



REFLECTION[◇]
Acetabular System

SYNERGY[◇]
Cementless Stem

Surgical Technique

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By combining the proven performance of Smith & Nephew products with cost efficiencies that align surgeons and administrators, Syncera is uniquely designed for patients, facilities, surgeons, and systems who want to leverage a value-driven approach to the acquisition and ongoing management of knee and hip implants.

The following technique guide was prepared under the guidance of Contributing Clinicians under close collaboration with each physician. It contains a summary of medical techniques and opinions based upon their training and expertise in the field, along with their knowledge of Smith & Nephew products. It is provided for educational and informational purposes only. Smith & Nephew does not provide medical advice and it is not intended to serve as such. It is the responsibility of the treating physician to determine and utilize the appropriate products and techniques according to their own clinical judgment for each of their patients. For more information on the products in this surgical technique, including indications for use, contraindications, effects, precautions and warnings, please consult the products' Instructions for Use (IFU).

Indications:

Hip components are indicated for individuals undergoing primary and revision surgery where other treatments or devices have failed in rehabilitating hips damaged as a result of trauma or noninflammatory degenerative joint disease (IDJD) or any of its composite diagnoses of osteoarthritis, avascular necrosis, traumatic arthritis, slipped capital epiphysis, fused hip, fracture of the pelvis, and diastrophic variant.

Hip components are also indicated for inflammatory degenerative joint disease Including rheumatoid arthritis, arthritis secondary to a variety of diseases and anomalies, and congenital dysplasia; treatments of nonunion, femoral neck fracture, and trochanteric fractures of the proximal femur with head involvement that are unmanageable using other techniques; endoprosthesis, femoral osteotomy, or Girdlestone resection; fracture-dislocation of the hip; and correction of deformity.

Total hip systems may be indicated for use (i) with bone cement (ii) without bone cement. or (jjj) for use with or without bone cement. Refer to the product labeling and literature for specific applications.

PREOPERATIVE PLANNING

Reflection[◇] acetabular component Synergy[◇] femoral stem

The goal of preoperative planning is to determine the correct stem and acetabular shell size, level of the femoral neck cut, proper head/stem offset combination, and proper acetabular shell location.

REFLECTION Porous-coated

120% Magnification
Shown with standard and +4mm lateralized liner head centers.

Shown with standard liner head centers.

Instrument Tip: *The templates have holes that allow you to mark the center of the standard liner*

120% Magnification Preoperative X-rays should include an AP of the pelvis centered over the hips and a lateral of the affected hip.

Templating can be done on the affected side, but it is important that the contralateral hip also be templated to verify the size.

To ensure a congruent fit, the acetabular component should sit against the subchondral bone and the medial aspect of the acetabulum, as indicated by the teardrop.

The center of rotation also should be marked for subsequent reference.

If the opposite hip is unaffected by disease, it can often provide accurate sizing information for the femoral stem. SYNERGY stems gain immediate, rigid fixation through 3-point contact with the femur.

As can be seen in Figure 1, the stem has direct contact with hard cortical bone at 3 points: proximally at the posterior aspect of the femur, anteriorly in the midsection of the stem, and posteriorly above the polished distal tip of the stem.



Figure 1 Postoperative lateral radiograph of a porous-coated SYNERGY stem showing 3-point fixation

To determine if a patient has a leg length discrepancy, the anteroposterior radiograph should be used. Draw a line tangential to both of the ischia or both of the obturator foramens. This line should extend out until it contacts the medial cortex of bone on both femurs. If the patient's legs are of equal length, the line that has been drawn will contact both femurs at the same level. If the patient's legs are of unequal length, the lines will contact the femurs at different levels along the femur. Select a reference point along the femur, such as the bottom of the lesser trochanter. The distance between the line that has been drawn and the reference point on both femurs is measured. The difference in these measurements indicates the patient's leg length discrepancy. This technique is shown in Figure 2.



Figure 2 Anteroposterior radiograph demonstrating leg length inequality

Note: Using this method of templating for leg length discrepancy assumes the patient has a normal, symmetrical pelvis and has neutral limb positioning.

Intraoperatively, leg length restoration can be verified by measuring the distance between a pin in the iliac wing and a mark on the greater trochanter before hip dislocation. This measurement should be recorded. It is compared later in surgery to a measurement using the same reference points after the implant trials are in place.

