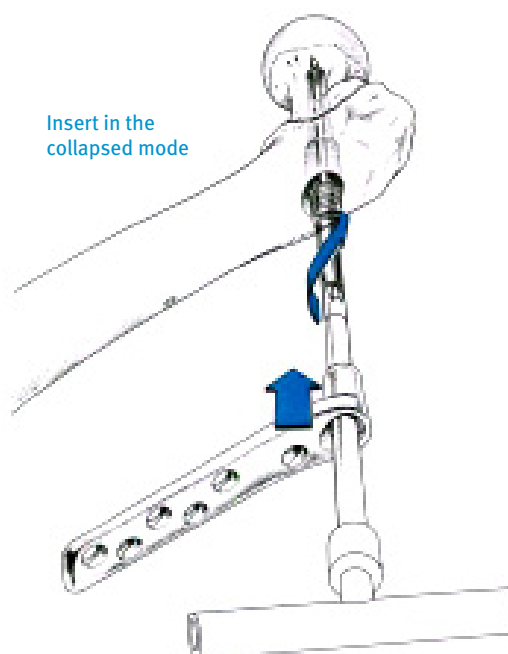


Fig. 9

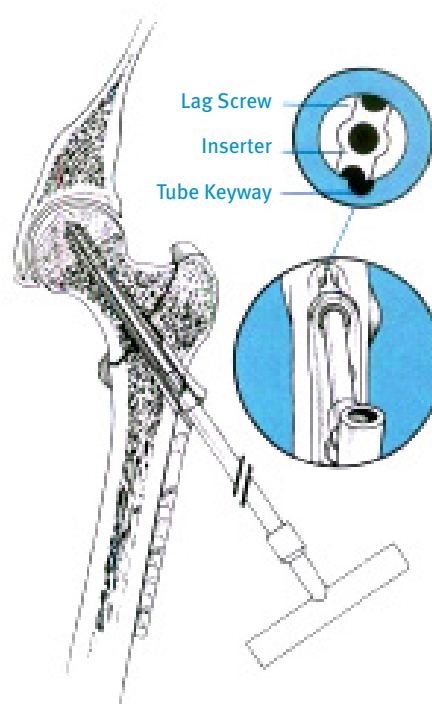


Fig. 10

To key the device, place the appropriate locking pin assembly on the Pin Inserter shaft until the rear of the locking pin sits on the inserter guide (Fig. 11).

The Pin Inserter is now placed through the tube/plate until the driver-type tip of the pin inserter mates with the driver slot of the lag screw. Location in the lag screw is checked by attempting to rotate the pin inserter and must be checked prior to engaging the pin and cartridge in the rear of the tube.

If the Pin Inserter rotates freely, it is not seated in the driver slot of the lag screw. Push on the handle until the cartridge sits squarely in the counterbore of the tube (Fig. 12). (Either the lag screw or the tube/plate may need to be rotated to allow the pin to drop into the tube keyway.)

The handle is now pushed until the pin is felt to click into place (Fig. 13). At this time the rear of the cartridge should be within approximately 2mm of the inserter handle. If resistance to insertion is felt prior to feeling the pin click in place, make a slight rotational adjustment to either the lag screw or the tube/plate and continue pin insertion. When in place, the rear of the pin will sit about 5mm inside the counterbore and its location can be verified by visual inspection.

The Pin Inserter is not a lag screw driver and should not be used as a substitute for the Lag Screw Inserter.

It is extremely important to use the proper length locking pin. Two sizes of locking pins are available-short and long.

The long pin, used with the standard length tube/plate is enclosed in a blue cartridge. The short locking pin for a short barrel tube/plate is enclosed in a white cartridge.

Attaching the Side Plate

Note: The side plate may be keyed on the back table prior to assembly with the side plate.

The side plate is attached to the shaft of the femur in the usual fashion. The proximal hole on the tube/plate has been enlarged to accept either 4.5mm cortical, 6.5mm cancellous, or 7.0mm cannulated screws. The larger screws are helpful in capturing medial fragments. The Load and Neutral Drill Guide is used to assure proper screw placement, the Screw Depth Gauge to determine the proper screw length, and the Bone Tap to assure proper interface between the bone screws and the bone.

