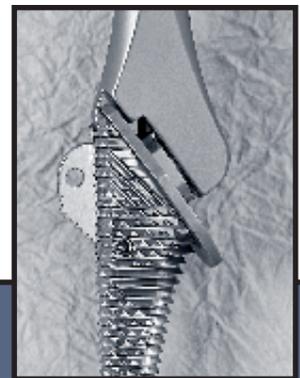
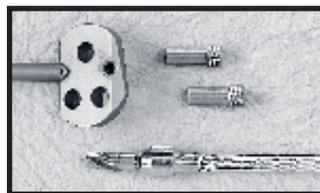
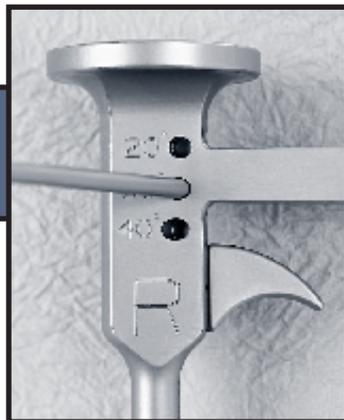


# BIO-MODULAR<sup>®</sup>

C H O I C E

shoulder system



SURGICAL TECHNIQUE

**BIOMET**  
ORTHOPEDICS, INC.

# BIO-MODULAR<sup>®</sup>

## C H O I C E

shoulder system

The Bio-Modular<sup>®</sup> Choice Shoulder System, designed for both total and hemiarthroplasty of the shoulder, has enjoyed nearly two decades of clinical success. The variety of head types and sizes, along with multiple glenoid options, allow the surgeon to better recreate the normal anatomy which is so important in tensioning of the soft tissues for joint stability and providing maximum postoperative function. The modular components also allow the surgeon to better reconstruct the rotator cuff tuberosity mechanism in difficult acute fractures and chronic malunions of the proximal humerus. The reverse Morse taper modular design enables the surgeon to easily revise a hemiarthroplasty by allowing unobstructed access to the glenoid. The modularity in both the implants and instruments, along with the numerous design options throughout, increase intraoperative flexibility, offering the surgeon an excellent overall system to perform arthroplasties tailored to each patient.



This brochure describes the surgical technique used by David M. Dines, M.D., and Russell F. Warren, 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 products and or surgical technique(s) to be used on any individual patient.

## SURGICAL TECHNIQUE

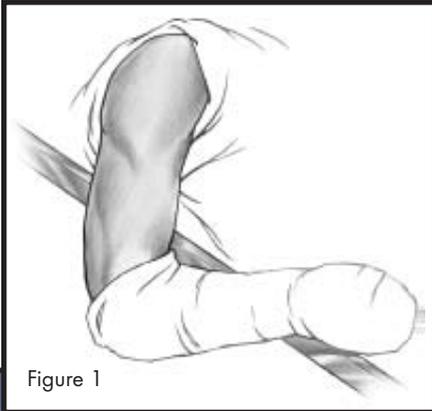


Figure 1

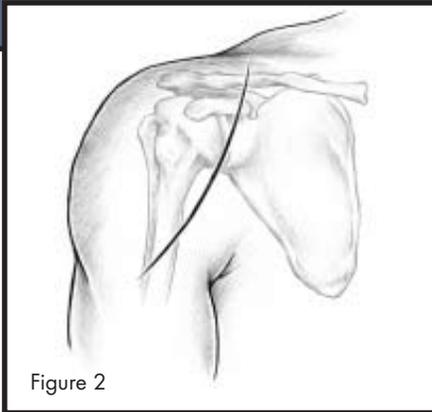


Figure 2

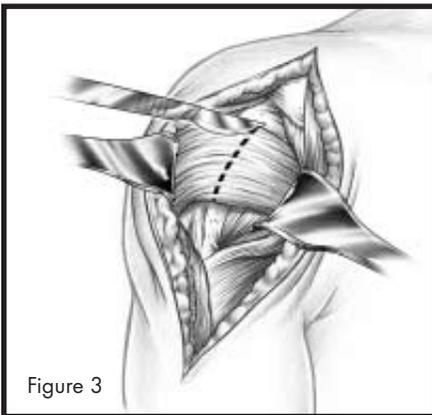


Figure 3

### Surgical Position

Once general anesthesia has been satisfactorily induced, or a supraclavicular nerve block has been given, the patient is placed supine with the affected shoulder positioned as lateral as possible on the operating table. A folded sheet is placed below the scapula and a modified beach chair position is utilized. The arm and shoulder are then prepped and draped free (Figure 1).

