smith&nephew

SYNERGY°

Hip System

Comprehensive. Simple. Efficient.

It's easy to understand why SYNERGY Hip System has been used for many years and its popularity continues to increase. As a result of building on the excellent clinical outcomes of earlier designs, SYNERGY Hip System has made significant advances over previous tapered implants.

Sophisticated design

SYNERGY Hip System incorporates successful Smith & Nephew design features including unique neck geometry and dual progressive offsets.

Superior range of motion

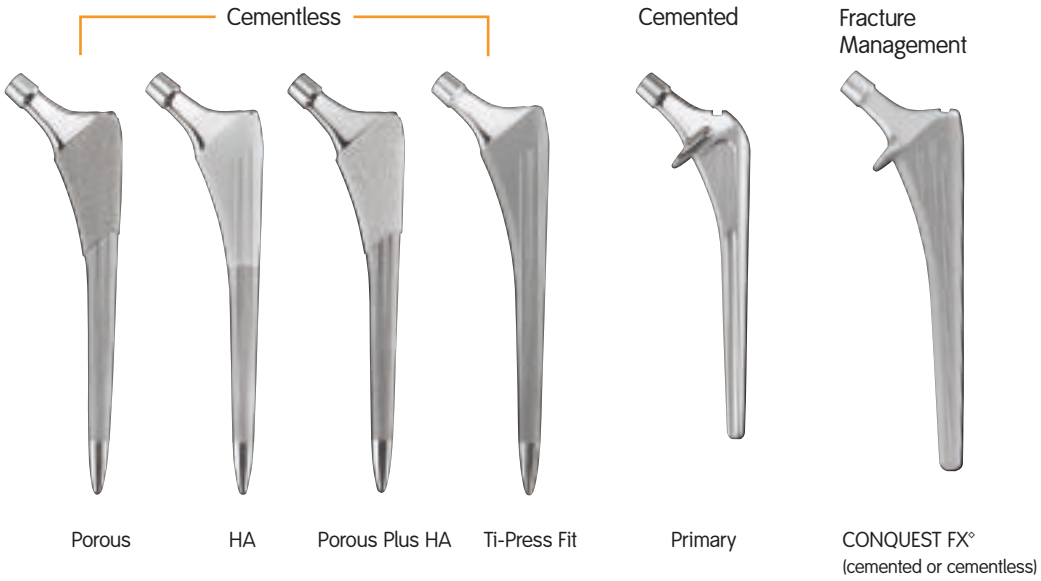
The circulotrapezoidal neck and optimized 12/14 taper designs of SYNERGY stems provide increased range of motion (ROM) compared to other designs.

Surgical simplicity

All of the stems in the SYNERGY system use the same 2 trays of instrumentation. The simple ream-and-broach system provides operating room efficiency: ream to a 14, broach to a 14, implant a 14 stem.

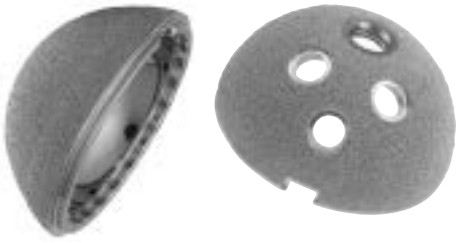
A truly comprehensive system

SYNERGY Hip System gives the orthopaedic surgeon a complete range of options that include cementless, cemented and fracture management stems. Each of these options uses the same 2 efficient instrument trays. The surgeon can also select from a number of acetabular and femoral head options.



A wide range of acetabular options

REFLECTION® acetabular shells and liners provide the perfect complement to SYNERGY Hip System. Available in a variety of options, REFLECTION shells use the MICROSTABLE® Liner Locking Mechanism, which securely holds a selection of liners.



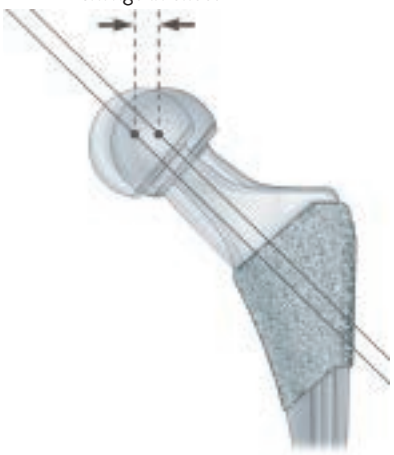
A choice of femoral heads

OXINIUM® Femoral Heads precisely fit the 12/14 taper of SYNERGY stems and provide excellent wear resistance. To ensure proper joint tension, Smith & Nephew femoral heads offer 19mm of adjustment, of which 11mm are provided without the disadvantage of a skirt.