When determining which size SYNERGY® stem to use, the anteroposterior and the lateral radiographs should be templated. Using the anteroposterior radiograph, place the femoral templates over the proximal femur of both the affected and unaffected hips. The junction of the lateral femoral neck and greater trochanter serves as a good reference point for placement of the X-ray templates. Place a mark at this junction and in the center of the femoral head. Align the lateral shoulder of the prosthesis with the mark at the junction. Find the appropriate stem that fits and fills the proximal femur and whose neck length matches the center of the femoral head. This is demonstrated in figure 3.

It is important to check that the stem fits properly into the femur on the lateral radiograph. As stated earlier, it is the lateral radiograph that shows best where 3-point fixation will occur.

A properly implanted porous-coated SYNERGY stem that provides both normal leg length and offset is shown in Figure 4.



Figure 4 Anteroposterior radiograph of a properly implanted porous-coated SYNERGY stem

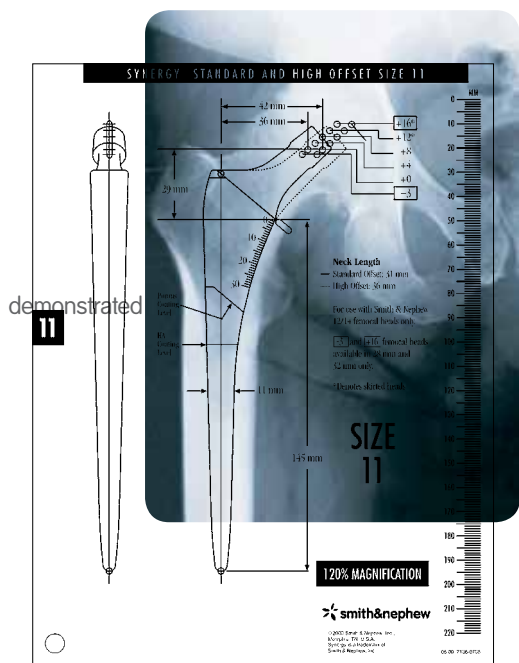


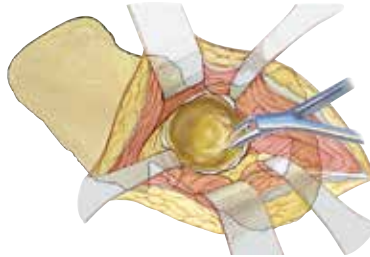
Figure 3 Anteroposterior radiograph demonstrating proper templating of a femur

