Modular Reach®

Revision Hip System

BIOMET ORTHOPEDICS, INC.

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Design Rationale

Mismatch of the femoral metaphysis and the diaphysis can present a major challenge for the orthopaedic surgeon in both primary and revision reconstructive surgery. Clinical experience has shown that various anatomical zones have different characteristics and that appropriate fit and fill to achieve a stable construct cannot always be accomplished with a non-modular implant design. The Modular Reach® Revision System addresses these complex reconstructions.

The Modular Reach® proximal component incorporates the sound fundamentals of the clinically proven Bi-Planar taper.[1,2] Coupled to this proximal component is a multitude of titanium distal components with various levels of porous coating and splined geometries to supplement the proximal component. Combining the two modular segments provides a greater opportunity to achieve a long-term stable construct and proximal stress transfer in a variety of femoral geometries.

Features & Benefits of the Modular Reach® Proximal Component

- The proximal segment incorporates a Bi-Planer taper for gradual stress transfer.
- Circumferential closed pore plasma spray (for a tight seal of the effective joint space throughout the proximal femur).
- Proximal segments are offered in collared and collarless designs to increase stability and load transfer.
- The Modular Reach® proximals utilize a wide variety of distal components to help achieve stability in bone with a metaphyseal and diaphyseal mismatch.
- The proximal and distal segments are secured through a proven Morse-type taper connection.
- A segmental locking screw further enhances the Morse taper connection and helps seal the taper from joint fluid.

Features & Benefits of the Modular Reach® Distal Stems

- Total interchangeability between proximal and distal components allows the system to address a wide variety of femoral geometries.
- Stem lengths range from 70mm to 300mm providing several fixation options for primary reconstruction and bone deficient revisions.
- A variety of distal stem geometries provide additional fixation and stability, addressing a wide range of femurs in the diaphyseal region.
- Titanium plasma spray porous coating is utilized circumferentially on the proximal and some distal segments for enhanced fixation and strength.

Stems clockwise from left: 170mm Impact Distal, 200mm STS™ Stem, 220mm 80% Coated, 300mm 60% Coated, 120mm Impact®, 250mm 40% Coated, 170mm Interlok®, and 165mm 100% Coated.

Femoral Defect Classification

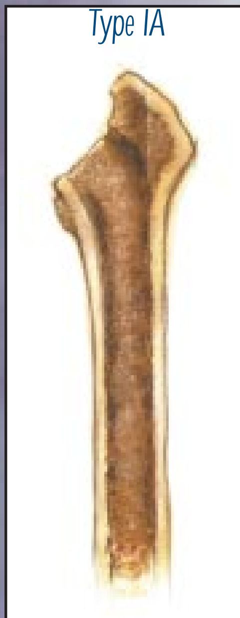


Figure 1

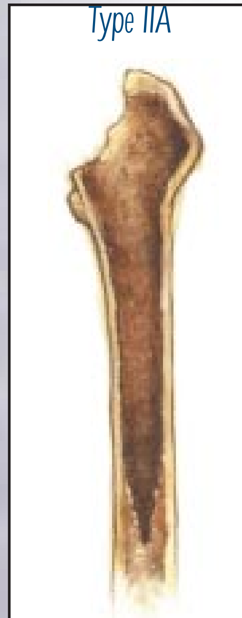


Figure 2

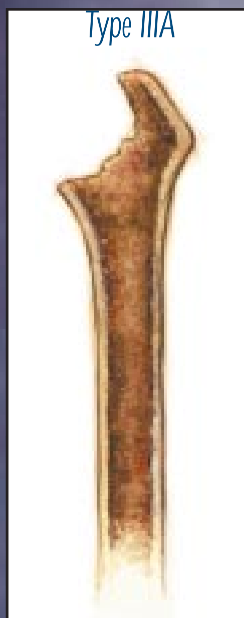


Figure 3

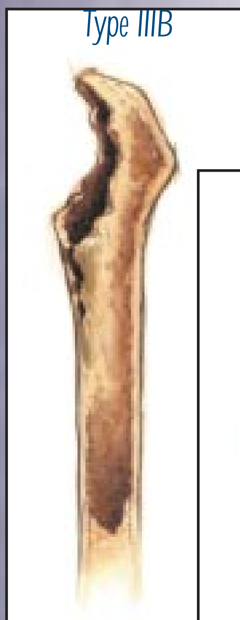


Figure 4

Figure 5

Type IA Femoral Defect

In the Type 1 femur, (Figure 1) medullary contents remain intact, offering two options for fixation. Cement can be used in this type of femur, taking advantage of existing microporosity.[3,4] A porous implant can also be utilized, to take advantage of the intact contents of the medullary canal.