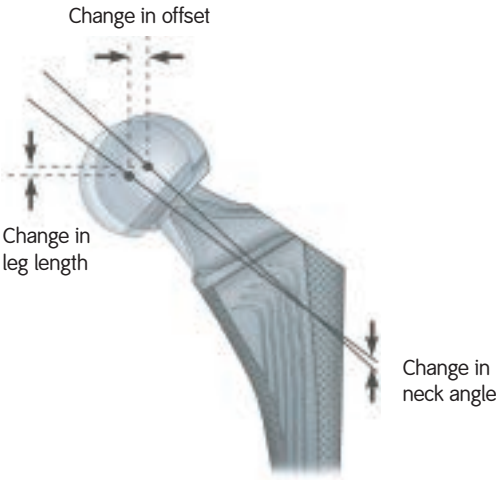
Sophisticated design

True dual offsets

SYNERGY stems offer both standard and high offset designs that enable surgeons to restore the biomechanics of patients without worrying about a change in leg length or neck angle. Other stem designs change offset by changing neck angle, which alters leg length. SYNERGY stem offset is realized by shifting the entire neck medially, while maintaining the same neck angle of 131°. With the high offset design of SYNERGY stem, leg length does not change because the femoral head is shifted medially, and its center of rotation remains at the same level.



True dual offsets of SYNERGY stems



Other designs of offset adjustment

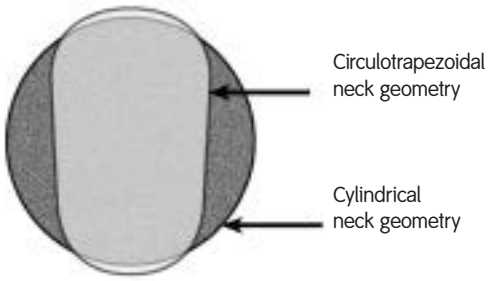
Threaded driving platform

SYNERGY stems feature a threaded driving platform with an elliptical slot for extra rotational and axial implant control during insertion as well as easy component removal.

Driving platform of SYNERGY stems

Improved neck geometry

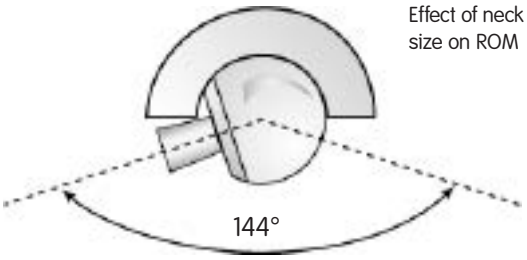
SYNERGY stems use a neck design that has proven successful for the SPECTRON® stem and most other Smith & Nephew femoral implants. The circulotrapezoidal neck design of the SYNERGY stem provides greater range of motion than circular necks,[1] less material in the anterior/posterior direction where fatigue is lower, and slightly more material in the medial/lateral direction to address *in vivo* requirements.



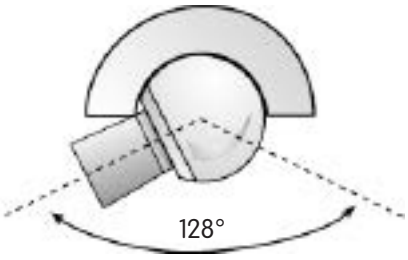
Circulotrapezoidal neck shown inside a traditional cylindrical neck design

Recommended head/neck ratio

All SYNERGY stems achieve the minimum 2:1 recommended head diameter-to-neck thickness ratio to achieve adequate range of motion.[2] To achieve this ratio with a 28mm head, the maximum neck diameter of SYNERGY stems does not exceed 14mm. The circulotrapezoidal neck geometry minimizes neck thickness in the AP direction, which also increases ROM. The result is less likelihood of impingement, which can lead to dislocation.



Circulotrapezoidal neck



Cylindrical neck

No unnecessary anteversion

With proper neck, taper and acetabular liner geometry, a neutral stem neck like a SYNERGY stem can provide greater ROM than a stem with a circular neck and built-in anteversion.

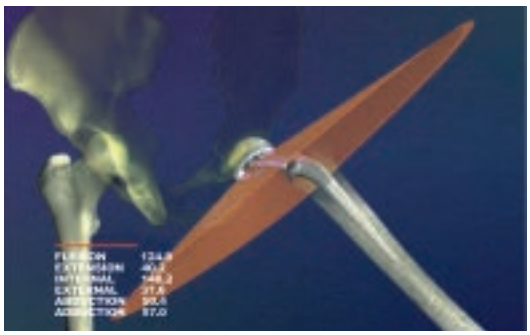
Optimized 12/14 taper

Taper size can affect ROM. A large exposed taper may impinge the cup, limiting ROM. The optimized 12/14 taper design of SYNERGY stems provides increased ROM compared to other designs.