The *Free-Lock* Hip Fixation side plate features Self Compression Plate (SCP) slots which allow angulation of the screws in order to stabilize fracture fragments with a bone screw.

Refer to pages 16 and 17 to review the use of the *Magna-FX*® Cannulated Bone Screw in the proximal hole of the tube/plate for better fixation in specific fracture indications.

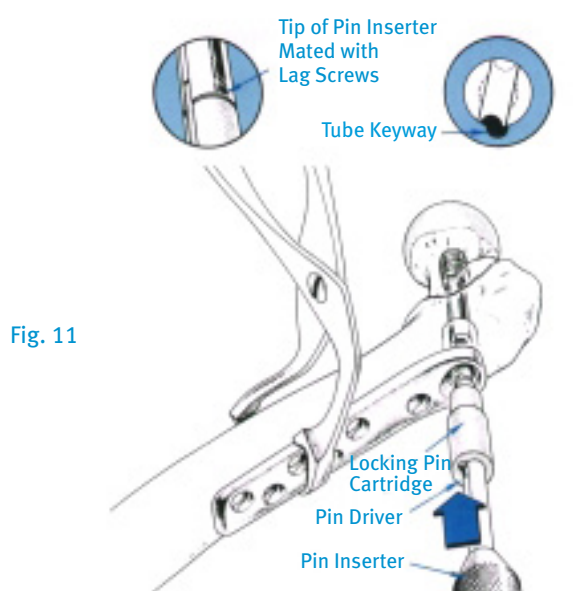


Fig. 11

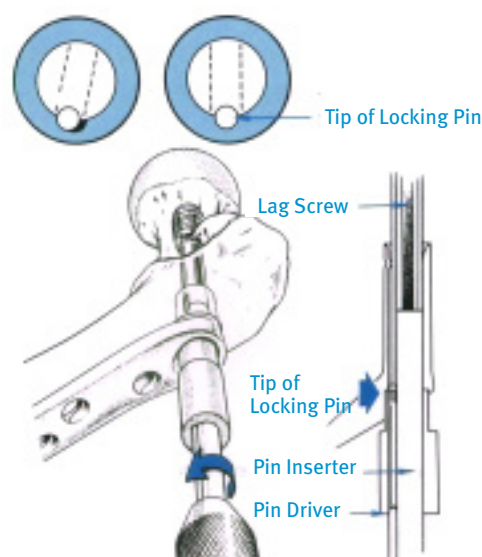


Fig. 12

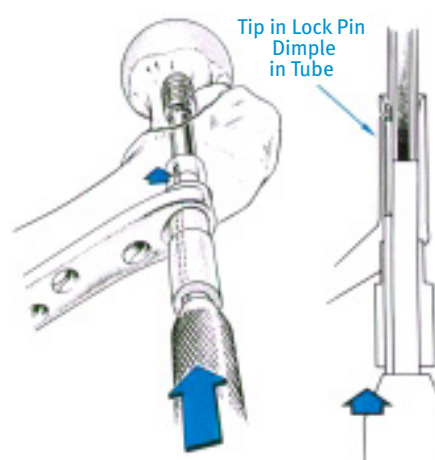


Fig. 13

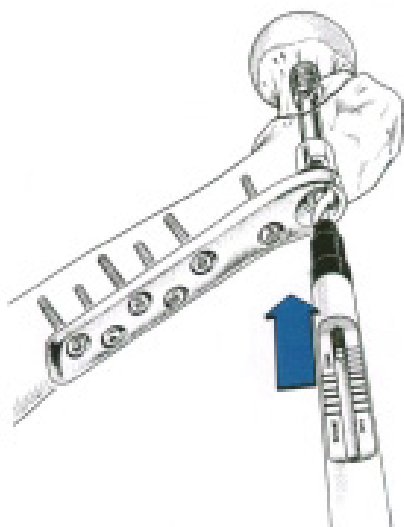


Fig. 14A

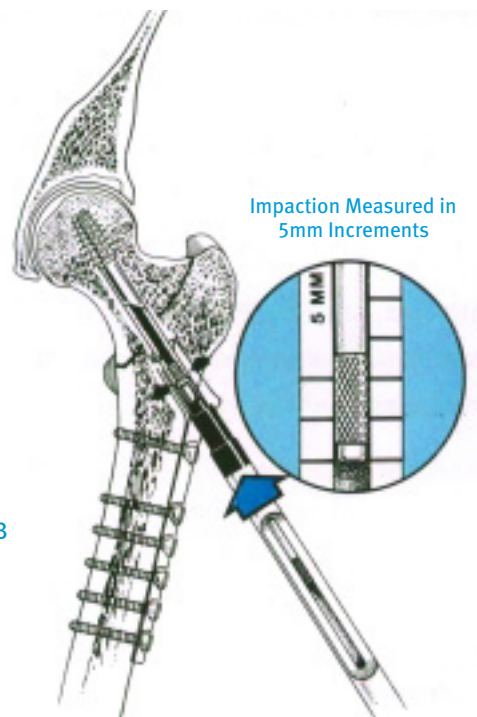


Fig. 14B

Impaction (Optional)

The Impactor is used to impact the fracture (Fig 14A). This instrument features a shaft which screws into the back of the lag screw. When the impactor is inserted over the shaft, calibration can be documented in 5mm increments, allowing the surgeon to measure the amount of impaction achieved (Fig. 14B).

Use of a compressing screw is recommended in all cases to ensure adequate overlap of the screw in the tube as well as to achieve further impaction (Fig. 15). However, it is important to avoid excessive force with compression or impaction because the lag screw may strip the threads in soft femoral head bone. After compression is achieved, the compression screw should be removed.