Short surgical technique

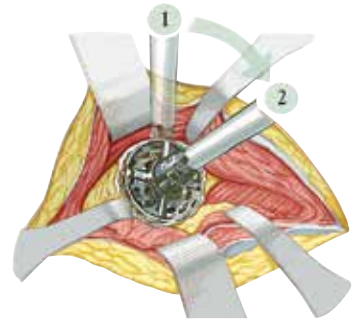
1 Preoperative Planning



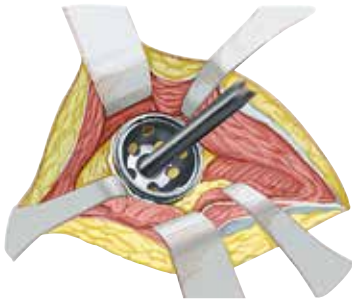
2 Acetabular Exposure



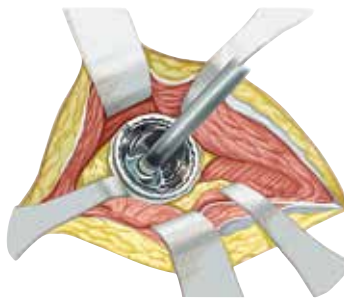
3 Acetabular Reaming



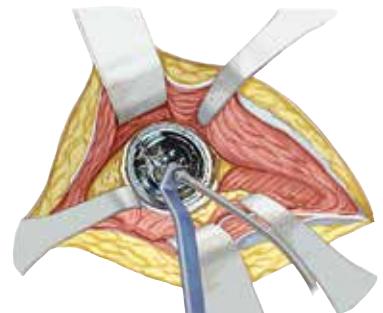
4 Acetabular Trialing



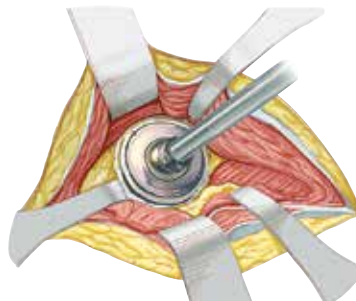
5 Acetabular Shell Insertion



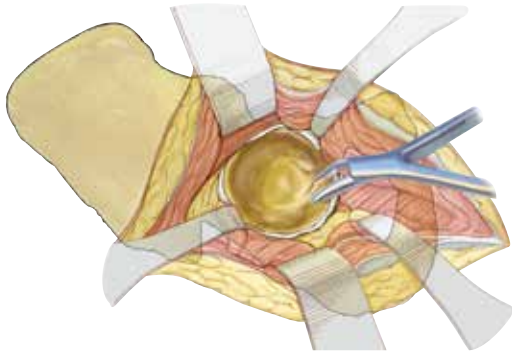
6 Acetabular Screw Insertion



7 Acetabular Liner Insertion



Acetabular preparation



Complete exposure of the acetabulum is required, regardless of the type of approach.

First, resect the acetabular labrum and place a blunt retractor anteriorly.

After identifying the transverse acetabular ligament, divide it inferiorly and place a blunt retractor around the inferior margin of the acetabulum.

Depending on the exposure, a third retractor can be placed posteriorly following the excision of the labrum.

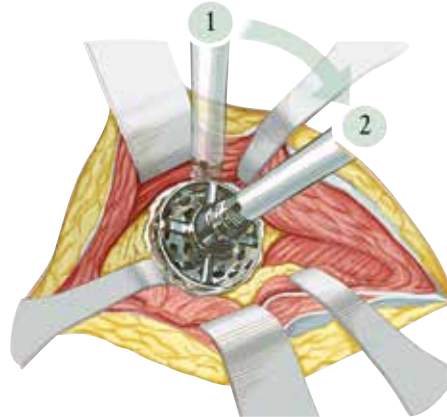
Remove all soft tissue and osteophytes in order to define the medial wall.

The acetabulum must be medialized to restore the normal center of hip rotation.

Surgical Tips: Dividing the transverse acetabular ligament will allow reaming to begin inferiorly, preventing the tendency of the reamer to migrate superiorly.

A medial osteophyte is often present in the fovea, which is usually visible on the preoperative radiographs.

Acetabular reaming



Select an acetabular reamer that is considerably smaller than the templated size of the cup. Position the initial reamer in a vertical direction¹ to ensure the reamer is taken down to the medial wall.

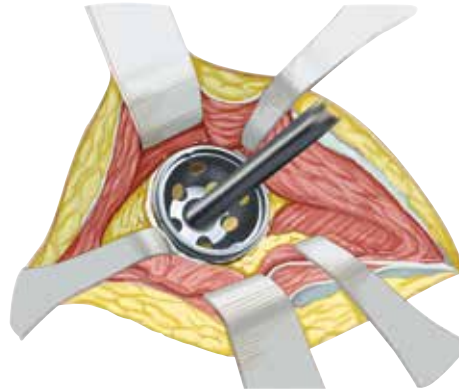
Direct the second reamer and all subsequent reamers in approximately 45° of abduction and 20° of anteversion for final position of the acetabular component¹.

Preserve subchondral bone to provide good support for the prosthesis. Care should be taken to avoid removing too much acetabular bone to avoid intrusion of the acetabular prosthesis.

Frequently palpate the posterior and anterior walls of the acetabulum during the reaming process as these walls will determine the largest acetabular size that can be accommodated.

To press-fit the THREE HOLE shell, the acetabulum should be under-reamed by 1-2 mm depending on bone quality and acetabular size. The shells are available in even sizes so the last reamer used should either be an odd size for 1 mm under-reaming or an even size for 2 mm under-reaming.

Acetabular trialing



Surgical Tips: Each successive reamer must be fully seated within the acetabulum. Failure to do so will result in lateralization of the trial and exposure of the porous coating. If lateralization occurs, go back to a smaller reamer and begin again, checking each size to ensure that the reamers are fully seated.

Increasing the reamer size by 2 mm is recommended, although in smaller patients 1 mm increments may be preferred.

Mark the medial wall with an electric cautery prior to using the last reamer. If the last reamer does not remove the mark, repeat reaming, dropping back a size if necessary.

Instrument Tip: The REFLECTION® reamer has an open back, which helps visualize reaming and allows easy access to bone chips. This style of reamer is hemispherical and when fully seated it should be covered by the rim of the acetabulum.

Gently rock reamer handle back and forth approximately 5° for last size used only to ensure rim is accurate for the desired press fit.

After the preparation of the acetabulum, the trial shell should be inserted to verify size and position of the cup.

