Surgical Technique

smith&nephew

CHS

Compression Hip Screw

Intermediate and Pediatric Osteotomy Systems

Intermediate and Pediatric Osteotomy Systems

By: Stephen Stricker, M.D.
Chief of Pediatric Orthopedics
Department of Orthopedics & Rehabilitation
University of Miami School of Medicine
Miami, Florida

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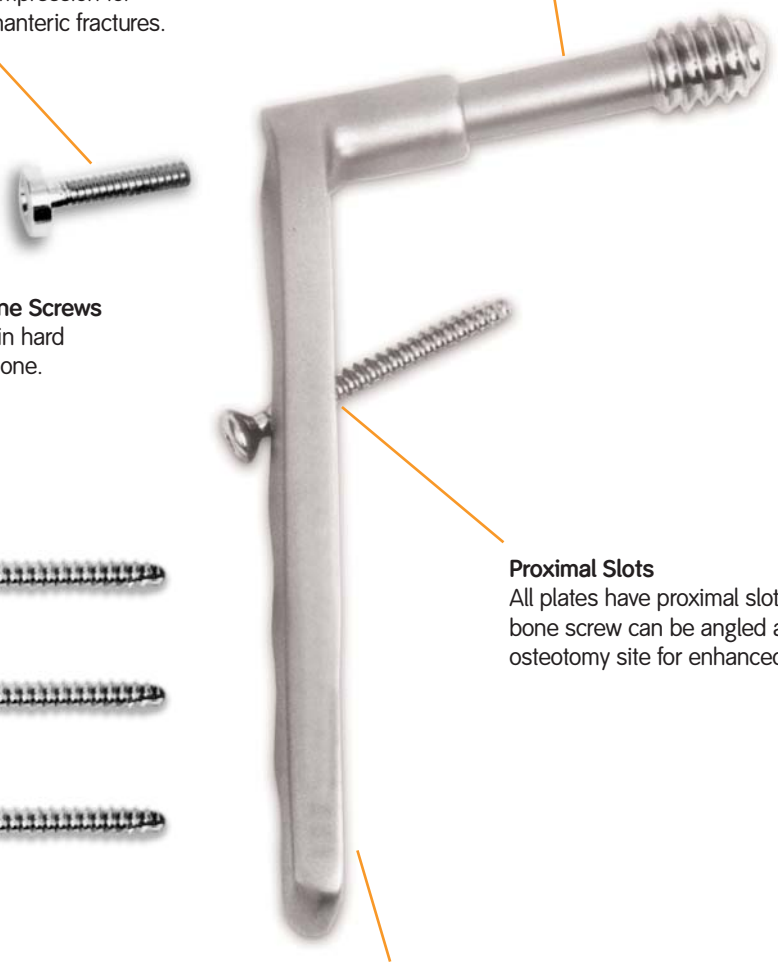
Nota Bene: The technique description herein is made available to the healthcare professional to illustrate the author's suggested treatment for the uncomplicated procedures. In the final analysis, the preferred treatment is that which addresses the needs of the specific patient.

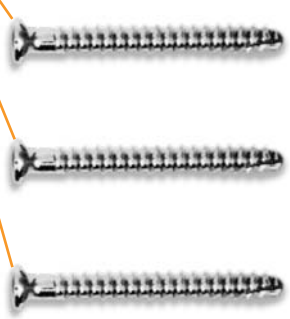
Design Features

Lag Screw
Achieve stable implant purchase in the proximal portion of the osteotomy.

Compression Screws
Maintain construct rigidity within the plate and lag screw and help gain compression for femoral neck and intertrochanteric fractures.



Self-Tapping, Cortical Bone Screws
Make it easier to advance in hard pediatric and adolescent bone.



Proximal Slots
All plates have proximal slots so that a bone screw can be angled across the osteotomy site for enhanced stability.

Plates
Stainless steel plates come in a variety of lengths and barrel angles.

Design Features

Intermediate

Lag Screws

Thirteen lag screws ranging from 35 mm to 95 mm in 5 mm increments.

Self-Tapping, Cortical Bone Screws

Twenty-four 3.5 mm bone screws, ranging in length from 14 mm to 40 mm in 2 mm increments, and from 45 mm to 90 mm in 5 mm increments.

Compression Screws

Hex head compressing screw.

Plates

Thirty-two plates in 55 mm, 76 mm, 102 mm, and 127 mm lengths, each with 4, 5, 6, or 8 holes (including 1 proximal slot), and angles ranging from 90° to 150°. The Intermediate plates all feature slots that allow compression of the osteotomy. The chart below details the compression possibilities for each size plate.

PLATE LENGTH	COMPRESSION SLOTS		SHAFT COMPRESSION
	NUMBER	LOCATION	
55 mm	1 Large	1st Distal Slot	6.5 mm
76 mm	1 Large	1st Distal Slot	6.5 mm
	2 Small	2nd & 3rd Slots	2.5 mm
102 mm	1 Large	1st Distal Slot	6.5 mm
	2 Small	2nd & 3rd Slots	2.5 mm
127 mm	1 Large	1st Distal Slot	6.5 mm
	2 Small	2nd & 3rd Slots	2.5 mm

*Note: Compression is not cumulative. Only one of multiple slots can be used for compression, depending on the amount of compression desired.

Design Features

Pediatric

Lag Screws
Seven lag screws, ranging from 22 mm to 40 mm in 3 mm increments.

Compression Screws
Slotted head compression screw.