Final radiographs should be obtained prior to closing to make certain that the fracture is completely compressed and there is no gap or abnormal angulation at the fracture site.

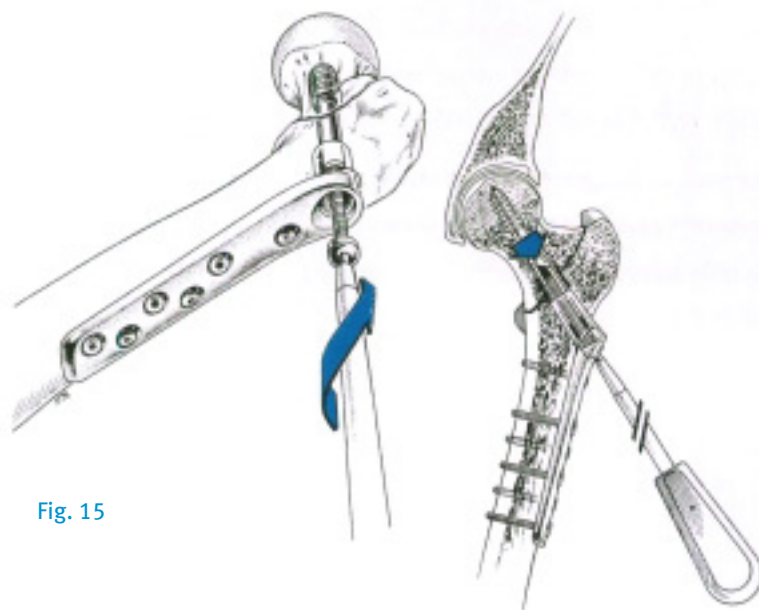


Fig. 15

Wound Closure

The wound is closed using widely separated and superimposed sutures in muscle, fascia, subcutaneous tissue, and skin to allow adequate drainage. Closed suction drains may be used for 24 to 48 hours postoperatively. The wound is dressed with a pressure dressing.

Postoperative Care

Patients are encouraged to get out of bed the day following surgery. The standing position helps prevent thromboembolism. A program of partial weight bearing is instituted to provide additional compression of the fracture fragments. Patients are allowed to ambulate with crutches or walkers. Full weight bearing is usually possible by the eighth week, but many patients begin full weight bearing at once because they would be unable to ambulate otherwise.