### Surgical Incision

The approach utilized is an extended deltopectoral anterior incision that begins immediately above the coracoid process and extends distally and laterally, following the deltopectoral groove along the anterior border of the deltoid (Figure 2). The deltoid muscle is carefully retracted laterally to avoid releasing the deltoid from the clavicle. If necessary, the deltoid may be partially released from its distal insertion by subperiosteal dissection. The conjoint tendon is retracted medially after partially releasing it (less than 1 cm through the tendon) from the coracoid.

Once the anterior structures are identified, the humerus is gently rotated externally, and a longitudinal incision is made through the tendinous portion of the subscapularis muscle and capsule, just medial to the lesser tuberosity (Figure 3). In cases of severe contracture, subscapularis lengthening may be required. The subscapularis tendon may be tagged at this time with non-absorbent sutures. The humerus is now externally rotated and extended to expose the humeral head. The axillary recess, if contracted, will require dissection inferiorly to avoid the axillary nerve.

In cases of hemiarthroplasty for proximal humeral fractures, the approach may have to be modified in order to better visualize the fracture fragments and mobilize the tuberosity fragments for reconstruction.

## Resection of the Humeral Head

Use the appropriate retractors to expose the humeral head and neck.

### Extramedullary Resection

Insert the knurled handle into the appropriate side (for right or left shoulder) of the extramedullary resection guide. Place the guide against the humerus at an appropriate height. Align the long shaft of the guide with the axis of the humeral shaft and the angled resection plate with the anatomical neck. Place the version control rod into the desired version hole and align it with the forearm flexed at 90 degrees. The guide may be pinned to the bone if desired. Use the angled resection plate to guide the saw blade into the humeral head (Figure 4).

### Intramedullary Resection

Using the 6mm reamer, drill a hole through the humeral head along the axis of the humeral shaft. This pilot hole will be just lateral to the articular surface of the head and just medial to the attachment of the rotator cuff. Ream the humeral canal with the 6mm reamer, stopping when the engraved line on the reamer shaft is parallel with the top of the humeral head. Sequentially ream in 1 mm increments until good cortical contact is achieved, leaving the last reamer in place (Figure 5). Remove the T-handle.

### Resection Guide Assembly

Attach the resection block to the short segment of the guide arm and tighten the thumbscrew. Insert the long segment of the guide arm into the appropriate side of the arm slide (labeled "right" and "left") and finger tighten the thumbscrew (Figure 6).