Type IIA Femoral Defect

With the proximal femur compromised because of the deficient cancellous content, distal fixation beyond the previous prosthesis should be utilized or supplemented by a proximal off-loading component (Figure 2). This concept utilizes the intact cortical tube for support and stability. Such fixation requirements necessitate long-stemmed devices press-fit into the isthmus, distal to the midshaft of the femur. Proximally, the prosthesis should have design features that will grasp the thin cortex of the femur and prevent rotation.[4]

Type IIIA Femoral Defect

In the Type IIIA femoral defect, both the medullary contents and the cortical tube in the femoral neck region have been destroyed. This deficiency exists from the proximal femur to the level of the lesser trochanter and greatly reduces rotational stability[4] (Figure 3). A modular cementless implant may be used in this situation due to the large metaphyseal defect and smaller diaphyseal area.

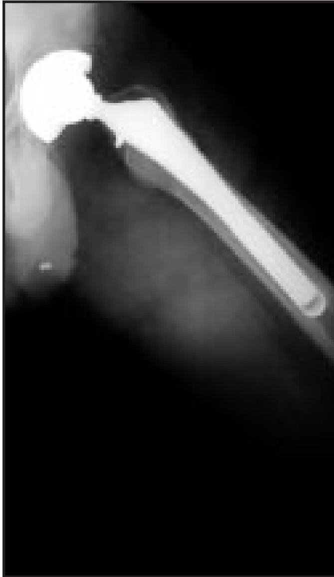
Type IIIB Femoral Defect

In the Type IIIB femoral defect both cortical tube and medullary contents are deficient. The deficiency exists from the proximal femur to the level of the isthmus[4] (Figure 4). A modular cementless proximal implant utilizing an extended porous coating long distal stem or a long splined stem would be useful in this situation for added rotational stability.

Type IIIC Femoral Defect

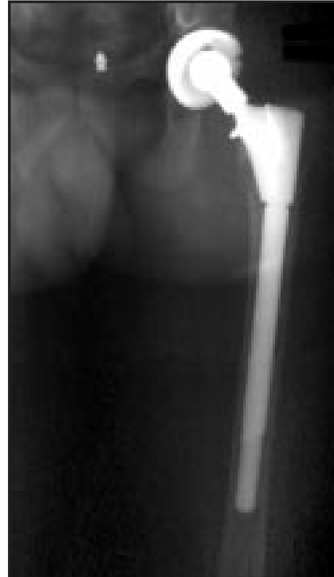
In the Type IIIC femoral defect both cortical tube and medullary contents are deficient. The deficiency exists from the proximal femur to the level of the isthmus[4] (Figure 5). A proximal load bearing calcar modular component utilizing an extensive coated long distal stem or long splined stem could be used in this defect.

Case Histories



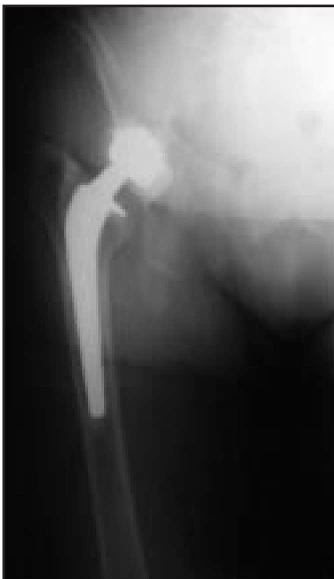
Preoperative Evaluation

Painful hip of 48-year old male renal transplant patient with aseptic failure due to polyethylene wear of an uncemented porous hemispherical cup. The uncemented stem appears loose on X-ray. Proximal bone loss is present due to osteolysis.



