The original Tri-Lock® Hip Stem (DePuy Orthopaedics, Warsaw, Ind.) has been in clinical use since 1981 with excellent reported survivorship and low complication rates.1-4

On March 14, 2008, DePuy released an upgraded version of this blade style implant called the Tri-Lock® Bone Preservation Stem. Compared to its predecessor, the Bone Preservation Stem implant is shorter, has a narrower distal segment, and features a curved distal tip. These revised design elements are intended to address patients with narrow femoral canals and further improve its utility in the direct anterior approach surgical technique. Additionally, this femoral stem’s surface interface is a high friction, commercially pure titanium (“Gription™”) that is engineered to provide maximum fixation on the proximal 50% portion. Minor anterior/posterior modifications were made to the stem, but the medial/lateral aspect of the Tri-Lock BPS continues to function as a tapered wedge—and that geometry is original to the 1981 heritage Tri-Lock stem design.

The purpose of this paper is to review a case history of a 34 year old female with an atypically high activity level and unusually narrow femoral canal.
Patient Presentation

This patient is a 34 year old female with two children, the youngest being five months of age.

Patient reports an active lifestyle, including running sports and working out at the gym at least five times per week. Recently, she has been unable to walk the two blocks to get to the gym, because of pain in the right groin and gluteus during weight bearing and twisting activities. She has never had an injury to the hip and no previous surgeries. Her family history revealed that her father has had both hips replaced at a relatively young age. The patient has failed conservative management including NSAIDS, but has had temporary relief with an intra-articular corticosteroid injection into the right hip.

Physical exam showed the patient height at 5’9”, weight of 160lbs, and BMI 23.6. She walks with an antalgic gait on the right, and protects her right hip from range of motion. Patient reports the hip is irritable. She also has frequent stiffness in the hip with internal rotation of 10 degrees on the right compared to the 30 degrees on the left; external rotation of 40 degrees on the right compared to 70 degrees on the left; and flexion of 100 degrees on the right compared to 130 degrees on the left. Her right leg appeared approximately 3-4 mm short when checked in a supine position, and radiographs showed clear signs of progressing osteoarthritis.

The patient’s x-rays demonstrated some dysplasia (shallow socket) of the right hip worse than the left hip. She had significant joint space narrowing, large marginal osteophytes about the femoral head, and a very narrow femoral canal.

Methods and Materials

We recognized the very narrow canal and considered approaching the femur with a ream-and-broach implant such as DePuy’s Summit™ Hip stem. However, I chose the Tri-Lock Bone Preservation Stem, which allows minimum bone disruption and lends itself well to a direct anterior surgical approach.

To ensure the Tri-Lock Bone Preservation Stem would indeed adequately address the patient’s needs, we undertook a templating exercise with specific focus on distal canal size and lateral offset requirements. Given this patient’s dysplastic socket, we also carefully planned the acetabular position and seating in advance of surgery.

For the articulation, we considered a hip resurfacing procedure, but decided against it. The patient is still breast feeding and anticipates another child in the future, so the selection of hip bearing components was considered with these factors in mind. The final bearing surface selected was a nanocomposite ceramic head (Biolox™ Delta, Ceramtec, AG) articulating against a contemporary highly crosslinked polyethylene liner (AltrX™, DePuy Orthopaedics).

Performing the Surgery

We performed a direct anterior approach to the right hip with the patient in a supine position on a standard operating room table. A spinal anesthetic was utilized for muscle relaxation. A size 52mm Pinnacle™ cup was utilized along with a 36 mm AltrX polyethylene liner, +4mm neutral. During the reaming process it was necessary to ream medially in order to gain adequate coverage of the Pinnacle acetabular shell. This lent itself well to utilizing the +4mm offset polyethylene liner, to restore center rotation of the femoral head.

Prior to performing the femoral broaching I sounded the canal medially to avoid any concerns of broach penetration. I utilized the starter broach, and even that encountered significant resistance due to the patient’s hard bone, petite anatomy, and narrow canal. Repetitive broaching was then performed with a size 0 broach. I used a small rongeur to remove some of the lateral bone along the femoral neck. I was then able to increase to a size 1 broach. I serially broached with a size 0 and then back to a size 1 in order to advance the stem to the desired level. I then performed trial reduction and utilized intra-operative fluoroscopy to check my stem position, restoration of offset, and leg length. The x-rays appeared that I could possibly use a larger stem. However, the broaching process was already extensive, up to a size 1. I decided to stay with a size 1. It felt very stable and there was no clear reason to attempt a larger size. The
size I high offset version of the Tri-Lock Bone Preservation Stem was inserted and seated to a level 1 mm proximal to the final broach. The bone envelope in this patient was well maintained in its rectangular shape and I did not have to add any bone graft A/P.

Postoperative Course

The patient was discharged on postoperative day two with instructions to maintain less than 50% weight bearing on the right hip for two weeks. Despite that the Direct Anterior Surgical Approach generally provides for a faster, less painful recovery, the physiology of bony and tissue ingrowth requires more than just a few days’ rest. Therefore, I advise my patients to take it easy and avoid rigorous physical activity and maintain 50% weight bearing only so as to permit the femoral and acetabular bones to completely accept the implanted components.

Physical therapy was utilized in the hospital for gait training, and a limited amount of physical therapy was utilized after discharge. We specifically avoided any active straight leg raising, squats, or repetitive abduction exercises.

This patient’s post operative course was uneventful and highly successful. At five months, the patient reported intermittent thigh ache during and following her daily workout routine that included an elliptical machine and stationary bike. If she diminished her activities somewhat and utilized cross training, her thigh ache went away.