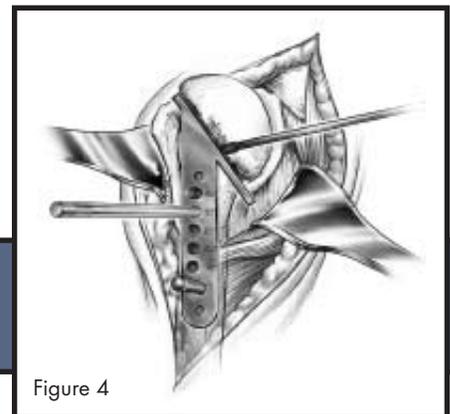


Figure 4

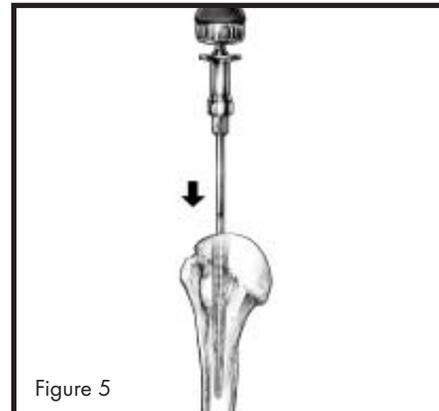


Figure 5

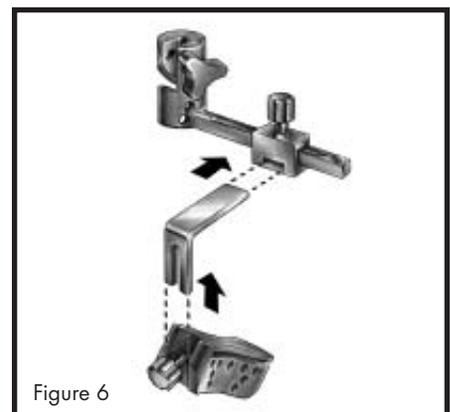


Figure 6

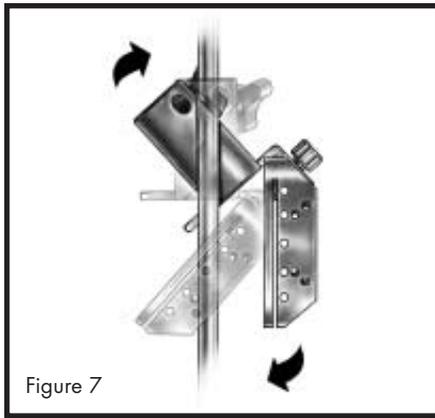


Figure 7

Rotate the entire IM resection guide assembly clockwise until the guide's angled cutout is parallel to the reamer shaft. Insert the reamer shaft into the angled cutout and turn the guide counterclockwise until straight (Figure 7). Finger tighten the thumbscrew. Place the version control rod into the appropriate version hole and align the rod with the forearm flexed at 90 degrees.

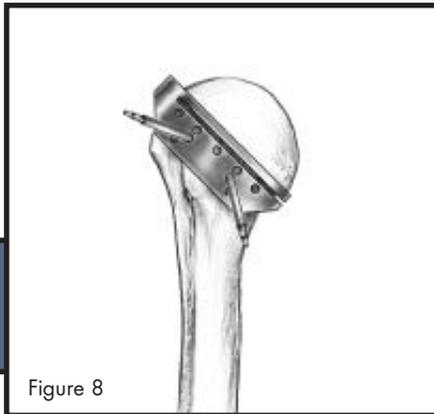


Figure 8

Make final position adjustments using two thumbscrews. Adjust the arm slide thumbscrew for medial/lateral movement and the reamer shaft thumbscrew for height. Once the final position has been set, insert two threaded Steinmann pins through the angled holes in the cutting block and into the bone.

Loosen the thumbscrew on the resection block and the thumbscrew on the reamer shaft. Raise the resection guide until it clears the cutting block then turn it clockwise and remove it from the reamer. Using the ratcheting T-handle, remove the reamer (Figure 8).

Place a saw blade through the cutting slot in the guide. The saw blade should be moving when it comes in contact with the bone. Using several passes, resect the humeral head. Remove the threaded Steinmann pins and the cutting block.

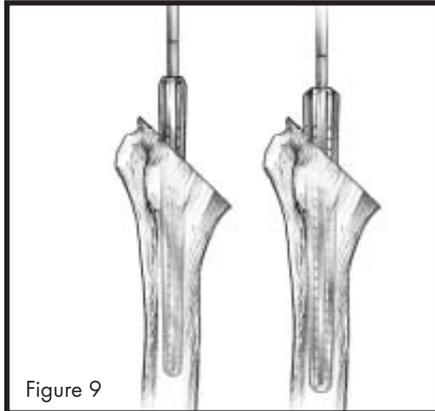


Figure 9

### Humeral Reaming

If the extramedullary resection guide was used in Step 2, proceed by reaming the humeral canal. Using the 6mm reamer, sequentially ream in 1 mm increments until good cortical contact is achieved (Figure 9).

## Humeral Broaching

Select a broach that is at least 2mm smaller than the last reamer used. A collar and a fin may be attached to the broach if desired.

### Collar Attachment

Place the appropriate size collar over the broach taper at a 90 degree angle. Turn the collar until it is fully seated and in the proper position (Figure 10).

### Fin Attachment

Place the modular fin, with teeth facing down, into the slot on the back of the broach. Insert the set screw from the side and tighten with an Allen wrench (Figure 11). If a permanent assembly is desired, apply a medical grade adhesive to the set screw threads. Use caution when broaching with a broach fin so the fin does not interfere with the biceps tendon.

Attach the broach to the broach handle and insert the version control rod into the same position used during resection (Figure 12). Flex the forearm to 90 degrees and externally rotate the arm to be parallel with the version control rod. Sequentially broach in 1 mm increments until good cortical contact is made in the humeral shaft. When using a broach collar, the collar should be seated on the bone resection surface. When a collar is not utilized, insert the broach to the depth where the flat, angled top of the broach is at the level of the resected bone surface. Remove the broach handle, leaving the last broach in place to use as a trial. If a modular fin is not utilized, use the lateral slot on the humeral broach as a guide for the fin broach.