Taper diagram showing how a 12/14 taper is defined

Superior range of motion

SYNERGY Hip System offers superior range of motion when compared to other designs. In studies conducted to assess overall ROM of different neck geometries, prosthesis ROM was evaluated by creating a cone that defined the limits of motion to impingement.[1] As illustrated in the diagrams below, a prosthesis with reduced motion produces a smaller cone than one with increased motion.

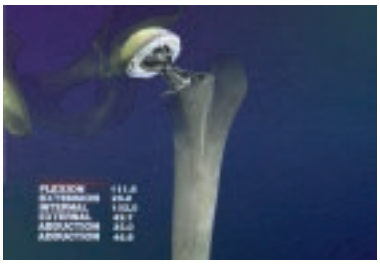


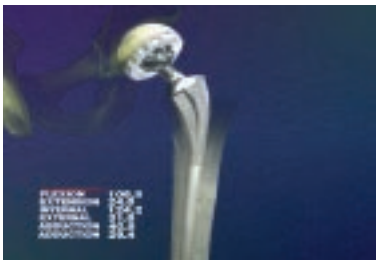
Cone of motion

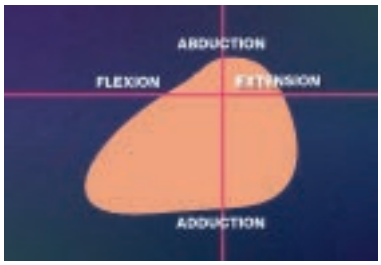
SYNERGY stem ROM

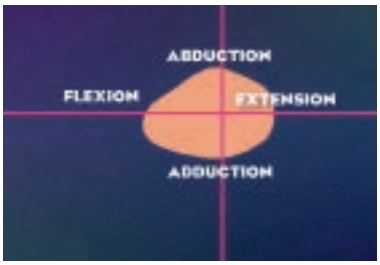
Design “A” ROM

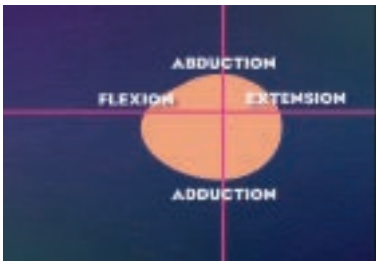
Design “B” ROM











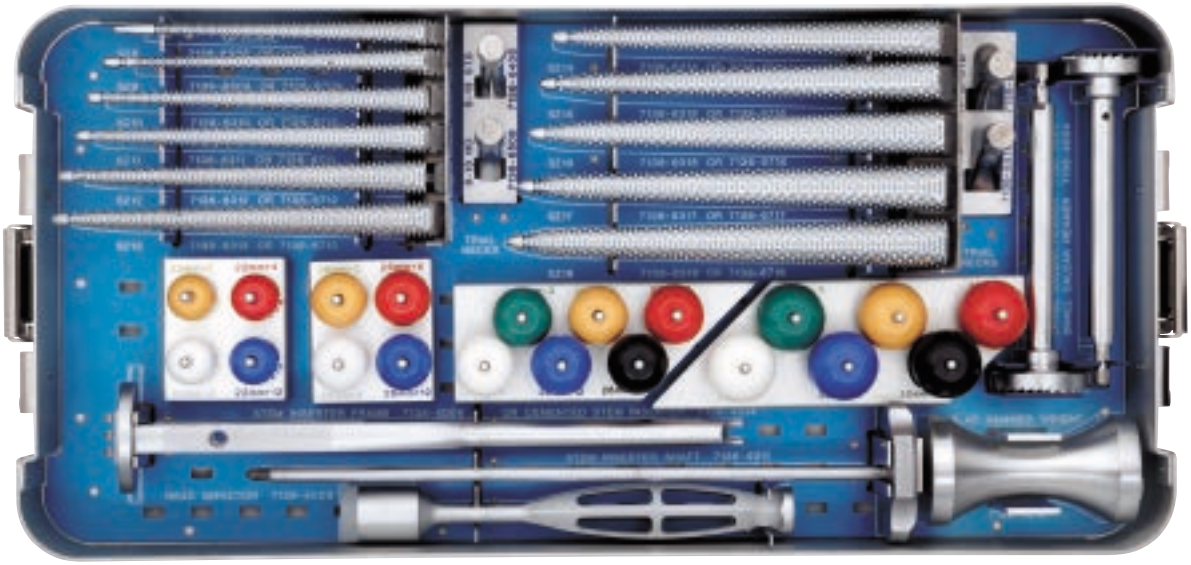
The ROM of SYNERGY Hip System when compared to other designs – a planer projection of the cone of motion

Maximizing the patient’s range of motion without impingement of the prosthesis is an important clinical goal in preventing increased poly debris, which can lead to osteolysis, subluxation and possible joint dislocation; prosthetic loosening; and dislodgement of a modular acetabular liner.[3]

Simple, efficient instrumentation

All stems of the SYNERGY Hip System use the same 2 trays of instrumentation. Designed to flow with the surgery, the first tray contains the femoral reamers, and the second tray includes the femoral broaches.