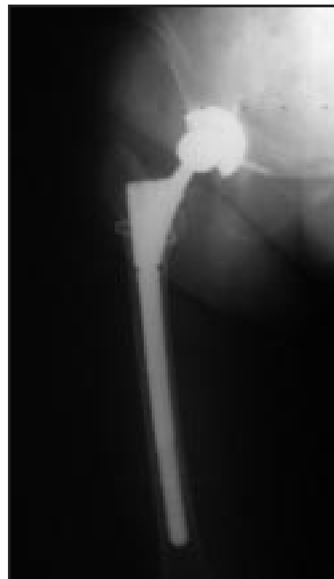
Postoperative Evaluation

Stem and socket were revised with a porous uncemented acetabular shell and ArCom® polyethylene liner. The femoral implant was revised with a size 3 collared Modular Reach® proximal and a 200mm STS™ distal stem, because of the proximal/distal mismatch created by proximal osteolysis. The revision implant is stable and the patient is pain free.



Preoperative Evaluation

A 76-year old female with aseptic failure of femoral stem and acetabular cup. The stem shows signs of subsidence and polyethylene wear is present in the socket.



Postoperative Evaluation

The patient was revised to a porous hemispherical acetabular shell with an ArCom® polyethylene liner. On the femoral side the collarless Modular Reach® was used with a 200mm STS™ distal stem to provide enhanced fit and fill of the revised femoral canal.

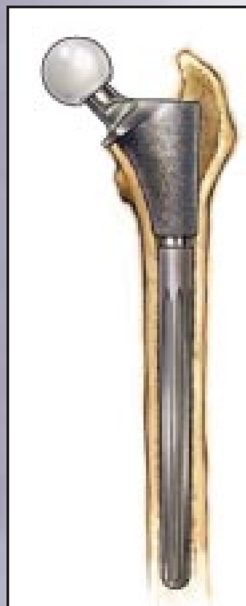
The Modular Reach® Hip System is cleared for press-fit applications for the following indications: non-inflammatory osteoarthritis, avascular necrosis, rheumatoid arthritis, revisions of hip replacement components, treatment of non-union, femoral neck and trochanteric fractures of the proximal femur with head involvement.

Surgical Technique

Preoperative Planning

Preoperative Defect

Trial


Final Implant

In planning for revision hip replacement, it is necessary to have an AP X-ray of the pelvis, AP X-ray of the entire femur, and a Lowenstein lateral of the femur. It is recommended that the Modular Reach® System be used in type I, II, and IIIA bone. However the femoral component must be stable and have host bone support of at least fifty percent to obtain a predictable result. X-ray templates can be utilized to approximate the desired resection level along with determining diaphyseal component fill.

Ideally, when templating for the proximal body it should be noted that the system is designed for a neck resection level of 8–10mm above the lesser trochanter. This should provide an accurate intraoperative landmark for placement of the stem; however, when medial bone is missing such that this landmark is unavailable, templating should also measure the distance using the greater trochanter.

Surgeon discretion is used to determine the level of placement and overall sizing of the implant. Prosthetic placement should respect the usual pattern of load distribution in the proximal femur. Care should be taken to choose the size that is not too small (avoiding subsidence) nor too large (avoiding overstuffing bone with metal). In those cases where this is not possible, the surgeon may choose a Mallory-Head® Modular Calcar proximal component.

When templating for the distal component, care should be taken to choose a length that extends past the most distal defect by 2 circumferences of the canal (roughly 2–4cm). The level of porous coating (40%, 60%, 80%, or 100%) can be chosen at this time.

The Modular Reach® surgical technique is utilized by Edward McPherson, M.D., and Michael Welch, M.D. Biomet, as the manufacturer of this device, does not practice medicine and does not recommend this or any other surgical technique for use on a specific patient. The surgeon who performs any implant procedure is responsible for determining and using the appropriate techniques for implanting the prosthesis in each individual patient. Biomet is not responsible for selection of the appropriate surgical technique to be used for an individual patient.