## Humeral Head Selection

Select the appropriate size of head trial based on the size of the resected humeral head. Place the desired head trial type (standard, offset, or Extended Articular Surface) on the broach to recreate the humeral anatomy. If a glenoid component will be used, remove the trial head for improved exposure. The broach can be left in place to protect the humerus.

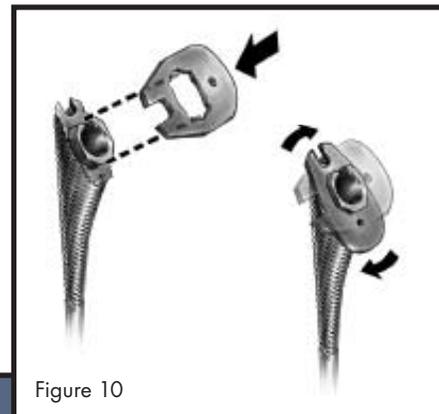


Figure 10

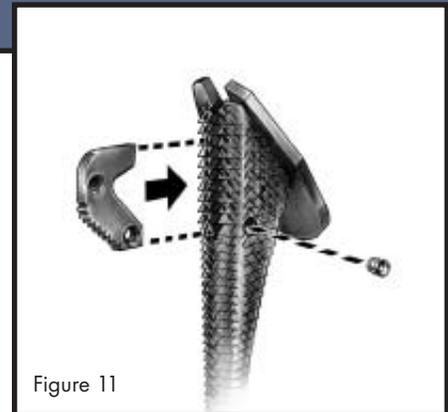


Figure 11

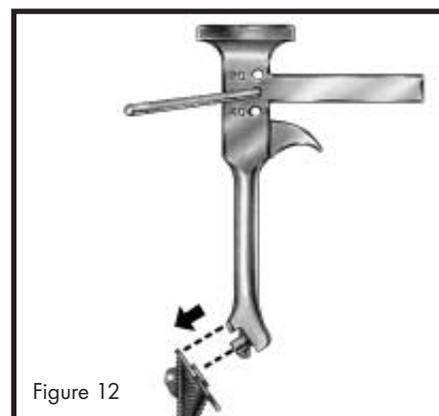


Figure 12

## Glenoid Preparation

Expose the glenoid surface by inserting the appropriate glenoid retractors (Figure 13). Remove the remaining articular cartilage and labrum with sharp dissection, curette, or high speed burr. It is important to preserve the subcondral bone when removing the articular cartilage.

Attach the threaded handle to the drill guide/sizer according to whether a left or right shoulder is being prepared. Place the drill guide/sizer on the glenoid with the wide side placed inferiorly and determine the appropriate size of glenoid implant needed (small, medium, or large). Use the center hole in the drill guide/sizer to drill a 4mm hole in the center of the glenoid (Figure 14).

Attach the appropriate size glenoid reamer (small, medium, or large) to either the straight or angled reamer shaft. Ensure the center peg on the glenoid reamer fits into the center hole on the glenoid prior to reaming. Use the reamer to reshape the glenoid, creating a concentric surface to the glenoid component. Remove as little bone as possible while maintaining or creating neutral glenoid version (Figure 15).

If the porous, screw-fixed component will be used, ream the glenoid with the reamer that has a central cone in the place of the central peg.