Since most of these patients are elderly, they are frequently given broad spectrum antibiotics prophylactically during or just before surgery; and the antibiotic regimen is continued for three days postoperatively. To help prevent thromboembolism, aspirin therapy (if not contraindicated) can be instituted and the patient fitted with antiembolism stockings.

Inserting the Magna-FX Cannulated Bone Screw

Step 1 – Guide Pin Placement*

Following fracture reduction under image intensification control, insert a 3.2mm, 9-inch long guide in across the fracture site, either freehand or using the 3.2mm pin guide, engaging the subchondral bone.

Step 2 – Measuring*

Place the Cannulated Depth Gauge over the guide pin and read the actual depth of the pin in the bone. The surgeon may elect to use a screw 5mm to 10mm less than the Depth Gauge reading.

Step 3 - Drilling* (Optional)

Using the Cannulated Reamer, drill to a depth 10mm less than the actual depth of the pin.

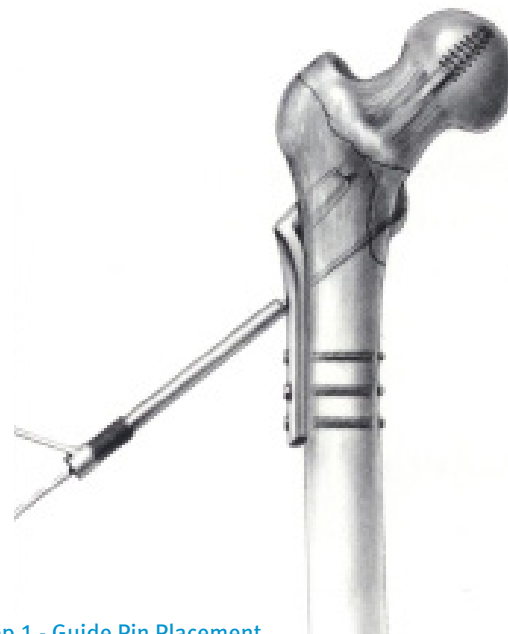
Step 4 – Tapping*(Optional)

The self-cutting threads of the *Magna-FX* Screw allow tapping to be optional. Place the Cannulated Tap over the guide pin and tap the proximal cortex. In young patients with hard bone, it may be necessary to tap the entire reamed length.

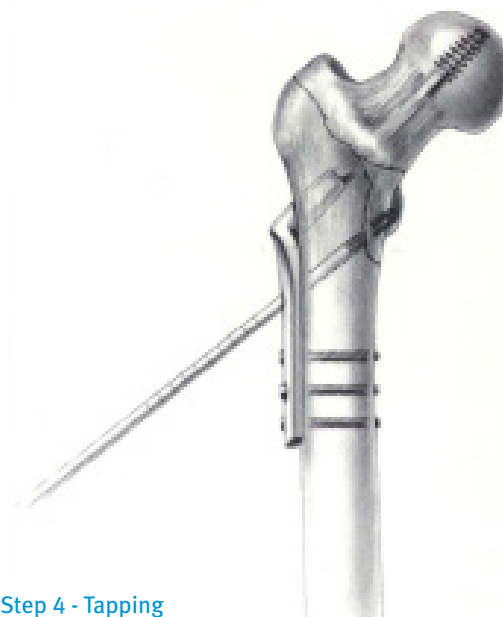
Step 5 – Screw Insertion*

- A. Using a power handpiece with the Cannulated Screwdriver Bit, insert the proper length *Magna-FX* Fixation Screw over the guide pin. When the screw head is one inch from the side plate, remove powered handpiece and screwdriver.
- B. Using the manual Cannulated Driver and T-handle, finish seating the screw and check fracture impaction with x-ray. Threads must not extend across the fracture site. Remove the guide pin.

*** PRECAUTION:** During placement of the guide pins, measuring, reaming, tapping, and screw insertion, check the guide wire position frequently using image intensifier control to prevent unintended guide wire advancement and/or penetration into the surrounding tissue.



Step 1 - Guide Pin Placement



Step 4 - Tapping



Step 2 - Measuring



Step 3 - Drilling



Step 5 - Screw Insertion



Final Implant Position

Surgical Technique for Supracondylar Fractures of the Femur

Introduction

Supracondylar femur fractures present a challenging problem in fracture management to the orthopaedic surgeon.