If trial reduction using a trial insert is desired, then the preparation of the femur should occur up until the trial reduction stage. The hip should be reduced and leg length, offset, and component position should be assessed.

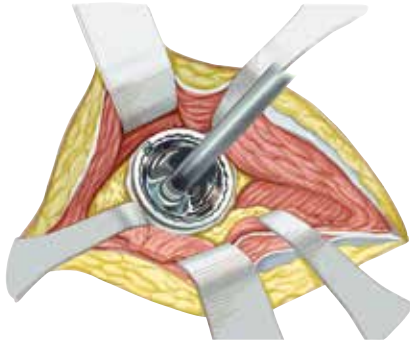
The surgeon should note the appropriate orientation of the acetabular trial to position the cup correctly.

Surgical Tips: The bone at the edge of the trial shell can be marked with an electric cautery to help in final component positioning.

In a relatively normal acetabulum, the final component can be positioned and head coverage adjusted if necessary using overhang liners.

Instrument Tip: The trial shells are the exact size specified and slightly less than hemispherical. They can be used to assess the accuracy of reaming or can be press-fit into the acetabulum if using a larger size than the final reamer.

Acetabular shell insertion



Select the appropriate size acetabular shell, attach the shell to the cup positioner/impactor and insert it into the acetabulum.

Rotate the X-bar shaft so that it is in line with the liner removal slot. This positions the THREE HOLE holes in the superior direction.

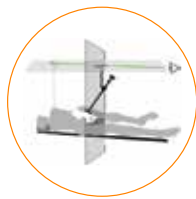
Position the X-bar so that the vertical bar is perpendicular to the long axis of the body and the appropriate crossbar aligns with the long axis of the body.

Firmly tap the inserter with a mallet until the shell is fully seated.

Gently toggle the impactor handle to assess the stability and contact of the shell.

Unscrew the impactor handle and look through the impactor hole to judge the distance between the medial wall and the shell.

If the shell is firmly seated, there should be no gap between the shell and the medial wall and no apparent movement in the component.

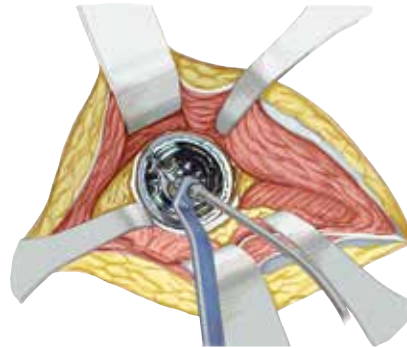


Surgical Tip: The change in pitch that occurs as the shell is seated against the medial wall is often audible. A depth gauge can be inserted through the screw holes and apex hole to determine the adequacy of shell seating.

Instrument Tips: The positioner, like the reamer handle, has an easy-to-remove spring to simplify cleaning; however, the spring and nut cannot detach from the shaft, which prevents items from being misplaced.

The positioner references 45° of abduction and 20° of anteversion.

Acetabular screw insertion



REFLECTION[®] screws work in compression, which allows the shell to fully seat in the acetabular cavity.

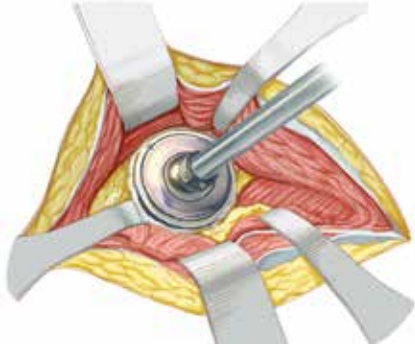
For screw fixation, each screw hole must be predrilled. First, seat the screw drill guide fully into the correct hole in the acetabular shell. The drill guide will position the screw properly, avoiding impingement of the screw head against the shell. After drilling the hole, use the depth gauge to verify appropriate screw length(s).

Use the screw forceps to hold the screw. Attach the screwdriver shaft to the end of the screw. Then introduce the screw into the hole and screw it into place using the ratcheting screwdriver handle. Make sure the screw is fully seated within the screw hole so that it will not impinge on the acetabular shell/liner.

Note: If the screw is not fully seated it will prevent the liner from fully seating with the acetabular shell

Surgical Tip: Screws have been shown to be a reliable method of assuring fixation; however, it is important to avoid neurovascular complications by proper screw placement, avoiding the anterior/superior or anterior/inferior quadrants.

Acetabular liner insertion



Trial reduction should be performed with the final shell and broach in place to appropriately assess neck length, stem offset, and liner style and stem position.