2-tray SYNERGY Hip System ream-and-broach instrument set used for all SYNERGY stems



Specialized reamers

Most hip replacement instrumentation sets contain a reamer for each size implant. Each femoral reamer within SYNERGY Hip System is designed to prepare the canal for 2 different implants, reducing the number of reamers required for surgery by 50%. Efficiency is further enhanced because each reamer removes 75% of the bone required for implantation of the appropriate stem.

The simple ream-and-broach system provides operating room efficiency: ream to a 14, broach to a 14, implant a 14 stem

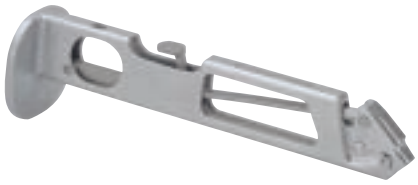
Double-duty broaches

SYNERGY Hip System broaches are designed for aggressive and efficient cutting. The tooth arrangement helps move bone chips up and out of the femoral canal, which facilitates cleaning and makes bone preparation straightforward. Broaches remove the remaining 25% of bone prior to trialing.

Simple, efficient instrumentation

Locking broach handles

Securely locking broach handles feature a wide striking platform and a quick connect and disconnect mechanism for fast and easy broaching of the femoral canal.



Few trial necks required

Because of efficient broach design, only 4 provisional necks are required for trialing all 11 sizes of stems (both standard and high offset). The necks allow for trial reduction with the broach in place and are clearly laser-marked. In addition, the trial necks will not fit on a broach that does not match. Joint tension is expedited by swapping trial necks between standard and high offset options. The necks also feature a magnet to lock to the broach, preventing the trial neck from falling into the wound site.

A variety of trial heads

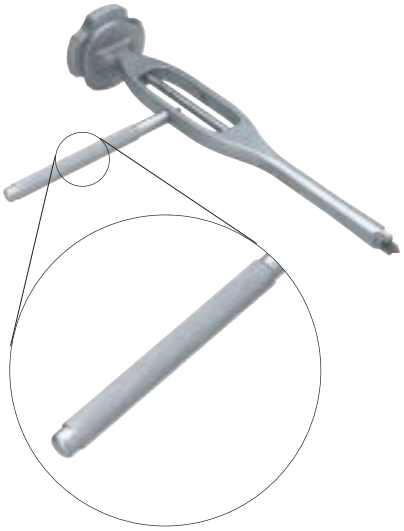
To address soft tissue variability and surgeon preference, 4 sizes of trial heads are available (22, 26, 28 and 32mm). Femoral heads, along with the optimized 12/14 taper, have been designed to reduce the use of skirts, which may lead to dislocation.[4] The heads allow for 19mm of adjustment and 11mm without skirts.

Rigid stem inserter

A rigid, threaded attachment mechanism enhances the ease of stem implantation. The locking stem inserter provides maximum control during implant seating.

Easy-to-use anteversion handle

A simple, knurled handle threads into both the broach handle and the stem inserter, giving extra visualization and control during both preparation and implantation.

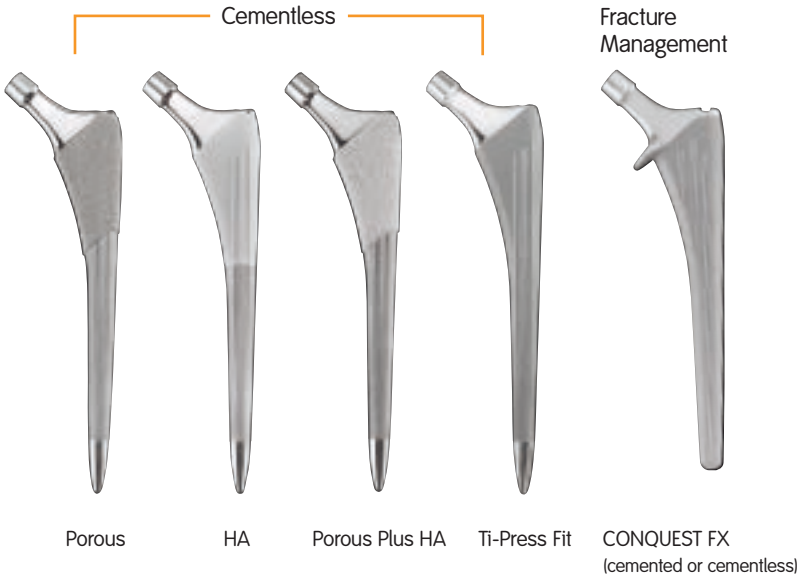


SYNERGY
Cementless Stem

Porous HA Porous Plus HA Ti-Press Fit CONQUEST FX
(cemented or cementless)