Self-Tapping, Cortical Bone Screws
Sixteen 2.7 mm bone screws range in length from 10 mm to 40 mm in 2 mm increments.

Plates
Six different plates, 53 mm long, each with 4 holes (including 1 proximal slot), and angles ranging from 90° to 140° in 10° increments.

Indications and Preoperative Planning

Intermediate Indications

The Intermediate Osteotomy Hip Screw is useful for proximal femoral osteotomies in children from ages 4 to 13. (Of course, choosing the proper size device is not age-dependent alone – some children are ready for the adult devices at age 13.)

The Intermediate Osteotomy Hip Screw is most commonly used in proximal femoral varus, valgus, shortening, or rotational osteotomies. Examples include developmental hip dysplasia, neurogenic hip dysplasia, Legg-Calve-Perthes disease, or excessive femoral anteversion.

Pediatric Indications

The Pediatric Osteotomy Hip Screw's primary indications are for varus or valgus derotation ostetomies of the hip to improve hip stability or to correct proximal femoral deformity. The system may be used for developmental hip dysplasia (usually in conjunction with an open reduction and capsulorrhaphy) when varus and derotation and/or shortening osteotomies are indicated.

Proximal femoral osteotomies in neurogenic hip subluxation (e.g., myelomeningocele, cerebral palsy, or paralytic disease) may also be treated with the system. Although basic cervical fractures of the hip are rare in infants and young children, they can also be treated with a Pediatric or Intermediate Osteotomy Hip Screw.

Note: This technique is written for the intermediate system. Both systems feature similar instrumentation, the primary difference being that of size. The steps are the same for pediatric osteotomies and proximal femoral fractures unless otherwise noted by a green subhead.

Surgical Technique

Preoperative Planning of the Osteotomy

Careful preoperative planning is required. The amount of varus or valgus derotation should be carefully determined and the correction planned, using preoperative studies that include standard radiographs, CT, and/or MRL Cutouts of the correction traced from standard X-rays are particularly useful. The cutouts also allow preoperative determination of the extent of geometry of wedge or shortening osteotomies.

This surgical technique will describe a varus osteotomy which will result in a varus correction of 20°.

Surgical Technique

Positioning the Patient

Place the patient on a radiolucent table in the supine position with the limbs draped free. Place a radiolucent pad under the patient's sacrum, proportionate to the patient's size. It is frequently expedient to drape both limbs, even in a unilateral procedure. Clinical exam during the procedure can provide the surgeon with information on the rotation and length of the unoperated limb, thus ensuring symmetry as well as hip stability.

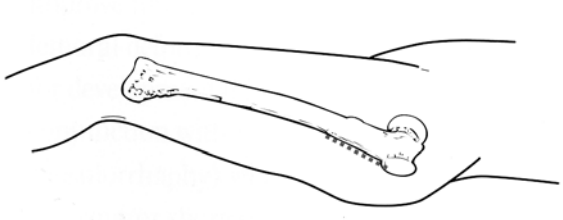


Figure 1

Making the Incision

Make a lateral thigh incision from the greater trochanter distally, parallel to the femur (Figure 1). The incision and exposure should be long enough to allow easy application of the sideplate. Carry the incision to the fascia lata, which is incised longitudinally. Retract the vastus lateralis anteriorly to prevent denervation of the muscle.

Inserting the Guide Pin

Once the lateral portion of the trochanter and the proximal lateral femur have been exposed, place a guide pin outside the capsule, anterior to the neck. Using the image, determine the direction of the neck.

Set the Adjustable Angle Guide to 120°, the hip's current angle, and position it against the lateral cortex. Attach the guide to the shaft with the Plate Clamp. Insert the guide pin through the cannulated portion of the Adjustable Angle Guide and into the femoral neck (Figure 2).