Before inserting the acetabular polyethylene liner, lavage any unused holes.

Cover the apex hole with the watertight threaded hole cover. Using the straight screwdriver, screw in the hole cover until it stops and is flush with the inner diameter of the shell. Insure no soft tissue is overhanging the edge of the shell that would interfere with the seating of the liner.

For the liner insertion, place the appropriate liner impactor head on the end of the cup positioner and ensure that the splines on the liner are aligned with the splines on the shell.

Firmly impact the inserter with the mallet until the liner is fully seated.

Inspect the liner/shell interface for proper seating.

Surgical Tips: If there is continual difficulty inserting the liner, recheck the lock mechanism to assure that no soft tissue is obstructing it.

Use an instrument such as a hemostat to assure proper locking of the polyethylene insert. A properly locked liner will not toggle; however, due to the unique, non-damaging lock mechanism, the liner can be pulled out. If the liner is not locked in place, even low loads will toggle it.

Instrument Tips: The liner requires an impaction force between 120 and 200 pounds increasing with the diameter of the shell.

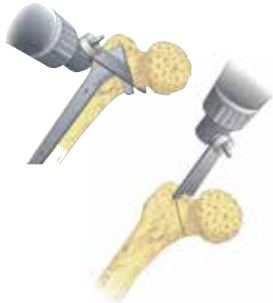
The liner can be removed and repositioned 3 times without compromising the locking mechanism of the liner. To remove, insert the removal tool fully into the removal slot and pry the liner loose.

The threaded trial liners are designed to screw into the shell, which provides more stability in trialing.

SYNERGY[®] FEMORAL STEM

Short surgical technique

1 Femoral Osteotomy



2 Canal Preparation



3 Femoral Reaming



4 Broach Assembly/
Disassembly



5 Femoral Broaching



6 Calcar Preparation
(optional)



7 Trialing



8 Stem Impactor
Assembly



9 Stem Insertion



10 Final Trial Reduction



11 Femoral Head Assembly



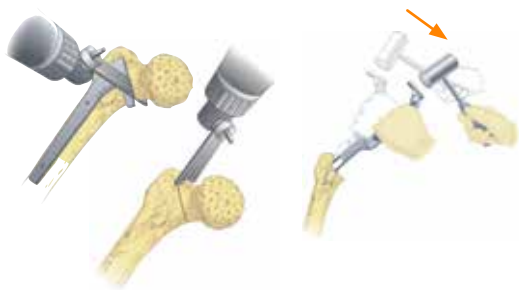
SURGICAL TECHNIQUE

Femoral osteotomy

The point of the femoral neck resection should be marked with electrocautery corresponding to both the preoperative templating and the intraoperative measurement. Prior to the resection of the femoral head, assemble the broach, trial neck and trial femoral head corresponding to the implant that was templated. Place this trial stem on the femur to verify that the center of the prosthetic head aligns with the center of the femoral head. This will confirm that the level of the femoral neck resection is appropriate and will re-establish the desired leg length and offset of the proximal femur. Osteotomize the femoral neck.

Open femoral canal

Remove remnants of the femoral neck and open the medullary canal using the box osteotome.



Femoral canal preparation

Use the canal finder and modular T-handle for initial femoral reaming.

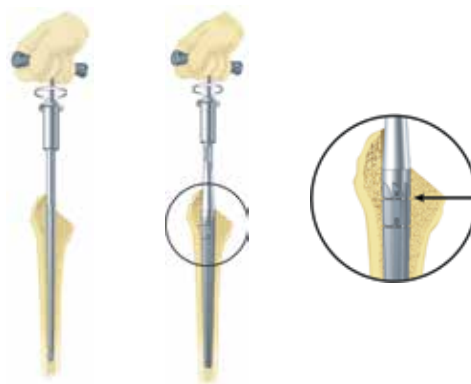
Note: It is important to stay lateral with both the box osteotome and canal finder. Care should be taken to ensure that the initial reaming tract into the femur is in neutral alignment with the femoral axis.

Femoral reaming

Continue to enlarge the femoral canal sequentially using the femoral reamers.

Each reamer is marked with 2 or 3 lines. Stop reaming when the mark on the reamer associated with the templated stem size is even with the medial femoral neck resection or endosteal bone resistance is encountered. If reaming becomes difficult before reaching the templated stem size, consider using a stem size smaller than the templated stem size.

Note: It is important to stay lateral with the femoral reamers to ensure that the canal is being opened in neutral alignment with the femoral axis.