A truly comprehensive system

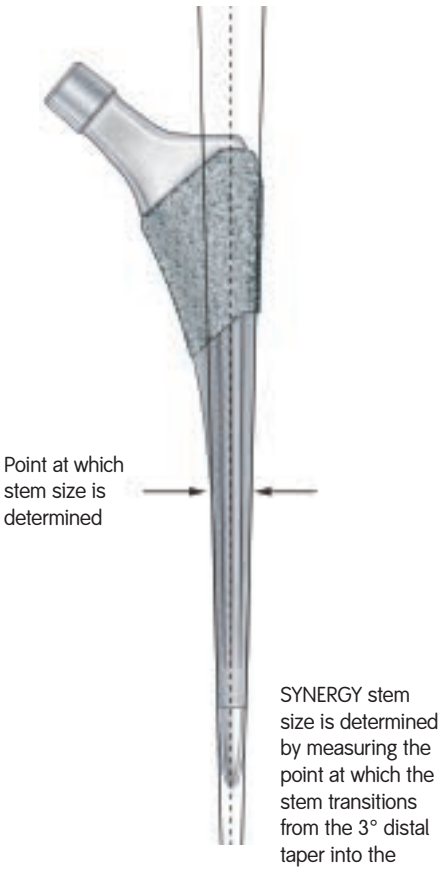
The SYNERGY Cementless family offers a choice of surface treatments including Porous, HA, Porous Plus HA and Titanium press-fit stems. A number of acetabular and femoral head options are also available.



Stem size variety

SYNERGY Cementless System offers sizes 8-18 in 1mm increments, as well as sizes for patients with special needs or unusual anatomy. Progressive stem lengths 120-180mm provide enhanced anatomy replication.

SYNERGY Cementless Stem (sizes 9-17) is available in 2 offsets.

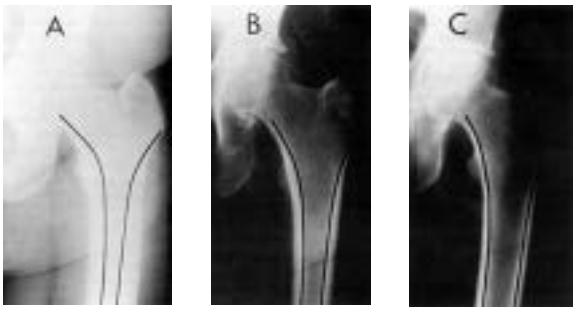


SYNERGY stem size is determined by measuring the point at which the stem transitions from the 3° distal taper into the medial curve

Stronger implant fixation

Titanium taper

The rationale of a titanium tapered design is based on 3 essential factors: a self-locking principle, the ease of surgical insertion[5] and the use of biocompatible low modulus material. Although tapered stem systems offer important advantages, femoral implants should be chosen according to the patient's anatomy.[6] Because of their shape, tapered stems work best in Type A and Type B femurs, which comprise 85% of the patient population.[5]



The shape of the femoral canal varies greatly, ranging from Dorr's champagne flute (Type A) to the stovepipe (Type C)

Anatomical 3° taper

SYNERGY Cementless Stem incorporates an anatomically based 3° taper. Studies have shown that the normal taper of a femur is from 2 - 4°.[7] Stems with tapers larger than 4° are unlikely to achieve a proper fit with the average patient's anatomy; a tapered stem with a 5° taper was shown to have an intraoperative fracture rate of 8%.[8]