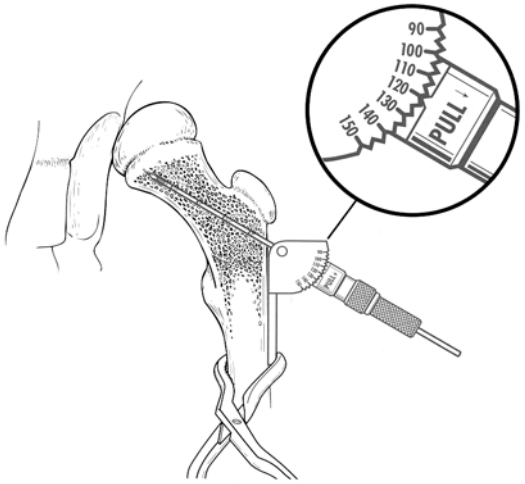


Figure 2

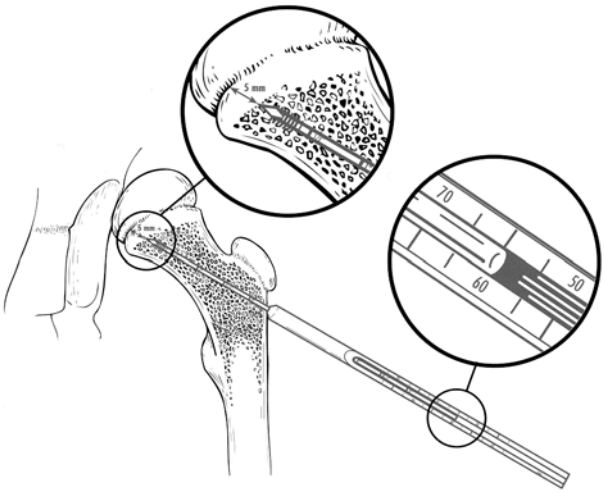


Figure 3

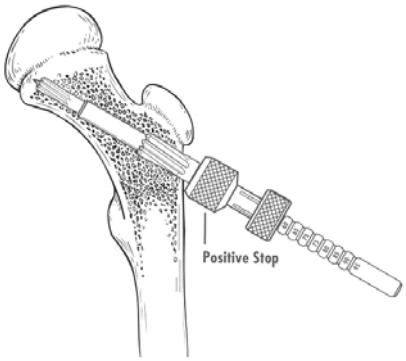


Figure 4

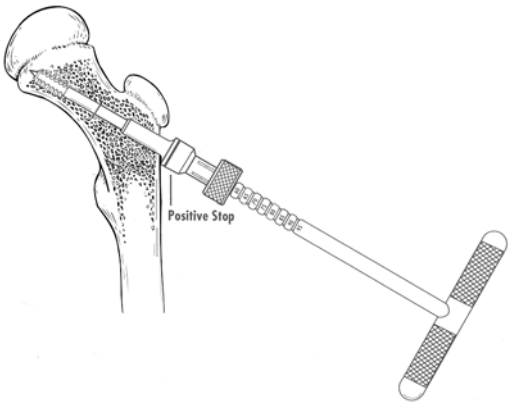


Figure 5

Predrilling the lateral cortex with the Twist Drill can aid in placing the guide pin. Take care to ensure that the guide pin is placed in the center of the femoral neck within 5 mm of the proximal femoral physis without violating it or the trochanteric apophysis (Figure 3). Verify guide pin placement in the A-P and lateral views on the image.

Determining Lag Screw Length

Once the guide pin is placed within 5 mm of the physis, use the Percutaneous Direct Measuring Gauge to determine the lag screw length (Figure 3).

Reaming and Tapping the Femur

Set the adjustable positive stop on the Combination Reamer to the lag screw length determined by the Percutaneous Direct Measuring Gauge. Place the reamer over the guide pin and ream until the positive stop reaches the lateral cortex (Figure 4). Take care not to violate the growth plate. It is also prudent to periodically check the fluoroscopic image during reaming to ensure that the guide pin is not inadvertently advancing into the femoral epiphysis.

Next, set the adjustable positive stop on the Lag Screw Tap to the same length that was reamed. Tap until the positive stop reaches the lateral cortex (Figure 5).

Reaming and Tapping the Femur (For the Pediatric System Only)

Place the Barrel Reamer over the guide pin, reaming until the positive stop reaches the lateral cortex (Figure 6). Remove the Barrel Reamer and place the Calibrated Lag Screw Reamer over the guide pin and ream until the appropriate lag screw length calibration meets the lateral cortex (Figure 7). Take care not to violate the growth plate. It is also prudent to periodically check the fluoroscopic image during reaming to ensure that the guide pin is not inadvertently advancing into the femoral epiphysis.

Next, place the Lag Screw Tap over the guide pin and tap until the appropriate lag screw length calibration reaches the lateral cortex (Figure 8).

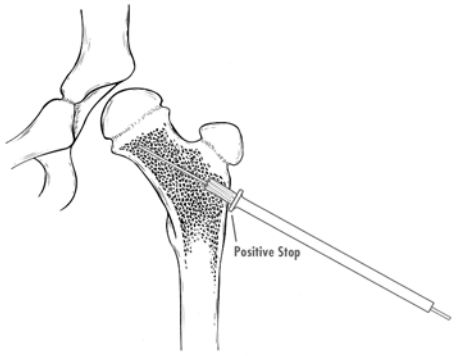


Figure 6

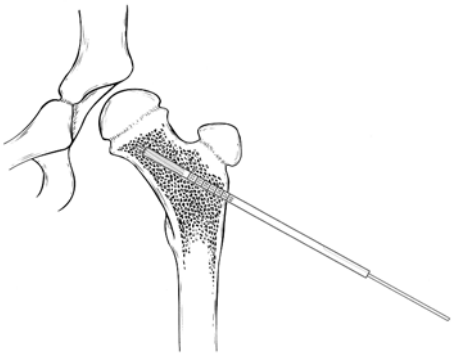


Figure 7

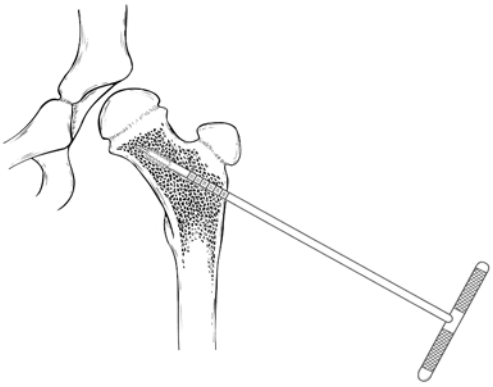


Figure 8

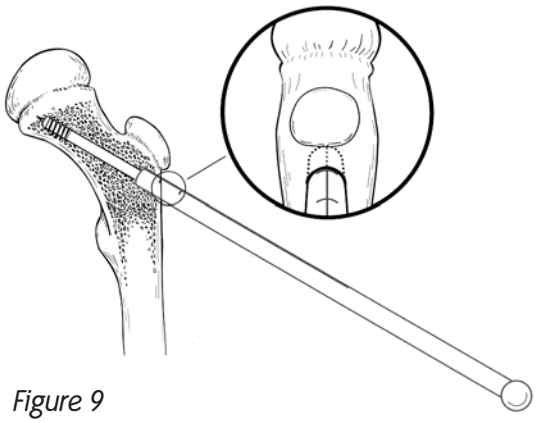


Figure 9

Figure 10

Inserting the Lag Screw for Osteotomies

Insert the selected lag screw into the distal end of the Insertion/Removal Wrench. Place it over the guide pin and into the reamed/tapped hole.