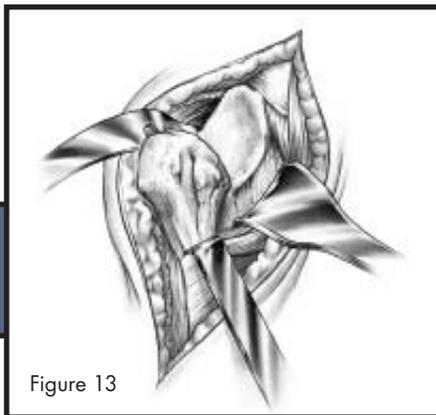


Figure 13

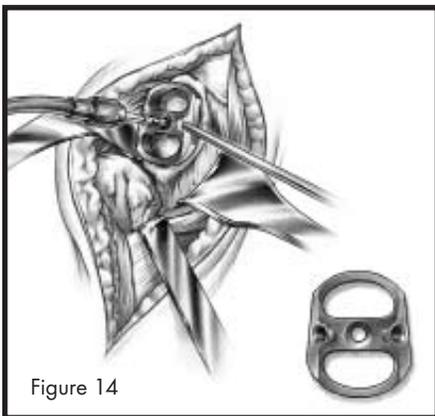


Figure 14

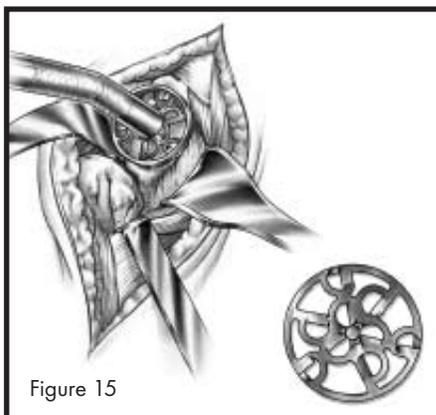


Figure 15

### **Keeled Glenoid**

Attach the threaded handle to the keeled glenoid drill guide according to whether a left or right shoulder is being prepared. Place the drill guide, with the wide side inferior, against the glenoid, ensuring the central peg is in the 4mm center hole on the glenoid. The two spikes on the guide will ensure stability when the guide is placed against the bone.

Using the 4mm drill bit, drill holes angling toward the center of the guide in each of the two slots (Figure 16). Remove the guide and connect the angled holes with a high speed burr. Use the glenoid broach to create the keel slot (Figure 17). Insert the keeled glenoid trial. Reassemble the humeral head trial on the humeral broach/trial and evaluate ROM. Adjustments may be made to the humeral head height or glenoid thickness to properly tension the joint.

### **Pegged Glenoid**

Attach the threaded handle to the three peg glenoid drill guide according to whether a left or right shoulder is being prepared. Place the drill guide, with the wide side inferior, against the glenoid, ensuring the central peg is in the 4mm center hole on the glenoid. The two spikes on the guide will ensure stability when the guide is placed against the bone.

Insert the 1/4" drill bit into the flexible drill shaft and drill three peg holes, beginning with the inferior-posterior hole. The hole depth is correct when the collar on the flexible drill shaft meets the drill guide. Place an anti-rotation pin in each of the first two holes after they are drilled (Figure 18).

Remove the guide and pins. Insert the three peg glenoid trial. Reassemble the humeral head trial on the humeral broach/trial and evaluate ROM. Adjustments may be made to humeral head height to properly tension the joint.

### **Porous Glenoid**

After reaming with the porous glenoid reamer (with cone), place the appropriate porous glenoid trial into the bone. Reassemble the humeral head trial on the broach/trial and evaluate ROM. Adjustments may be made to humeral head height or glenoid thickness to properly tension the joint.