The natural 2 - 4° taper of the femur

3° taper of SYNERGY stem

Stronger implant fixation

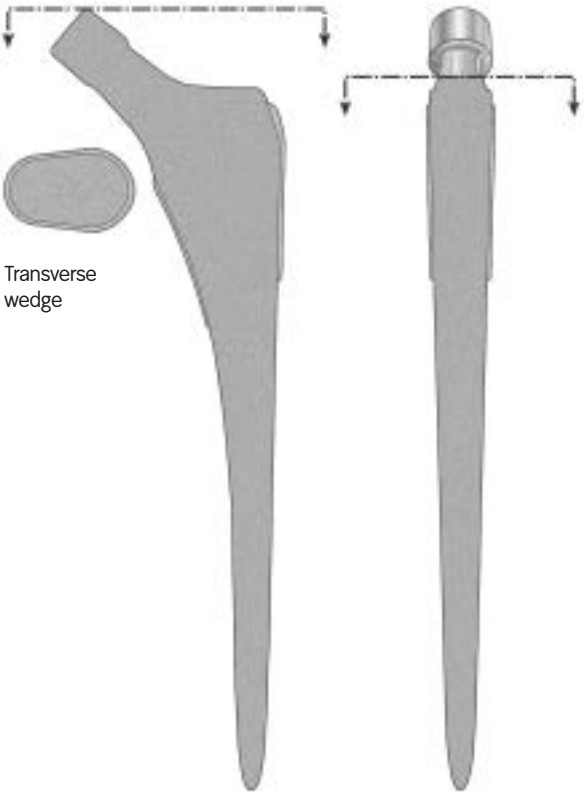
Stable, 3-point fixation

SYNERGY Cementless tapered stems achieve 3-point fixation, maximizing rigidity and providing long-term stability. The implant locks with the cortical bone proximally at the posterior section of the femur, anteriorly midway down the stem, and distally at the posterior wall.[5]

Lateral X-ray of a SYNERGY stem showing 3-point fixation

Self-locking wedge

The tapered design of SYNERGY Cementless Stem is based on a self-locking wedge, which provides rotational stability. Creating a wedge in 3 different planes – coronal, sagittal and transverse – the geometry loads the proximal part of the femur. As a result, bone develops the structure most suited to resist the forces acting upon it.

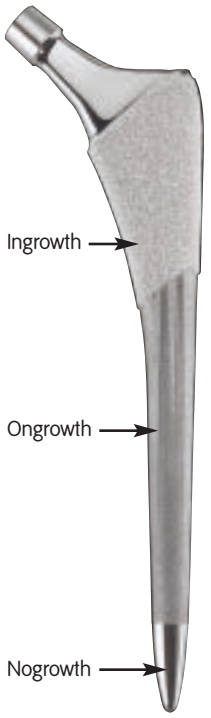


3 wedges associated with a SYNERGY stem

Transition of coatings

In addition to the 3° taper and the use of titanium material (see page 13), the design of SYNERGY Cementless Stem addresses transmitting stress and eliminating stress shielding and thigh pain by incorporating surface transitions.

In the proximal region of the Porous and HA stem designs there are surfaces where the bone can attach or grow. Below the proximal third, the stem has been grit blasted. This is a less rigid fixation than in the proximal, but still allows a good surface for ongrowth. The distal tip of SYNERGY stems is polished and bullet-shaped, which allows nogrowth.



Advanced proximal coatings

For heightened proximal fixation, SYNERGY Cementless Stem offers several porous-beaded surface options, providing an additional 0.5mm of press-fit not accounted for with the broach.

No bony impingement

The polished distal tip is an important feature of SYNERGY Cementless Stem. It is bullet-shaped to allow for it to taper away from the bone, offloading stress and avoiding cortical impingement. The polished tip prevents abrasion with the cortical walls and ensures that the bone does not attach, which can cause thigh pain.

Enhanced bone ongrowth

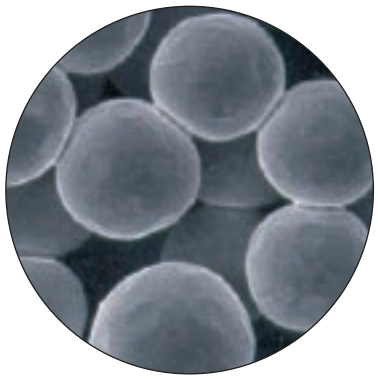
SYNERGY Cementless Stem is grit-blasted below the proximal third. Tests show that a roughened surface is conducive to bone ongrowth.[9]

Advanced proximal coatings

Porous

The sintered-bead ROUGHCOAT® Porous Coating from Smith & Nephew, manufactured from commercially pure titanium, has demonstrated several advantages over plasma spray or simple macro-textured surface: irregularly layered beads provide 3-D interlock; studies have reported that sintered beads provide 2-3 times less wear than plasma spray;[10] and sintered beads have been shown to have a greater bond strength than either plasma spray or diffusion bonded wire.[11,12,13]

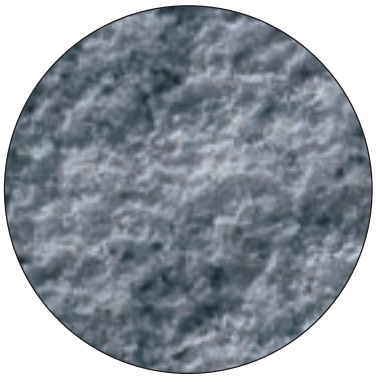
Mechanical testing has shown the optimal pore size for bone ingrowth to be between 50-400 microns.[14] The pore size of SYNERGY Cementless Stem is 200 microns.