The lag screw is at the proper depth when: The Insertion/Removal Wrench's first depth marking is flush with the lateral cortex (Figure 9 Inset).

The handle of the Insertion/Removal Wrench is perpendicular to the shaft of the femur, with the longitudinal key line facing proximally.

This positioning will ensure that the plate barrel and lag screw shaft are properly keyed for rotational stability (Figure 9). Remove the guide pin once the lag screw is at the appropriate length.

Performing the Osteotomy

With the lag screw in place, perform the osteotomy (20° transverse osteotomy is illustrated). Make the cut as proximal as possible, just below the lag screw entry point, because the proximal metaphyseal bone usually heals better than the cortical subtrochanteric bone (Figure 10). In addition, the correction of proximal femoral deformity is best accomplished close to the deformity, i.e., as close to the femoral head as possible.

Note: Turn to page 16 for lag screw insertion instructions for proximal femoral fracture cases.

Insert the Barrel Guide into the back of the implanted lag screw to help position the proximal femur. The desired correction can be accomplished by tilting the head into valgus or, in this case, varus (Figure11), removing wedges to customize the fit if needed (Figures 12 & 13). Iliopsoas tenotomy or recession may also facilitate positioning of the osteotomy.

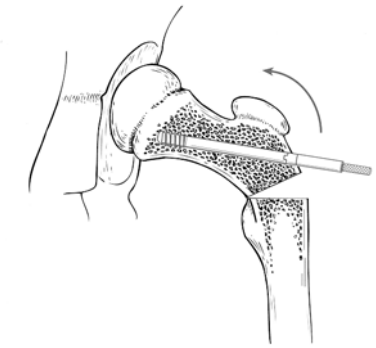


Figure 11

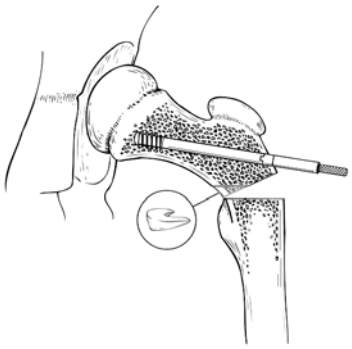


Figure 12

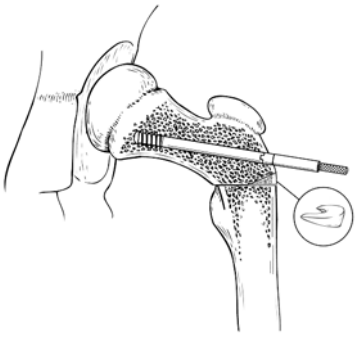


Figure 13

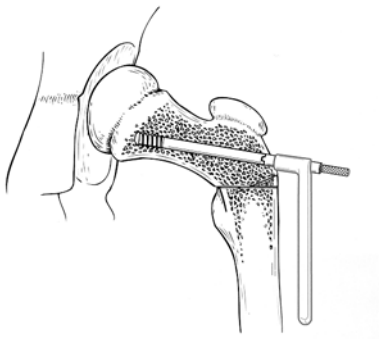


Figure 14

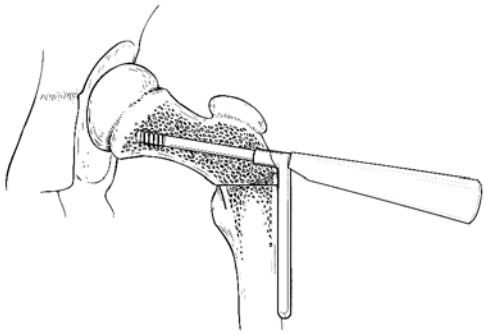


Figure 15

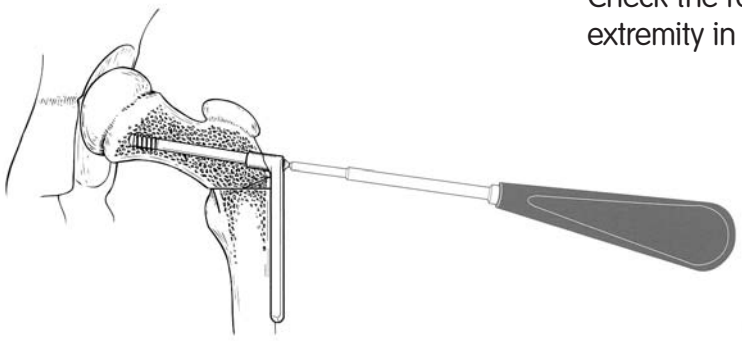


Figure 16

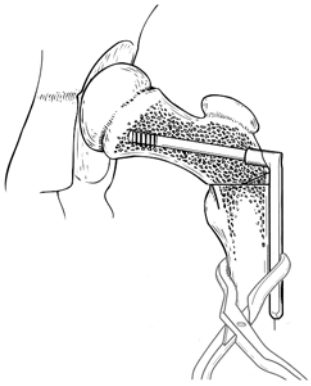


Figure 17

Applying the Plate and Compression Screw

Take the plate chosen during preoperative planning (100° x 76 mm x 4 hole in this case) and insert its barrel over the Barrel Guide and onto the back of the lag screw (Figure 14). If necessary, insert the Cannulated Plate Tamper over the Barrel Guide and tap it several times in order to fully seat the plate (Figure 15).