Broach assembly/disassembly

Assemble the broach to the broach handle by placing the broach post in the clamp and lock the broach handle.

Femoral broaching

Start the broaching procedure along the axis of the femur with a broach at least 2 sizes smaller than the last reamer used. Sequential broaching should then be carried out to the templated stem size. Stop broaching when the top of the last broach is slightly below the level of the resected femoral neck to facilitate calcar reaming.

Note: Care should be taken not to force a broach that is too large into the femur. Consideration should be given to using a stem size smaller than the size templated. This helps avoid intraoperative fractures of the femur.

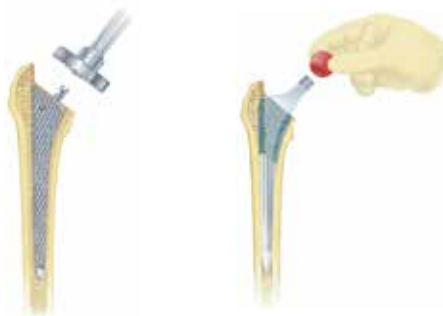


Calcar preparation

With the final broach fully seated, remove the broach handle. Place the calcar reamer over the post of the broach and machine the femoral neck for optimal implant collar/femoral neck contact.

Trial reduction

Place the standard or high offset trial neck (as determined by templating) onto the broach post. Select the trial femoral head of desired diameter and neck length. Measure the distance between the mark at the lesser trochanter and the center of the trial femoral head. This number should correspond to the preoperative and intraoperative measurements. Adjustments in neck length and/or offset can be made at this time.



Femoral head and neck length options			
Trial Color	28 mm	32 mm	36 mm
Green	-3	-3	-3
Orange	+0	+0	+0
Brown	+4	+4	+4
Gray	+8	+8	+8
Blue	+12*	+12*	+12*
Black	+16*	+16*	—

* Denotes skirted heads

Reduce the hip and evaluate in the following ways:

Soft tissue tension

Some shuck is normal when applying a longitudinal distraction force to the hip.

Shuck should not be excessive, and the hip should not dislocate.

Anterior stability

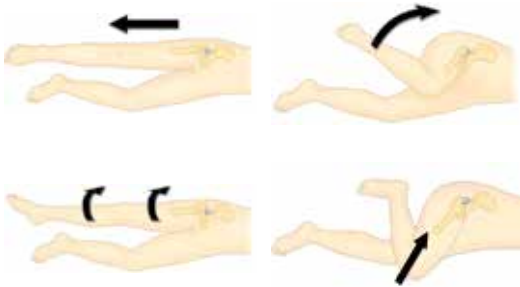
Place the leg in full adduction, full extension and hyperextension, while exerting an external rotation force. If the hip cannot be fully extended, it may be too tight. If it dislocates easily, it is too loose and impingement must be addressed or component malposition exists.

Posterior stability

Place the leg in neutral adduction and 90° flexion. Gradually rotate internally. If it dislocates with minimal internal rotation, it is too loose and impingement must be addressed or component malposition exists.

Sleep position

Place the leg in the "sleep position" with the operated leg semiflexed, adducted and internally rotated over the other leg. Apply axial force to try to dislocate. This position represents a dangerously unstable position that may be adopted by a patient sleeping on their nonoperated side.



Stem insertion

Insert the selected femoral stem into the canal. Apply hand pressure and rotate the stem into the correct position. Use gentle mallet blows to seat the stem to the position of the neck resection. Check stem stability.

If the implant has stopped moving with gentle mallet blows and is not completely seated, remove the stem and repeat the same size reaming and broaching steps.

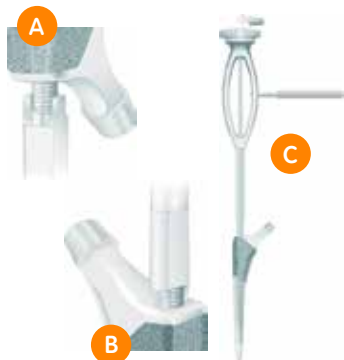
Caution: Do not use excessive force to seat the stem.



Stem/impactor assembly

Place the stem inserter pommel through the stem inserter frame and stand upright so that the threaded tip is pointed up (A). Screw the implant onto the threaded tip as far as possible.

Flip the assembly over so that the stem tip is now pointing down (B). Engage the frame tines into the slots adjacent to the threaded hole on the stem. Screw the pommel until assembly is secure (C).



Final trial reduction

A final trial reduction may be performed at this time using trial femoral heads.