Exposure of the Femur

Reaming

Flexible reamers over a guide wire are utilized to ensure safe distal reaming when a bowed distal stem is preferred. The distal femoral reaming for the 220, 250, and 300mm should progress to approximately 1mm over the greatest outside diameter of selected implant size to accommodate the bow of the component and porous coating. Extensive coating (80%–100% porous coating) or varying bone quality may require additional over-reaming at the discretion of the surgeon (Figure 1).

Reaming for the Mallory-Head® STS™ (splined taper straight) distal stem requires the use of the STS™ reamers. STS™ reamers are advanced into the canal until cortical chatter is obtained. A line-to-line fit is recommended for the STS™ stem. Four lines on the reamer identify the various proximal components and STS™ stem lengths. The second line from distal to proximal represents the ream level for the Modular Reach® with 200mm STS™ stem, and the fourth line represents the ream level for the 240mm STS™ stem. These lines are advanced into the canal until the appropriate mark is at the medial neck resection level (Figure 2).

Figure 1

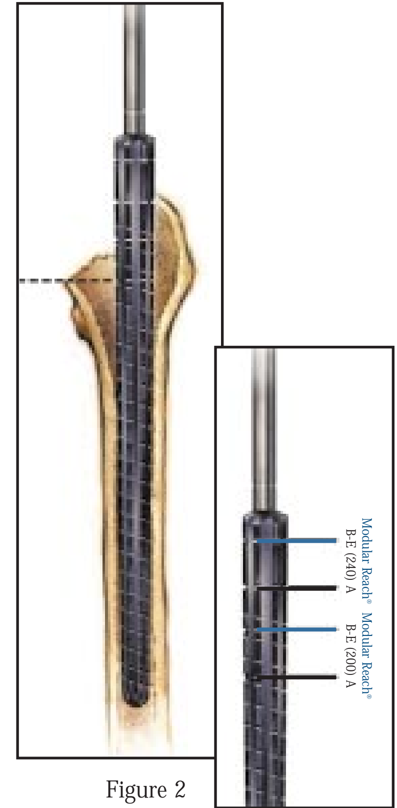


Figure 2

Reaming/ Implanting Chart for Biomet Distal Options	**Impact® Stem 70, 90, 120, 140(straight) and 170mm(bowed) Flexible Reamers Used**	**Mallory-Head® InterLok® Stem 170mm(straight)**	**Mallory-Head® 100% Porous Stem 165mm(straight)**	**Mallory-Head® 220, 250 Stem and 300mm(bowed)**	**Mallory-Head® STS™ 200 Stem and 240mm(straight)**
Recommended Ream	Line to line with cylindrical reamers i.e. Ream 13mm Implant 13mm Bowed–use flexible reamers	Line to line with cylindrical reamers i.e. Ream 13mm Implant 13mm	Over Ream by .5mm cylindrical reamers i.e. Ream 13.5mm Implant 13mm	Over Ream by 1mm with flexible reamer i.e. Ream to 14mm Implant 13mm Use flexible reamers	Line to line with STS™ reamers i.e. Ream to 15mm Implant 15mm Ream to 2nd line = 200mm Ream to 4th line = 240mm
Amount of Press Fit	1⁄4mm per side or 1⁄2mm total	None	1mm to 1.5mm circumferentially	1mm to 1.5mm circumferentially	Splines engage 1/2mm per side or 1mm circumferentially
Distal Provisional Used	Use same size distal diameter as reamed	Use same size distal diameter as reamed	Use 1mm smaller distal diameter than reamed i.e. Ream to 14mm use 13mm trial	Use 1mm smaller distal diameter than reamed i.e. Ream to 14mm use 13mm trial	Use same STS™ distal stem provisional as ream diameter
Implant	Same size as reamed	Same size as reamed	1mm smaller than reamed	1mm to 1.5mm smaller than reamed	Same size as reamed
Overall Length From Resection Level to Distal Tip	70mm = 114mm 90mm = 134mm 120mm = 164mm 140mm = 184mm 170mm = 214mm	170mm	165mm	220mm 250mm 300mm	200mm 240mm

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Broaching

Broach Assembly

The 170mm distal pilots are recommended when broaching. Select a distal pilot based on the last size reamer utilized (Example: If flexible reaming to 14mm, select 13mm distal pilot). The appropriate sized distal pilots are attached to the selected proximal broach by the means of a self-contained segmental locking screw located in the proximal broach/trial. The screw is tightened with a 3.5mm screwdriver. If STS™ implants are being utilized, select the same diameter STS™ distal provisional as reamed (Figure 3). This may be used as a pilot for the broach, and as a trial.