Remove the Barrel Guide and insert a compression screw to prevent the plate from disengaging during the reduction maneuver. Use the Slotted Screwdriver for the Pediatric compression screw or the Hex Screwdriver for the Intermediate compression screw (Figure 16).

Reduce the osteotomy and secure the plate to the femur using the Plate Clamp (Figure 17). Check the rotational position of the lower extremity in extension.

Inserting the Bone Screws for Plate Fixation and Compression of the Osteotomy

A range of 2.5 to 6.5 mm of femoral shaft compression is possible with the use of Intermediate Osteotomy Hip Screw. To achieve up to 6.5 mm of compression, insert the drill guide end of the Intermediate Combination Drill/Tap Guide into the distal portion of the most distal compression slot. Drill through to the medial cortex using the Twist Drill (Figure 18).

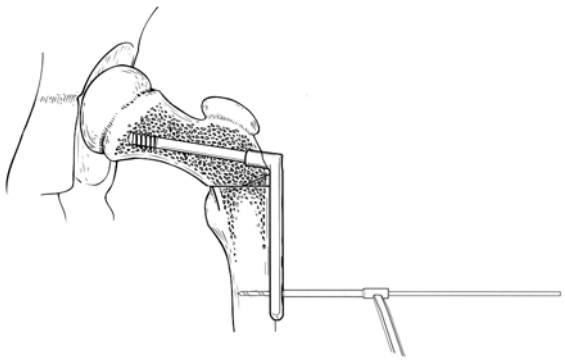


Figure 18

If less compression is required, follow the same steps detailed above in the distal portion of either the 2nd or 3rd distal slots for up to 2.5 mm of compression. If no compression is needed, follow the same steps listed above, except begin by placing the Intermediate Combination Drill/Tap Guide in the proximal portion of the slot instead of the distal portion used for compression.

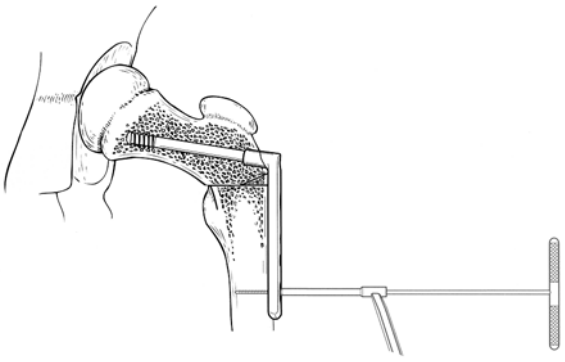


Figure 19

Next, insert the tap guide end of the Intermediate Combination Drill/Tap Guide into the slot and insert the Bone Screw Tap (Figure 19).

Insert the Depth Gauge through the slot and into the drilled/tapped hole. Make sure that the nose of the guide is fully inserted into the plate's slot. Insert the needle of the Depth Gauge and hook it on the medial cortex. Read the bone screw length measurement directly off of the Depth Gauge (Figure 20).

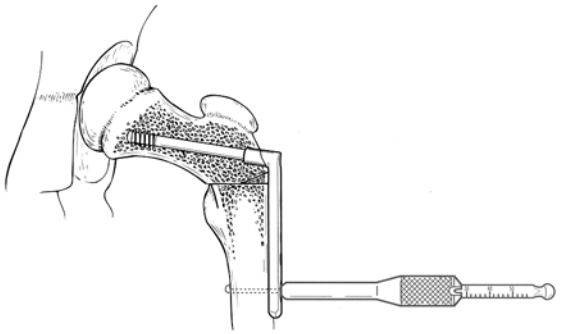


Figure 20

NOTE: The Plate Clamp is not shown in the remaining illustrations for clarity

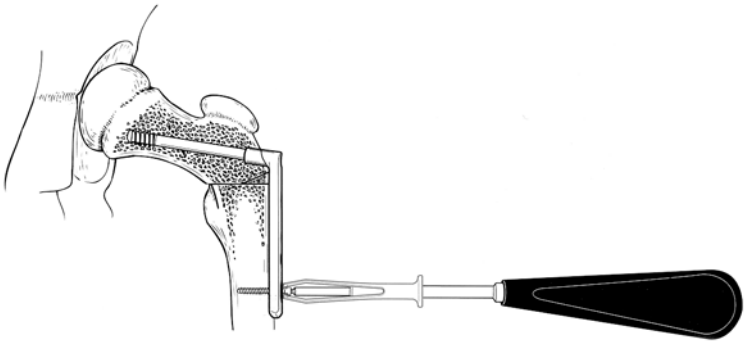


Figure 21

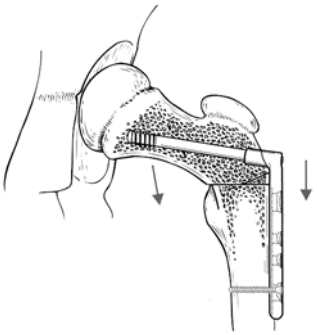


Figure 22

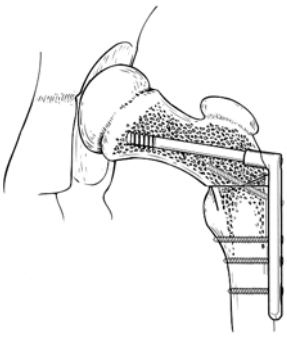


Figure 23

Select the appropriate length bone screw and insert it using the Hex Screwdriver. Use the Self-Holding Sleeve to keep the screw from disengaging from the screwdriver (Figure 21).