The use of a 95° or 90° compression screw and side plate has provided one acceptable method of rigid internal fixation of fractures. The 95° or 90° compression screw is indicated in the treatment of both intra-articular and extra-articular supracondylar femur fractures with vertical intra-articular extension through the intercondylar notch are ideal for this device as compression may be applied across the fracture site.

Patient Positioning and Radiographic Control

The patient is placed under a general or spinal anesthetic and then transferred to the operating table in the supine position. A bump may be placed under the ipsilateral hip. The affected leg is prepped and draped using sterile technique. The calf and foot are placed in a sterile stockinette. The contralateral lower extremity and perineum are excluded from the sterile field with a U-drape. The ipsilateral iliac crest should be included in the operative field, should a bone graft be required. The use of image intensification or other x-ray imaging is required. The image intensifier should be sterile-draped and may be positioned from either the contralateral or ipsilateral side of the operating table. A sterile bump may be placed under the ipsilateral thigh (Fig.1).

Fig. 1

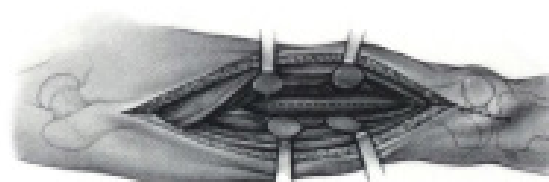
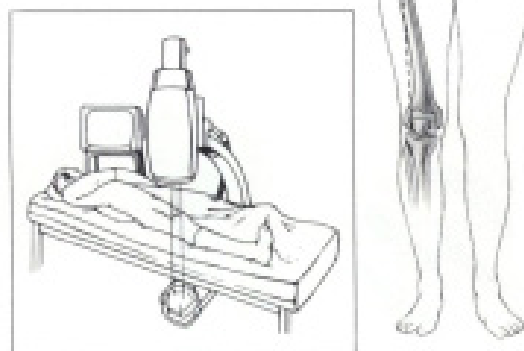


Fig. 2

Surgical Procedure

Incision, Exposure, and Fracture Reduction

The supracondylar fracture is exposed through an anterolateral approach (Fig. 2). A linear incision is made starting approximately 15cm proximal to the patella along a line that runs from the anterior-superior iliac spine to the lateral border of the patella. The incision is carried distally to the lateral border of the patella. The exact length of the incision is determined by the extent of the fracture. The interval between the vastus lateralis and the rectus femoris is opened to expose the vastus intermedius. The fibers of the vastus intermedius over the anterior aspect of the femur are incised longitudinally and dissection extended subperiosteally around the bone. The exposure may be carried distally by continuing the skin incision distally along the lateral border of the patella, ending 1 cm below the joint line of the knee. The lateral patellar retinaculum is incised 1 cm from the patella and the synovium is incised to expose intra-articular fractures (Fig. 3). An alternative approach is a lateral approach which goes posterior to the vastus lateralis. However, the anterolateral approach provides a better exposure of intra-articular fractures.

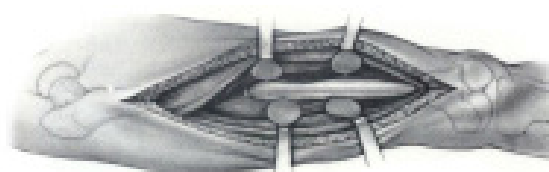


Fig. 3

The fracture is reduced under direct vision. Intra-articular fractures may be temporarily stabilized with cancellous interfragmentary screws or K-wires (Fig. 4 inset). Care must be taken to place these screws or K-wires anterior or posterior to the insertion site of the 95° supracondylar compression screw in the center of the anterior half of the femoral condyles.

The supracondylar portion of the fracture is inspected for comminution and the need for bone grafting is assessed. The fracture is reduced under direct vision and stabilized with bone clamps.