Broach Insertion

Upon assembly of the broach, insert it into the femur to contour the proximal envelope. In the atrophic femur, for maximum bone stock preservation, gentle sculpting with a high speed surgical cutting tool is preferred over aggressive broaching. The distal pilot helps to assure proper alignment with the shaft axis. Carefully advance the broach until it becomes snug. Sequentially larger broaches are used until desired fit is achieved (Figure 4). Intraoperative X-rays may be obtained to ensure optimal sizing of the component and are frequently encouraged and utilized by the designing clinician team.

Trial Reduction

With the final broach still in place, provisional heads are selected to determine the appropriate neck length (Figure 5).

Assembly of Stem

Once the desired version has been determined, the sundial may be utilized to duplicate the version of the provisional (Figure 6). Impact the proximal component onto the distal component on the back table and insert segmental locking screw (Figure 7).

Stem Insertion

Final Trial Reduction

A final trial reduction may be performed off of the final implant to determine proper neck length. Once the correct length head is determined, impact the final femoral head (Figure 8). Closure is performed in a standard fashion.

Ordering Information

Modular Reach® Proximal Body				
Collared Implants	Collarless Implants	Broach/Provisional	170 Distal Provisional	Description
Part No.	**Part No.**	**Part No.**	**Part No.**	
108391	**108291**	31-108291	31-108011	Size #1
108393	**108293**	31-108293	31-108013	Size #2
108395	**108295**	31-108295	31-108015	Size #3
108397	**108297**	31-108297	31-108017	Size #4
108399	**108299**	31-108299	31-108019	Size #5
108401	**108301**	31-108301	31-108021	Size #6

200mm Mallory-Head® STS Distal Stem		
Implants	Provisional	Description
Part No.	**Part No.**	
108740	31-108740	14mm
108741	31-108741	15mm
108742	31-108742	16mm
108743	31-108743	17mm
108744	31-108744	18mm
108745	31-108745	19mm
108746	31-108746	20mm

240mm Mallory-Head® STS Distal Stem		
Implants	Provisional	Description
Part No.	**Part No.**	
108750	31-108750	14mm
108751	31-108751	15mm
108752	31-108752	16mm
108753	31-108753	17mm
108754	31-108754	18mm
108755	31-108755	19mm
108756	31-108756	20mm

Template Modular Reach® System

162485

STS™ Stem Template

108715	200mm stem
108716	240mm stem

Mallory Head® STS™ Reamers

31-108760	14mm
31-108761	15mm
31-108762	16mm
31-108763	17mm
31-108764	18mm
31-108765	19mm
31-108766	20mm

Additional Distal Options

Distal stems from L to R: straight stem Interlok® 170mm; STS® 200mm; STS® 240mm; 40% coated 220mm; 80% coated 220mm; 40% coated 250mm; 80% coated 250mm; 60% coated 300mm; and Impact® distals.

Notes:

References

[1]Head, W.C.: *Mallory-Head Porous Press-Fit Primary Hip Replacement,* Presented at the Tenth Annual International Symposium: New Developments in Total Joint Reconstruction, Lake Tahoe, Nevada, June 14–16, 1993.

[2]Mallory, T.H., Head, W.C.: *Two To Seven Year Follow-Up of 311 Proximal One-Third Plasma Spray Coated, Monolithic Femoral Components in Total Hip Arthroplasty,* Presented at the AAOS, New Orleans, Louisiana, February, 1994.

[3]Charnley, J.: *The Bonding of Prostheses to Bone Cement,* Journal of Bone and Joint Surgery, 16B:518, 1964.

[4]Mallory, T.H.: *Preparation of the Proximal Femur in Cementless Total Hip Revision,* Clinical Orthopedics, 235:47, 1988.

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