In cases where compression is being applied, the bone screw abuts the inclined distal aspect of the slot as it is being seated, forcing the plate and the attached proximal fragment slightly distally until resisted by compression of the osteotomy (Figure 22). Follow the same steps for the remaining two slots.

Finally, in the most proximal slot, the Intermediate Combination Drill/Tap Guide can be angled proximally so that the drill and, ultimately, the bone screw will cross the osteotomy line. Positioning the proximal bone screw in this way can provide additional stability at the osteotomy site (Figure 23).

Inserting the Bone Screws for Plate Fixation (Pediatric System Only)

Notes:
Reference illustrations are shown on Intermediate bone models.
Pediatric plates do not have compression slots due to their size.

Insert the drill guide end of the Pediatric Combination Drill/Tap Guide into the distal hole. The guide can be angled in the transverse plane so that the drill emerges through the medial cortex. Drill using the Twist Drill (See Figure 18 on page 12).

Next, insert the tap guide end of the Pediatric Combination Drill/Tap Guide into the hole and insert the Bone Screw Tap (See Figure 19 on page 12).

Insert the Depth Gauge through the plate's hole and make sure that the nose of the guide is fully inserted. Insert the needle of the Depth Gauge and hook it on the medial cortex. Read the bone screw length measurement directly off of the Depth Gauge (See Figure 20 on page 12).

Select the appropriate length bone screw and insert it using the Hex Screwdriver. A Self-Holding Sleeve is available for use with the Hex Screwdriver (See Figure 21 on page 13). Follow the same steps for the remaining two holes.

In the most proximal hole, the Pediatric Combination Drill Tap Guide can be angled proximally so that the drill and, ultimately, the bone screw will cross the osteotomy line. Positioning the proximal bone screw in this way can provide additional stability at the osteotomy site (See Figure 23 on page 13).

Closure

Close the wound. At your discretion, drains may be employed. Apply a hip spica cast, and do not permit weight-bearing until healing is adequate.

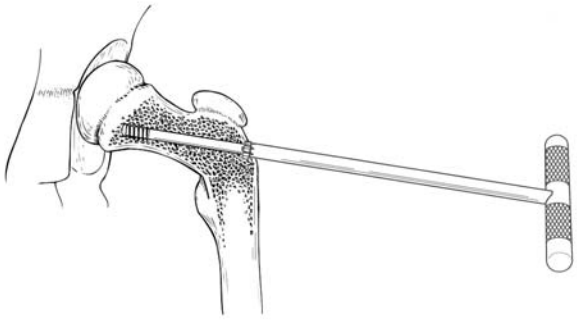


Figure 24

Removal of the Smith + Nephew Osteotomy Hip Screw

Open the original incision in the same manner as before. Divide and retract the muscles. Remove the compression screw. Remove the bone screws and lift the plate off of the lag screw. Use the Lag Screw Trephine to remove any restrictive tissue from around the lag screw (Figure 24).

Then, place the Insertion/Removal Wrench over the back of the lag screw. Insert the Lag Screw Retaining Rod through the wrench and thread it into the distal portion of the lag screw. This will allow you to pull outward while turning the Insertion/Removal Wrench counterclockwise (Figure 25).

Close the wound.

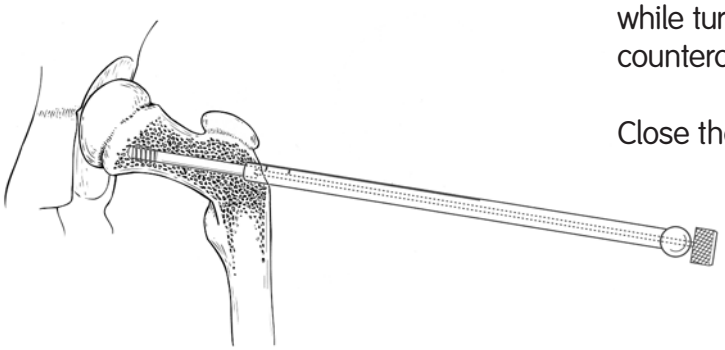


Figure 25

Inserting the Lag Screw for Proximal Femoral Fractures

In a case where the system is being used to treat a basic cervical or intertrochanteric fracture, the lag screw can be inserted further to afford compression later in the procedure. However, the lag screw must not violate the physis.

To insert the lag screw for approximately 5 mm of compression, stop when the lateral cortex is midway between the two depth calibrations (Figure 26).

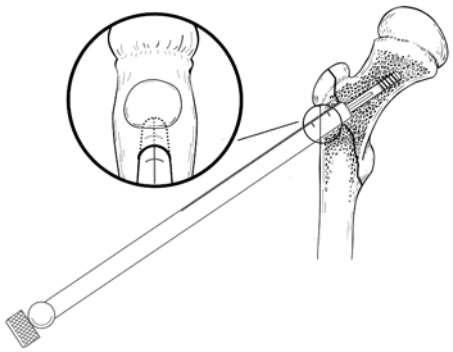


Figure 26

To insert the lag screw for approximately 10 mm of compression, stop when the second depth calibration meets the lateral cortex (Figure 27).