Femoral head assembly

Clean and dry the neck taper with a clean, sterile cloth. Place the prosthetic femoral head on the neck taper and firmly impact with the femoral head impactor and a mallet several times.



SPECIFICATIONS

REFLECTION[®] acetabular components

Range of motion

Liner style			
	28 mm	32 mm	36 mm
Neutral	142°	145°	148°
20° Overhang	122°	126°	128°

Polyethylene thickness

Acetabular cup size					
Femoral head size	46-48 mm	50-52 mm	54-56 mm	58-60 mm	62-64 mm
28 mm	5 mm	7 mm	9 mm	10 mm	12 mm
32 mm	NA	5 mm	7 mm	8 mm	10 mm
36 mm	NA	NA	5 mm	6 mm	8 mm

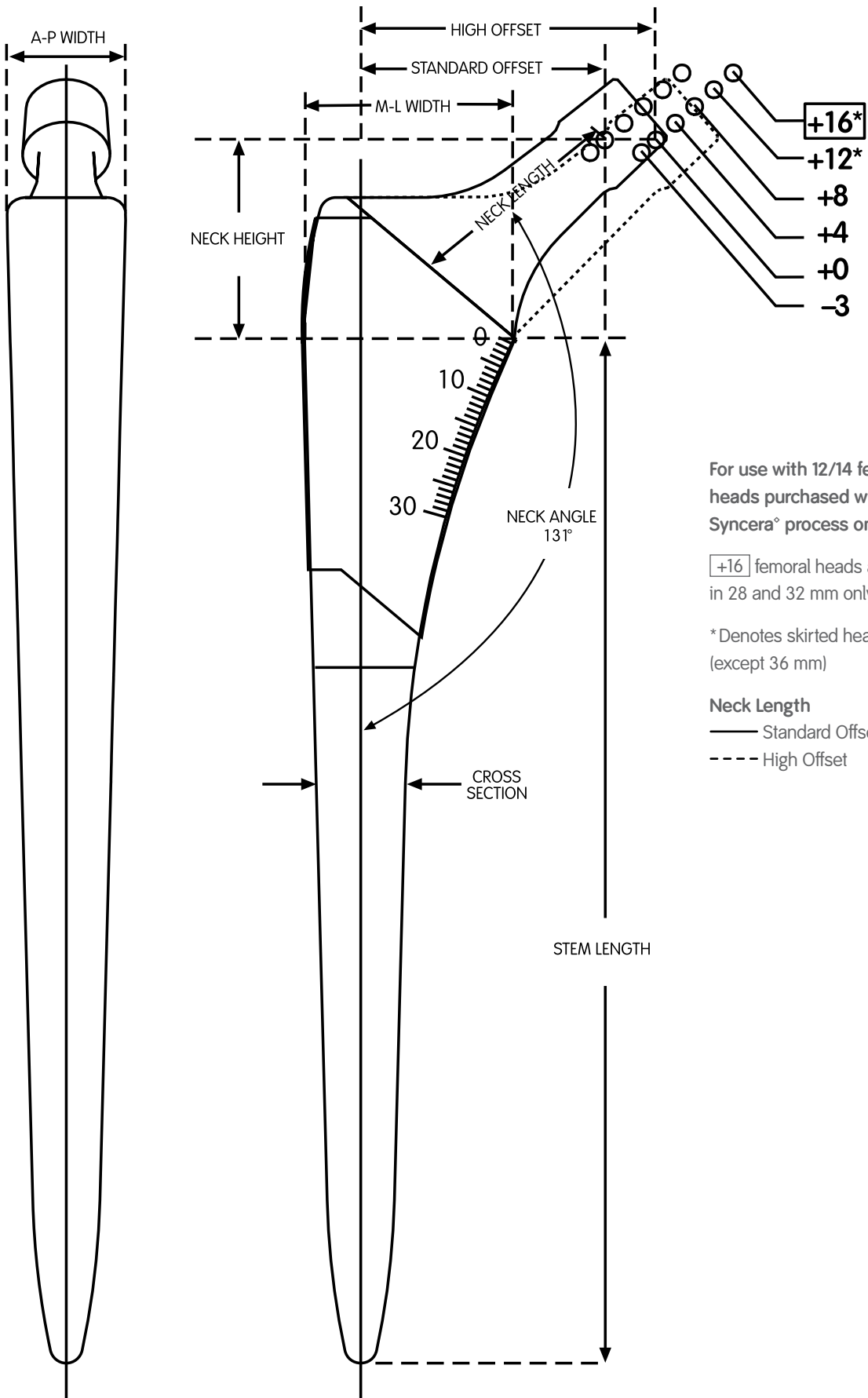
SYNERGY[®] femoral stems

Stem size	Neck angle	Conical cross section (mm)	Stem length (mm)	A-P width (mm)	M-L width (mm)
9	131°	9	135	13.5	28.5
10	131°	10	140	14.5	29.5
11	131°	11	145	15.5	30.5
12	131°	12	150	16.5	31.5
13	131°	13	155	17.5	32.5
14	131°	14	160	18.5	33.5
15	131°	15	165	19.5	34.5
16	131°	16	170	21.5	35.5
17	131°	17	175	22.5	36.5
18	131°	18	180	23.5	38.5

Neck height mm when femoral head component selected is:						
Size	-3	+0	+4	+8	+12	+16
9	26	28	30	33	35	38
10	26	28	31	33	36	39
11	27	29	32	34	37	39
12	28	30	32	35	37	40
13	28	30	33	35	38	41
14	29	31	33	36	39	41
15	30	32	34	37	39	42
16	30	32	35	37	40	43
17	31	33	35	38	41	43
18	32	33	36	39	41	44

Neck offset mm when femoral head component selected is:						
Size	-3	+0	+4	+8	+12	+16
9	32	34	37	40	43	46
9 HO	38	40	43	46	49	52
10	33	35	38	41	44	47
10 HO	39	41	44	47	50	53
11	34	36	39	42	45	48
11 HO	40	42	45	48	51	54
12	34	37	40	43	46	49
12 HO	40	43	46	49	52	55
13	35	37	40	43	46	49
13 HO	41	43	46	49	52	55
14	36	38	41	44	47	50
14 HO	44	46	49	52	55	58
15	37	39	42	45	48	51
15 HO	45	47	50	53	56	59
16	37	40	43	46	49	52
16 HO	45	48	51	54	57	60
17	38	40	43	46	49	52
17 HO	46	48	51	54	57	60
18	39	41	44	47	50	53
18 HO	47	49	52	55	58	61

Neck length mm when femoral head component selected is:						
Size	-3	+0	+4	+8	+12	+16
9	27	30	34	38	42	46