Guide Pin Placement

Next, attention is directed toward placement of the guide pin. The 95° template is placed along the lateral femoral condyle and used to establish the appropriate angle between the guide pin and the lateral femoral cortex. The guide pin should ideally pass through the center of the anterior half of the condyles without penetrating the intercondylar notch. The guide pin will pass approximately parallel to the knee joint; however, small angular deviations may be necessary to ensure that the side plate lies flush against the lateral femoral cortex. A guide pin may be temporarily placed along the anterior aspect of the distal femur running through the center of the femoral condyles and remaining superior to the notch. Image intensification is used to confirm the guide pin position (Fig. 4).

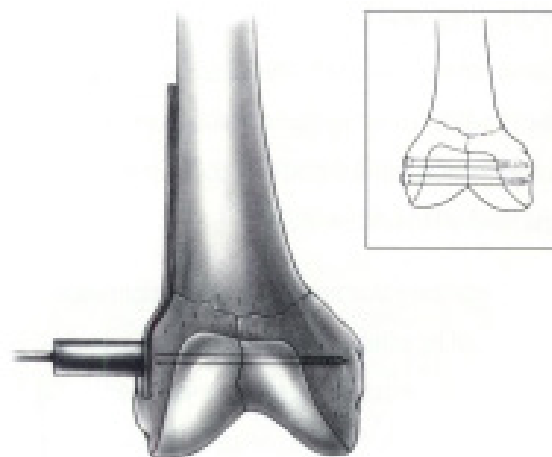


Fig. 4

The starting point on the lateral femoral condyle for the guide pin is marked. The guide pin is drilled into the condyles under image intensification guidance and advanced until it abuts the subchondral bone of the medial femoral condyle.

The guide pin placement for a 90° compression screw will be similar to that for 95° compression screw with the exception that the 90° template is used to establish the appropriate angle between the guide pin and lateral femoral cortex. In this case, the 90° template, when positioned flush against the lateral femur, will direct the guide pin at approximately 5° superior to the knee joint.

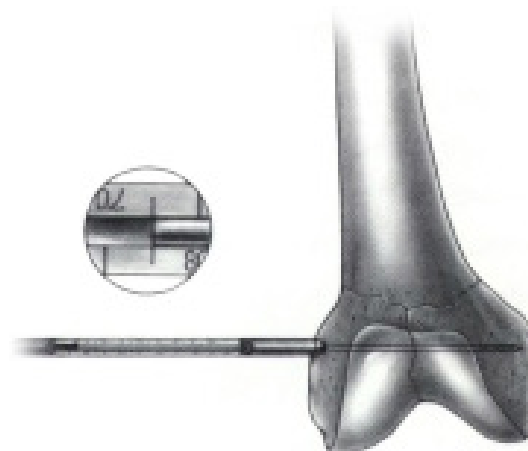


Fig. 5

Determining Guide Pin Depth and Reaming and Tapping the Lag Screw Channel

The Guide Pin Depth Gauge is used to measure the length of the pin within the bone. This measurement, called the “pilot length,” is used to determine the length of the lag screw and to set the depth of the Lag Screw Reamer. For young patients with healthy bone, the surgeon should ream to the pilot length to make lag screw insertion easier. In elderly patients with osteopenic bone, the surgeon should ream to a depth 10mm shorter than the pilot length to enhance screw purchase in the bone (Fig. 5).

The Lag Screw Reamer should be used with the Short Barrel Reamer Head only. This ensures that the reamer head does not cross the fracture site. The reamer is designed to countersink the lateral femoral cortex for optimal side plate placement, flush against the bone. Reaming should be performed under image intensification to prevent unintended guide pin advancement (Fig. 6).

After reaming the lag screw channel, the surgeon may wish to tap this channel using the Cannulated Bone Tap (1180-70) with Centering Collar. The tap is set by placing the front of the collar with the desired millimeter setting read at the front (Fig. 7). The 1199-05 Bone Tap and the 1199-14 Large Bone Tap are designed to measure from the tip of the tap to the rear of the locking assembly. Tapping is usually not needed with osteopenic bone.

Determining the Lag Screw Length

The lag screw length is determined from the “pilot length.” Because a short barrel will be used, the lag screw may need to be up to 10mm longer than the pilot length to ensure adequate overlap between the lag screw and tube/plate.