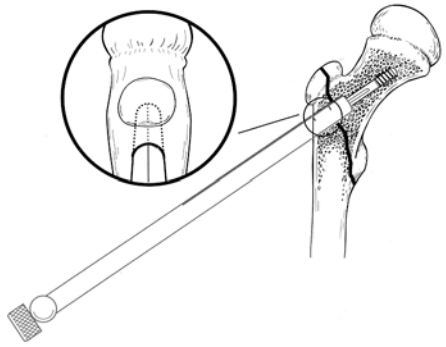


Figure 27

Intermediate Implants

Barrel Length 20 mm

Plates (3 holes) 55 mm

Cat. No.	Angles
7112-3122	90°
7112-3124	100°
7112-3126	110°
7112-3128	120°
7112-3130	130°
7112-3132	130°
7112-3122	90°
7112-3134	140°
7112-3136	145°
7112-3138	150°

Plates (4 holes) 76 mm

Cat. No.	Angles
7112-3140	90°
7112-3142	100°
7112-3144	110°
7112-3146	120°
7112-3148	130°
7112-3150	135°
7112-3152	140°
7112-3154	145°
7112-3156	150°

Plates (6 holes) 102 mm

Cat. No.	Angles
7112-3158	90°
7112-3160	100°
7112-3162	110°
7112-3164	120°
7112-3166	130°
7112-3168	135°
7112-3170	140°
7112-3172	145°
7112-3174	150°

Plates (8 holes) 127 mm

Cat. No.	Angles
7112-3176	130°
7112-3178	135°
7112-3180	140°
7112-3182	145°
7112-3184	150°

Intermediate Implants

Lag Screws

Major Thread Dia. 9.5 mm
Minor Core Dia. 6.5 mm
Thread Length 12.7 mm

Cat. No.	Length
7112-3186	35 mm
7112-3187	40 mm
7112-3187	45 mm
7112-3189	50 mm
7112-3190	55 mm
7112-3191	60 mm
7112-3192	65 mm
7112-3193	70 mm
7112-3194	75 mm
7112-3195	80 mm
7112-3196	85 mm
7112-3197	90 mm
7112-3198	95 mm

Compression Screw, Hex Head (2.5 mm)

Cat. No. 7112-3199

3.5 mm Cortical Bone Screw Self-Tapping, Hex Head (2.5mm)

(1 per package)

Cat. No.	Length
7114-9514	14 mm
7114-9516	16 mm
7114-9518	18 mm
7114-9520	20 mm
7114-9522	22 mm
7114-9524	24 mm
7114-9526	26 mm
7114-9528	28 mm
7114-9530	30 mm
7114-9532	32 mm
7114-9534	34 mm
7114-9536	36 mm
7114-9538	38 mm
7114-9540	40 mm
7114-9545	45 mm
7114-9550	50 mm
7114-9555	55 mm
7114-9560	60 mm
7114-9565	65 mm
7114-9570	70 mm
7114-9575	75 mm
7114-9580	80 mm
7114-9585	85 mm
7114-9590	90 mm

Guide Pins: 2.4 mm x 152 mm Tip Threaded

Cat. No.	Description
7112-3200	Sterile, Single
12-8196	Nonsterile, 6 per package

Barrel Guide

Cat. No. 7113-4052

Combination Reamer

Cat. No. 7113-4054

Lag Screw Tap

Cat. No. 7113-4056

Lag Screw Insertion/Removal Wrench

Cat. No. 7113-4058

Lag Screw Retaining Rod

Cat. No. 7113-4060

Lag Screw Trephine

Cat. No. 7113-4062
O.D. 9.5 mm
I.D. 6.4 mm

Depth Gauge

Cat. No. 41-3501

2.7 mm Twist Drill

Cat. No. 7113-4064

Intermediate Instrumentation

Plate Clamp
Cat. No. 21-0204

2.5 mm Ped./Int. Hex Screwdriver
Cat. No. 7113-4022

Self-Holding Sleeve
Cat. No. 7113-4024

Combination Drill/Tap Guide
Cat. No. 7113-4066

Ped./Int. Adjustable Angle Guide
Cat. No. 7113-4028

3.5 mm Bone Screw Tap
Cat. No. 7113-4068

Ped./Int. Cannulated Plate Tamper
Cat. No. 7113-4032

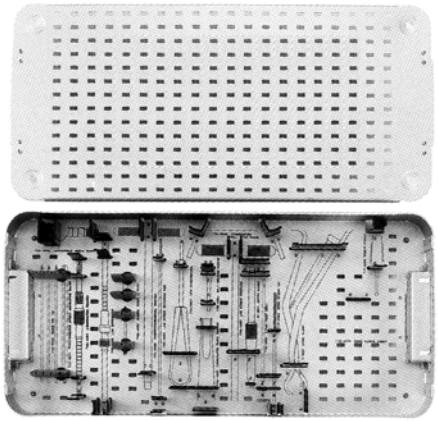
Percutaneous Direct Measuring Gauge
Cat. No. 7113-4070

Bone Screw Caddy
Cat. No. 7113-4076

Intermediate Instruments

Screw Pickup

Cat. No. 7111-5085



Sterilization Tray

Cat. No. 7113-4050

Intermediate Instrument Set

Cat. No. 7113-4072 (Not Shown)

Set includes one each of the following:

Cat. No.	Description
7113-4050	Sterilization Tray
7113-4052	Barrel Guide
7113-4054	Combination Reamer
7113-4056	Lag Screw Tap
7113-4058	Insertion/Removal Wrench
7113-4060	Lag Screw Retaining Rod
7113-4062	Lag Screw Trephine
41-3501	Depth Gauge
7113-4064	Twist Drill
21-0204	Plate Clamp
7113-4022	Ped./Int. Hex Screwdriver
7113-4024	Self Holding Sleeve
7113-4066	Combination Drill/Tap Guide
7113-4028	Ped./Int. Adjustable Angle Guide
7113-4068	Bone Screw Tap
7113-4032	Ped./Int. Cannulated Plate Tamper
7113-4070	Percutaneous Direct Measuring Gauge