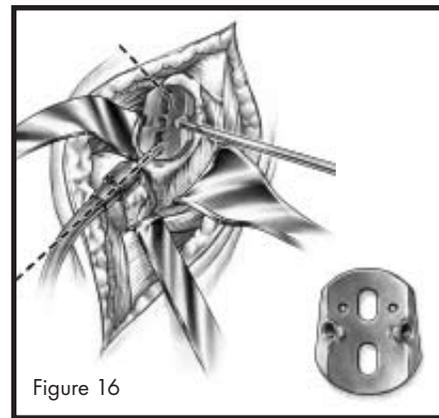


Figure 16

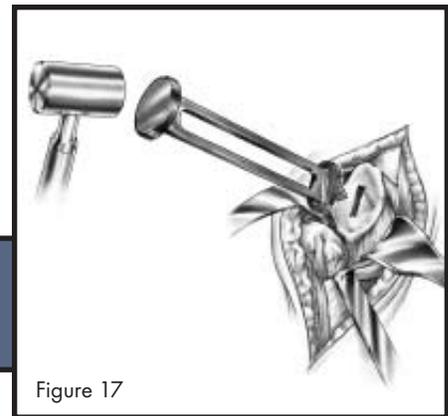


Figure 17

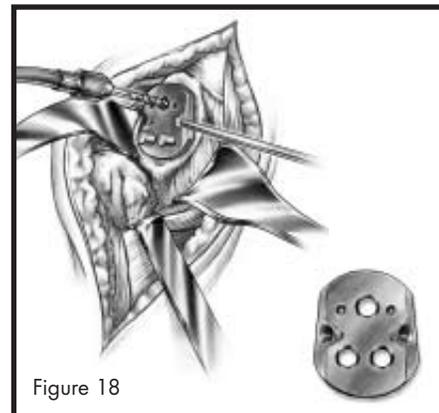


Figure 18

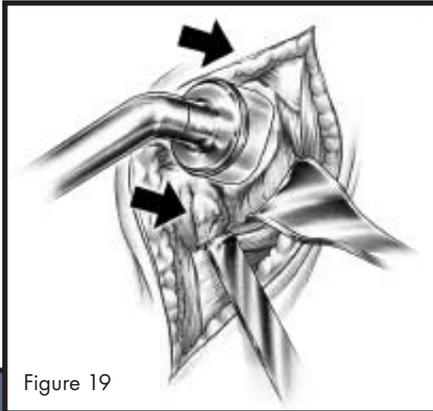


Figure 19

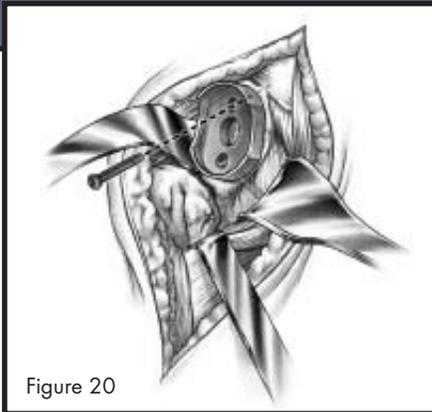


Figure 20

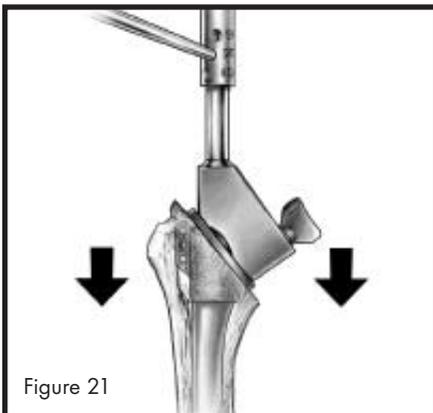


Figure 21

## Glenoid Fixation

### Cement Fixation

Use a high-speed irrigation lavage system prior to cementing the selected glenoid component to cleanse the cortical cancellous surface. Introduce the component into bone cement with digital pressure to ensure proper component fixation. The glenoid impactor may be used to seat the component (Figure 19). Carefully remove all excess cement, particularly posterior to the component where visualization may be impaired.

### Screw Fixation (Modular Porous Glenoid Only)

Attach the porous glenoid tray to the porous tray impactor. Once the component is aligned, impact it into place. Drill the superior and inferior screw holes using the 2.8mm quick connect drill bit, the flexible drill shaft, and the 2.8mm drill guide. Using the appropriate low profile 5mm titanium screws, fix the glenoid tray into the glenoid cavity (Figure 20). Insert the polyethylene glenoid liner into the tray using direct impaction.

## Humeral Stem Insertion

### Press Fit Technique

Attach the broach/trial handle to the broach and remove it from the humeral canal. Assemble the humeral stem onto the stem inserter by threading the thumbscrew on the inserter into the alignment pin hole on the stem. Do not overtighten. Place the version control rod into the desired version hole and align it with the forearm flexed at 90 degrees. Insert the stem into the humeral canal, impacting if necessary (Figure 21). Release and remove the inserter.

### Cemented Technique

Attach the broach/trial handle to the broach and remove it from the humeral canal. Select a humeral stem 2mm smaller than the final broach/trial used. Assemble the humeral stem onto the inserter by threading the thumbscrew on the inserter into the alignment pin hole on the stem. Do not overtighten. Place the version control rod into the desired version hole on the inserter. Use a pulsating lavage/suction unit to thoroughly clean the humeral canal. Dry the canal with absorbent gauze and inject doughy cement in a retrograde manner, completely filling the humeral canal. Progressively introduce the implant into the canal, keeping the alignment rod in line with the forearm, until the desired position is attained. Remove all excess cement.