SYNERGY ROUGHCOAT Porous Coating magnified 30x

HA

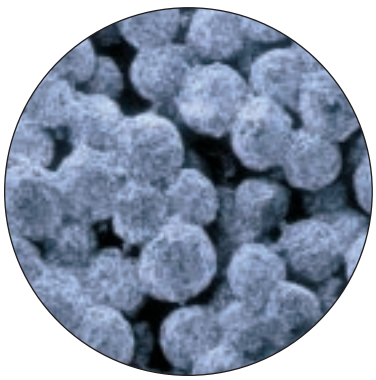
SYNERGY HA Cementless Stem is a press-fit stem with the proximal one-third sprayed with 50 microns of almost 100% pure HA over a grit-blasted surface. A thin HA coating can be discontinuous, causing loss of mechanical integrity. On the other hand, a thick coating is likely to have lower attachment strength, leading to cracking and delamination under fatigue loads. The optimum thickness of HA has been shown to be 50 microns with a minimal amount of impurities.[15,16]



SYNERGY HA Coating magnified 100x

Porous Plus HA

SYNERGY Porous Plus HA Cementless Stem uses the same technology as the SYNERGY Porous Stem. HA is applied to the porous coating using the same specifications as the HA stem. Tests have shown that HA does not occlude the porous beads.



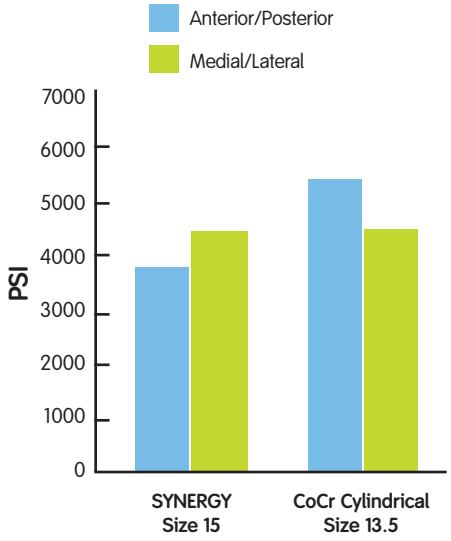
SYNERGY Porous Plus HA does not clog pores

Unique construction advantages

Benefits of Titanium

The cementless line of SYNERGY stems is manufactured from a titanium alloy, Ti 6Al-4V, chosen for its excellent biocompatibility, strength and low modulus of elasticity.

The difference in stem stiffness between titanium alloy and cobalt chrome can be seen in 4-point bending tests that were performed on a SYNERGY Cementless Stem and a cylindrical cobalt-chrome stem with more than 20 years of clinical history. These tests indicate that the larger SYNERGY Cementless Stem can be used with less concern about stress shielding, which is associated with the cylindrical, cobalt-chrome stem design.[17]



4-point bending test comparing SYNERGY stems and cobalt-chrome stems

Superior rotational stability

Implant stability is an important factor in attaining long-term fixation. SYNERGY Cementless Stem achieves rotational stability through anterior/posterior fins and additional press-fit. The broach creates a line-to-line fit throughout the stem, except in the porous-coated region and anterior and posterior fins. The porous coating, which is 0.25mm proud on each side, achieves press-fit of 0.5mm. Fins extend to 0.75mm on the HA and Titanium press-fit stems. These fins increase the press-fit and have been shown in testing to improve the rotational stability of the stem by up to 20% over a similar-geometry stem without fins.[18]

Anterior/posterior fins provide increased rotational stability

SYNERGY
Cemented Stem

SYNERGY Cemented Stem offers many of the advantages of the cementless system, along with special benefits due to its unique design. Surgeons use the same SYNERGY instrumentation and simple ream-and-broach system, e.g., ream to a 14, broach to a 14, implant a 14 stem.

Primary

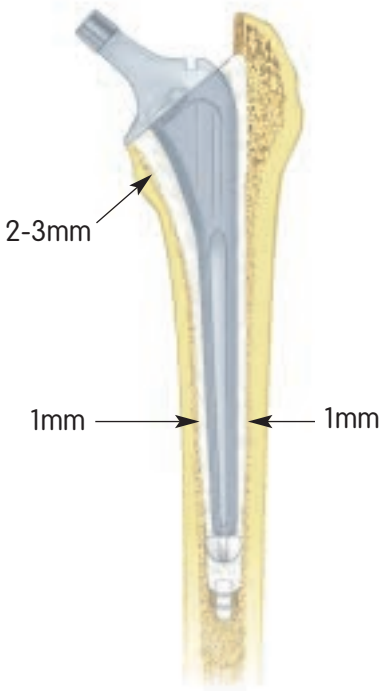
CONQUEST FX
(cemented or cementless)

Sophisticated stem design

SYNERGY Cemented Stem, which is made of forged cobalt chrome with a satin surface finish, is available in 7 sizes in 1mm increments. The stem shape is based on the SPECTRON stem by Smith & Nephew, which has a 20-year record of clinical success.