At the one year follow up, the patient noted no thigh ache, even as she gradually resumed her five days per week workout routine. She stated that initially her operated leg felt too long, but at the one year interval she feels that her legs are of equal length. The patient’s legs have been clinically measured to be equal length.

Discussion

While performing total hip arthroplasty in a young patient, the surgeon often encounters a very narrow canal or “Type A Femur.” Surgical options would include hip resurfacing, or the use of a reamed implant, which sacrifices bone. A cemented stem would generally be avoided in somebody of this young age. The Tri-Lock BPS has a shortened distal stem and narrowed medial/lateral dimension to accommodate for narrow canals. In my experience with the Tri-Lock BPS, I have come to gain confidence in broaching more firmly than with other implant systems. I strike the broach a bit harder and continue this serial broaching process until I feel like there is good fit. I have never experienced any femoral fractures, especially in patients with narrow canals. I think that there is significant mid-stem fit with this design at the distal half of the Gription™ porous coating. This occurs in an area where femur fractures are unlikely, as there is little splitting force at the proximal femoral neck. This is an unreamed system and relies entirely on broaching.

I would reiterate that it is of the utmost importance to protect the weight bearing force for a period of time and avoid excessively rigorous rehabilitation post operatively. This has the potential to add excessive torsion to the stem prior to maturation of tissue ingrowth into the Gription ingrowth porous coating. Whether the patient is young or old, there is a biological process which takes time for bone ingrowth. Therefore, I instruct the physical therapist not to be too aggressive. In the same line of thinking, it is possible that the use of preemptive analgetic program with non-steroidals will slow bone growth.
Conclusion

The Tri-Lock Bone Preservation Stem and Pinnacle cup system utilizing BioLox delta ceramic head and cross linked polyethylene AltrX, I believe, will provide a very durable product in this young lady who may consider becoming pregnant again. The Tri-Lock BPS femoral system, in particular, accommodated the patient’s very narrow canal with minimal loss of bone in the region of her isthmus. Further, the direct anterior approach allowed the supine positioning in the use of fluoroscopy in surgery. It also allowed me to intra-operatively direct comparison of the patient’s foot position to accurately establish component positioning, restoration of offset and leg length. I continue to treat many of my patients, including the younger, active patient population, through the direct anterior approach with the Tri-Lock Bone Preservation Stem.

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References


Total Hip Prostheses, Self-Centering™ Hip Prostheses and Hemi-Hip Prostheses

IMPORTANT This Essential Product Information sheet does not include all of the information necessary for selection and use of a device. Please see full labeling for all necessary information.

INTENDED USE/INDICATIONS Total Hip Arthroplasty (THA) is intended to provide increased patient mobility and reduce pain by replacing the damaged hip joint articulation in patients where there is evidence of sufficient sound bone to seat and support the components.

THA IS INDICATED for a severely painful and/or disabled joint from osteoarthritis, traumatic arthritis, rheumatoid arthritis or congenital hip dysplasia; avascular necrosis of the femoral head; acute traumatic fracture of the femoral head or neck; failed previous hip surgery; and certain cases of ankylosis. Self-Centering Hip Prostheses and Hemi-Hip Prostheses are intended to be used for hemi-hip arthroplasty where there is evidence of a satisfactory natural acetabulum and sufficient femoral bone to seat and support the femoral stem.

HEMI-HIP ARTHROPLASTY IS INDICATED in the following conditions: Acute fracture of the femoral head or neck that cannot be reduced and treated with internal fixation; fracture dislocation of the hip that cannot be appropriately reduced and treated with internal fixation; avascular necrosis of the femoral head; non-union of femoral neck fractures; certain high subcapital and femoral neck fractures in the elderly; degenerative arthritis involving only the femoral head in which the acetabulum does not require replacement; and pathology involving only the femoral head/neck and/or proximal femur that can be adequately treated by hemi-hip arthroplasty.

CONTRAINDICATIONS

THA AND HEMI-HIP ARTHROPLASTY ARE CONTRAINDICATED IN CASES OF: active local or systemic infection; loss of musculature, neuromuscular compromise or vascular deficiency in the affected limb, rendering the procedure unjustifiable; poor bone quality; Charcot’s or Paget’s disease; for hemi-hip arthroplasty – pathological conditions of the acetabulum that preclude the use of the natural acetabulum as an appropriate articular surface. Ceramic heads are contraindicated in revision surgery when the femoral stem is not being replaced or for use with any other than a polyethylene or metal-backed polyethylene cup. In the USA and Canada, ceramic heads are not approved for use with metal inserts.

WARNINGS AND PRECAUTIONS Ceramic coated femoral stem prostheses are indicated for uncemented press fit fixation.

CAUTION: DO NOT USE BONE CEMENT FOR FIXATION OF A CERAMIC COATED PROSTHESIS.

Components labeled for “Cemented Use Only” are to be implanted only with bone cement. The following conditions tend to adversely affect hip replacement implants: excessive patient weight, high levels of patient activity, likelihood of falls, poor bone stock, metabolic disorders, history of infections, severe deformities leading to impaired fixation or improper positioning, tumors of the supporting bone structures, allergic reactions to materials, tissue reactions, and disabilities of other joints.

ADVERSE EVENTS The following are the most frequent adverse events after hip arthroplasty: change in position of the components, loosening of components, wear or fracture of components, dislocation, infection, peripheral neuropathies, tissue reaction.

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Printed in USA.
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