Pediatric implants

Plates (4 holes) 50 mm Length

Cat. No.	Angles
7112-3242	90°
7112-3244	100°
7112-3246	110°
7112-3248	120°
7112-3250	130°
7112-3252	140°

Lag Screw

Major Thread Dia. 6.35 mm
Minor Core Dia. 4.0 mm
Thread Length 9.5 mm

Cat. No.	Lengths
7112-3254	22 mm
7112-3256	25 mm
7112-3258	28 mm
7112-3260	31 mm
7112-3262	34 mm
7112-3264	37 mm
7112-3266	40 mm

Compression Screw (Slotted Head)

Cat. No. 12-5195

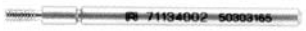
2.7 mm Hex Head Bone Screws Self-Tapping, Hex Head (2.5 mm)

(1 per package)

Cat. No.	Lengths
7114-9410	10 mm
7114-9412	12 mm
7114-9414	14 mm
7114-9416	16 mm
7114-9418	18 mm
7114-9420	20 mm
7114-9422	22 mm
7114-9424	24 mm
7114-9426	26 mm
7114-9428	28 mm
7114-9430	30 mm
7114-9432	32 mm
7114-9434	34 mm
7114-9436	36 mm
7114-9438	38 mm
7114-9440	40 mm

Pediatric Instrumentation
Guide Pins: 1.6 mm x 152 mm Guide Pins

Cat. No.	Description
7112-3268	Sterile, Single
12-8197	Nonsterile, 6 per package



Barrel Guide

Cat. No. 7113-4002

Calibrated Lag Screw Reamer

Cat. No. 7113-4004

Barrel Reamer

Cat. No. 7113-4006

Lag Screw Tap

Cat. No. 7113-4008

Lag Screw Insertion/Removal Wrench

Cat. No. 7113-4010

Lag Screw Retaining Rod

Cat. No. 7113-4012

Lag Screw Trephine

Cat. No. 7113-4014
O.D. 6.3 mm
I.D. 3.9 mm

Depth Gauge

Cat. No. 41-3501

Pediatric Instrumentation

2.0 mm Twist Drill

Cat. No. 7113-4016

Plate Clamp

Cat. No. 11-0960

Slotted Screwdriver

Cat. No. 7113-4020

2.5 mm Ped./Int. Hex Screwdriver

Cat. No. 7113-4022

Self-Holding Sleeve

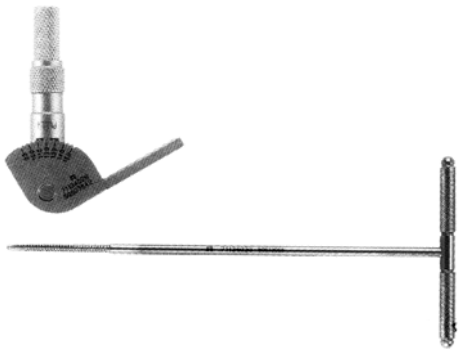
Cat. No. 7113-4024

Combination Drill/Tap Guide

Cat. No. 7113-4026

Ped./Int. Adjustable Angle Guide

Cat. No. 7113-4028



2.7 mm Bone Screw Tap

Cat. No. 7113-4030

Ped./Int. Cannulated Plate Tamper

Cat. No. 7113-4032

Percutaneous Direct Measuring Gauge

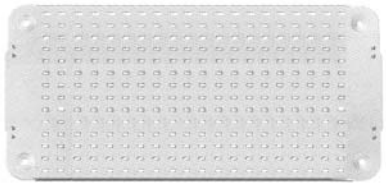
Cat. No. 7113-4034

Bone Screw Caddy

Cat. No. 7113-4040

Screw Pickup

Cat. No. 7111-5085



Sterilization Tray

Cat. No. 7113-4000

Pediatric Osteotomy Instrument Set

Cat. No.7113-4036 (Not Shown)
Set includes one each of the following:

Cat. No.	Description
7113-4000	Sterilization Tray
7113-4002	Barrel Guide
7113-4004	Calibrated Lag Screw Reamer
7113-4006	Barrel Reamer
7113-4008	Lag Screw Tap
7113-4010	Insertion Removal Wrench
7113-4012	Lag Screw Retaining Rod
7113-4014	Lag Screw Trephine
41-3501	Depth Gauge
7113-4016	Twist Drill
11-0960	Plate Clamp
7113-4020	Slotted Screwdriver
7113-4022	Ped./Int. Hex Screwdriver
7113-4024	Self Holding Sleeve
7113-4026	Combination Drill/Tap Guide
7113-4028	Ped./Int. Adjustable Angle Guide
7113-4030	Bone Screw Tap
7113-4032	Ped./Int. Cannulated Plate Tamper
7113-4034	Percutaneous Direct Measuring Gauge

Notes

Notes

Orthopaedics
Smith & Nephew, Inc.
1450 Brooks Road
Memphis, TN 38116
USA

Telephone: 901-396-2121
Information: 1-800-821-5700
Orders/Inquiries: 1-800-238-7538

www.smith-nephew.com

The following statement is required by the U.S. FDA:

WARNING: This device is not approved for screw attachment or screw fixation to the posterior elements (pedicles) of the cervical, thoracic, or lumbar spine.

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