Cement mantle

SYNERGY Cemented Stem broaches prepare a 1mm cement mantle for the stem except in the medial curve, where there is a 2-3mm mantle. The purpose of the extra mantle in the medial curve is to replace the cancellous bone that has been removed.



Distal groove stability

Distal cement grooves aid in rotational stability and help counter torque when under pressure.

Ramp and collar pressurization

Proximal ramps provide pressurization of the medial cement mantle and also help keep the implant lateral during insertion. A collar provides additional pressurization of the cement mantle and also indicates that the stem is fully seated when calcar contact is made.

Endnotes

1. Thornberry, R.; Lavernia, C.; Barrack, R.; Tozakoglou, E.: "The Effects of Neck Geometry and Acetabular Design on the Motion to Impingement in Total Hip Replacement." A Scientific Exhibit at the 1998 AAOS Meeting.

2. Chandler, David R., B.S.E.; Glousman, Ronald, M.D.; Hull, David, Ph.D.; McGuire, Patrick J., P.A.; Kim, Ik San, M.D.; Clarke, Ian C., Ph.D.; Sarmiento, Augusto, M.D.: "Prosthetic Hip Range of Motion." Clinical Orthopaedics and Related Research. Number 166, June 1982, pp. 284-291.

3. "Impingement in THA: The Effect of Neck Geometry and Acetabular Design." Smith & Nephew Technical Publication, September 1998.

4. "The Effect of Hip Implant Design Factors on the Incidence of Early Impingement." Smith & Nephew Technical Summary, December 1998.

5. Bourne, R.B., M.D.; Rorabeck, C.H., M.D.: "A Critical Look at Cementless Stems." Clinical Orthopaedics and Related Research. October 1998, Number 355.

6. Noble, Philip C., M.S.; Alexander, Jerry W., B.S.; Lindahl, Laura J., B.S.; Yew, David T., B.S.; Grandberry, William M., M.D.; Tullos, Hugh S., M.D.: "The Anatomic Basis of Femoral Component Design." Clinical Orthopaedics and Related Research. October 1988, Number 235, pp. 148-165.

7. Yanagimoto, S.; Sakamaki, T.: "Basic Study of Hip Prosthesis Design: Analysis of Shape of the Femoral Medullary Canal in Japanese Subjects by Computed Tomographic Scanning." Hip Biomechanics, 1993, pp. 289-302.

8. Capello, W. N.; D'Antonio, J.A.; Feinberg, J.R.; Manley, M.T.: "Hydroxyapatite-Coated Total Hip Femoral Components in Patients Less Than Fifty Years Old." Journal of Bone and Joint Surgery, Volume 79-A, Number 7, July 1997, pp. 1023-1029.

9. Feighan, J.E.; Goldberg, V.M.; Davy, D.; Parr, J.A.; Stevenson, S.: "The Influence on Surface-Blasting on the Incorporation of Titanium-Alloy Implants in a Rabbit Intramedullary Model." Journal of Bone and Joint Surgery, Volume 77-A, Number 9, September 1995, pp. 1380-1395.

10. Bal, Sony B.; Vandelune, Dan; Gurba, Dan M.; Jasty, Murali; Harris, William: "Polyethlene Wear in Cases Using Femoral Stems of Similar Geometry, but Different Metals, Porous Layer, and Modularity." The Journal of Arthroplasty, Volume 13, Number 5, 1998.

11. Smith & Nephew Data: "Bead Pull-off Testing of Ti-6Al-4V," In-House Test Data Summary, February 1993.

12. Andersen, P.; Levine, D.: "Adhesion of Fiber Metal Coatings." ASTM STP 953: Quantitative Characterization and Performance of Porous Implants for Hard Tissue Applications, J. Lemons, Ed., ASTM Special Publication, 1987.

13. Robinson, T.; Bearcroft, J.: Smith & Nephew Advanced Technology Report AT-93-14, May 1993.

14. Bobyn, J. D., M. Sc.; Pilliar, R.M., Ph.D.; Cameron, M. B., Ch.B., F.R.C.S.; Weatherly, G.C., Ph.D.; Kent, G.M., D.V.M.: "The Effect of Porous Surface Configuration on the Tensile Strength of Fixation of Implants by Bone Growth." Clinical Orthopaedics and Related Research. Number 149, June 1980.

15. Jaffe, W.L.; Scott, D.F.: "Total Hip Arthroplasty with Hydroxyapatite-Coated Prosthesis." Journal of Bone and Joint Surgery, Volume 78-A, Number 12, Dec. 1996, pp. 1918-1934.

16. Søballe, K.: "Hydroxyapatite Ceramic Coating for Bone Implant Fixation." Acta Orthopaedica Scandinavica. Number 255, Volume 64, 1993.

17. Data on File at Smith & Nephew, TM240601.

18. Data on File at Smith & Nephew, TM328802.

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