Insertion of the Implant

The appropriate length lag screw and selected tube/plate are placed over the guide pin and inserted into the lag screw channel using the Lag Screw Insertor (Fig. 8). After partial insertion of the lag screw, the tube/plate may be moved into position over the lag screw with the barrel resting in the lag screw channel. The T-handle of the inserter should be in the same plane as the shaft of the femur when the screw is completely inserted to the appropriate depth. At this point, there should be solid fixation of the condyles.

Keying the Implant

The implant should be keyed using the white (short) Locking Pin Cartridge. The semi-circular barrel keyway must be aligned with the corresponding semi-circular groove in the lag screw to form a complete circular opening of the locking pin (Fig. 9 inset). The Pin Insertor and the Short Locking Pin Cartridge are mated with the barrel keyway in the counterbore of the barrel. The Pin Insertor is pushed until the pin is felt to click into place in the barrel keyway. The rear of the pin should sit about 5mm inside the counterbore (Fig. 9).

Fig. 6

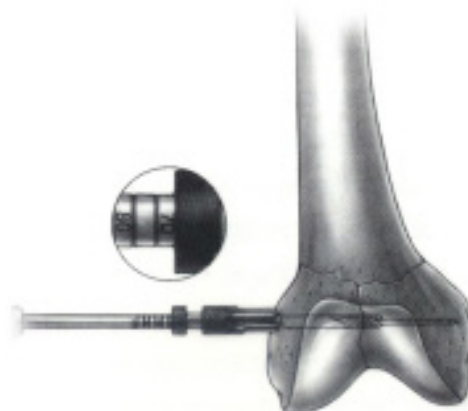


Fig. 7

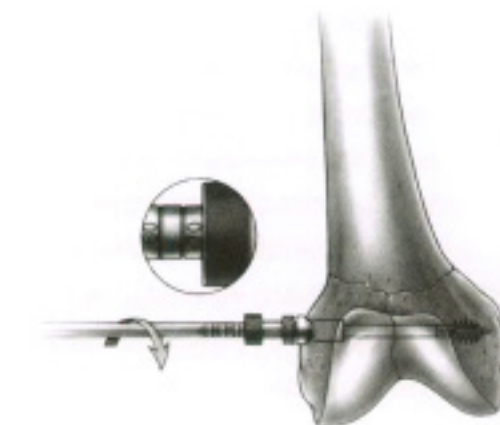


Fig. 8

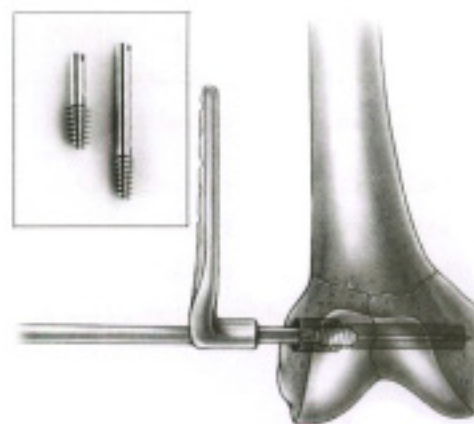
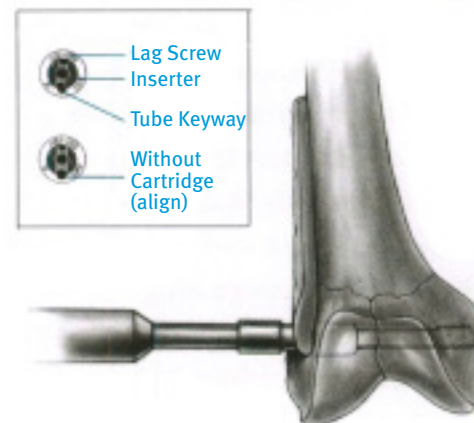


Fig. 9



Attaching the Side Plate

Reduction of the supracondylar portion of the fracture is reconfirmed. The side plate is now fixed to the lateral femoral cortex using 4.5mm bicortical bone screws in the proximal holes and 6.5mm cancellous or 7.0mm cannulated bone screws in the two distal holes. Each hole is sequentially drilled, measured, and tapped, and the appropriate length screw is inserted in a neutral position (Figs. 10 & 11).