9 HO	31	34	38	42	46	50
10	28	30	34	38	42	46
10 HO	32	35	39	43	47	51
11	28	31	35	39	43	47
11 HO	33	36	40	44	48	52
12	29	32	36	40	44	48
12 HO	33	36	40	44	48	52
13	30	32	36	40	44	48
13 HO	34	37	41	45	49	53
14	30	33	37	41	45	49
14 HO	36	39	43	47	51	55
15	31	34	38	42	46	50
15 HO	37	40	44	48	52	56
16	31	34	38	42	46	50
16 HO	37	40	44	48	52	56
17	32	35	39	43	47	51
17 HO	38	41	45	49	53	57
18	33	36	40	44	48	52
18 HO	38	41	45	49	53	57



REFLECTION[◊] THREE HOLE Acetabular Components

**Technique described by Robert L. Barrack, MD
St. Louis, Missouri**

Nota Bene: This 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 patient. Prior to performing this technique, or utilizing any product referenced herein, please conduct a thorough review of each product's indications, contraindications, warnings, precautions and instructions as detailed in the Instructions for Use provided with the individual components.

SYNERGY[◊] Cementless Stem

Surgical technique completed in conjunction with:

Robert B. Bourne, MD, FRCS(C)
London, Ontario, Canada

John W. McCutchen, MD
Orlando, Florida

Professor Ernesto DeSantis
Rome, Italy

Cecil H. Rorabeck, MD, FRCS(C)
London, Ontario, Canada

Wayne M. Goldstein, MD
Chicago, Illinois

James P. Waddell, MD
Toronto, Ontario, Canada

Gianni L. Maistrelli, MD, FRCS(C)
Toronto, Ontario, Canada

Nota Bene: The technique description herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient. Prior to performing this technique, or utilizing any product referenced herein, please conduct a thorough review of each product's indications, contraindications, warnings, precautions and instructions as detailed in the Instructions for Use provided with the individual components.

Reference

1 Lieberman, JR; Kay, RM; Hamlet, WP; Park, SH; Kabo, JM. Wear of the polyethylene liner-metallic shell interface in modular acetabular components. An in-vitro analysis. J Arthroplasty. 1996 Aug; 11(5):602-8.