Bone graft should now be placed at the fracture site if it is required.

Impaction (Optional)

If you elect to impact the fracture, use the Impactor. (If bone graft will be used at the fracture site, the graft should be inserted before impaction.)

Screw the Impactor Guide into the back of the lag screw. Slide the Impactor over the guide until the plastic nose fits flush onto the place. Carefully tap on the Impactor with a mallet while monitoring the degree of impaction.

Insertion of Compression Screw

A compression screw is placed in the end of the lag screw to achieve further impaction at the intercondylar fracture site, if needed (Fig. 12). After compression is achieved, the compression screw should be removed. Excessive force on the compression screw may cause stripping of the lag screw threads in osteopenic bone. In osteopenic patients, the surgeon may decide to use a lag screw with extra-wide threads in order to increase the purchase in the medial condyle. Image intensification is used to examine the fracture alignment and hardware position (Fig. 13).

Fig. 10



Fig. 11

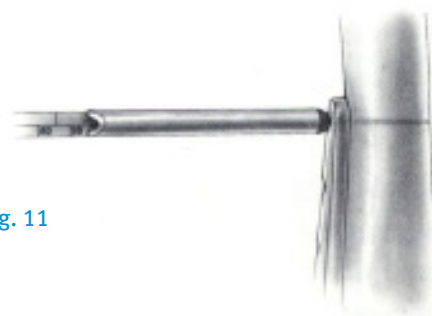


Fig. 12

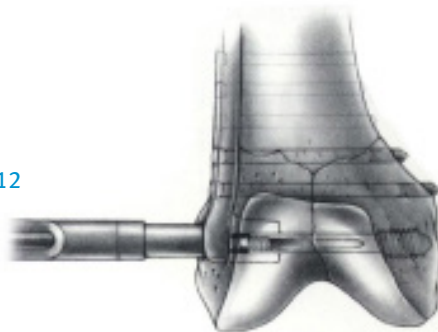
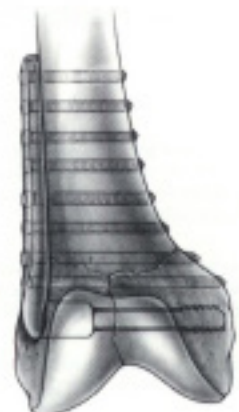


Fig. 13



Wound Closure

The wound is irrigated with antibiotic solution. Closed suction drains are placed in the wound and used for 48 hours postoperatively. The wound is closed with interrupted absorbable sutures in muscle, fascia, and subcutaneous tissues. Skin is closed with staples and a pressure dressing is applied.

Postoperative Care

The patient is given prophylactic antibiotics for 48 hours. Anti-embolism stockings and aspirin therapy are used, when possible, to help prevent thromboembolism. Continuous passive motion of the ipsilateral knee is initiated in the immediate postoperative period.

The patient is encouraged to sit in a chair on the first postoperative day. The patient is sent to physical therapy for ambulation training, non-weight bearing on the affected leg on the second postoperative day. Serial x-ray films should be taken to document healing (Fig. 14). Gradual increase in weight bearing may be allowed as healing progresses.

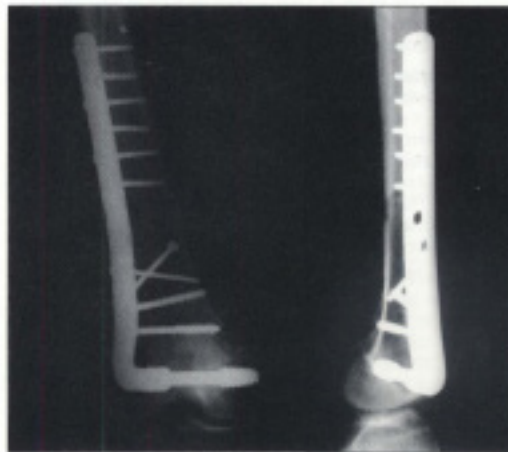


Fig. 14

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