## Humeral Head Insertion

Thoroughly clean and dry the reverse Morse taper. Place the appropriate size/style humeral head onto the humeral stem. Use the humeral head impactor to impact the head onto the stem (Figure 22).

When using the offset humeral head an alignment pin option is available. The pin, packaged with the implant, is inserted into the threaded hole below the taper on the stem. The offset trial and head can then be placed in one of eight preset positions. Alternatively, the pin can be discarded and the humeral head implant placed in any position.

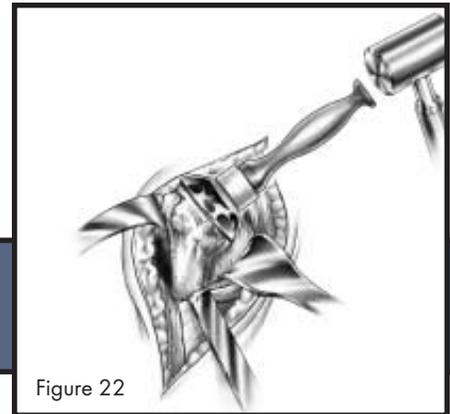


Figure 22

---

## POSTOPERATIVE CARE

At the time of the subscapularis tendon repair the surgeon should evaluate the limits of external rotation. Knowing this, he/she can better decide on the amount of external rotation to allow during the rehabilitation period.

The patient is immobilized in a sling and swathe for 24 hours. Active motion of the hand and elbow are encouraged early on. Gentle passive range of motion is begun on day two, postoperatively, depending on the fixation of the tuberosities. Generally active assisted elevation can be initiated three to four days after surgery.

# ORDERING INFORMATION – IMPLANTS

Standard Humeral Heads	
Part No.	Size
113760	40x15mm
113762	40x20mm
113757	40x22mm
113763	44x15mm
113764	44x17mm
113766	44x22mm
113768	44x27mm
113769	48x19mm
113770	48x24mm
113771	48x27mm
113772	54x22mm
113775	54x24mm
113774	54x27mm

Humeral Stem Prosthesis	
Part No.	Diameter
11-113702	6x70mm
11-113700	6x115mm
11-113703	7x115mm
11-113704	8x115mm
11-113705	9x115mm
11-113706	10x115mm
11-113707	11x115mm
11-113708	12x115mm
11-113709	13x115mm
11-113710	14x115mm
11-113711	15x115mm
11-113800	7x190mm
11-113802	9x190mm
11-113804	11x190mm
11-113806	13x190mm

Centering Sleeves	
Part No.	Diameter
113789	6mm
113790	7mm
113791	8mm
113792	9mm
113793	10mm
113794	11mm
113795	12mm
113796	13mm

Offset Humeral Heads	
Part No.	Size
113921	44x17mm
113922	44x22mm
113923	44x27mm
113924	48x19mm
113925	48x24mm
113926	48x27mm
113927	54x22mm
113928	54x24mm
113929	54x27mm

All-Poly Keeled Glenoid Component	
Part No.	Size
113849	Small, 4mm
113850	Small, 7mm
113851	Medium, 4mm
113852	Medium, 7mm
113853	Large, 4mm
113854	Large, 7mm

5mm Titanium Glenoid Screws	
Part No.	Length
113843	15mm
113844	20mm
113845	25mm
113846	30mm
113847	35mm
113848	40mm

Modular Glenoid Component – Tray	
Part No.	Size
113930	Small
113933	Medium
113936	Large

Extended Articular Surface Heads	
Part No.	Outer Diameter
113880	40x15mm
113882	40x20mm
113884	44x17mm
113886	44x22mm
113888	44x27mm
113890	48x19mm
113892	48x24mm
113894	54x22mm
113896	54x24mm

All-Poly Pegged Glenoid Component	
Part No.	Size
113870	Small, 4mm
113872	Medium, 4mm
113874	Large, 4mm

Modular Glenoid Component – Poly Liner	
Part No.	Size
113931	Small, 4mm
113932	Small, 6mm
113934	Medium, 4mm
113935	Medium, 6mm
113937	Large, 4mm
113938	Large, 6mm

# ORDERING INFORMATION – INSTRUMENTATION

## Humeral Resection and Reamer Instrumentation – Case #1

### Humeral Reamer

406806	6mm
406807	7mm
406808	8mm
406809	9mm
406810	10mm
406811	11mm
406812	12mm
406813	13mm
406814	14mm
406815	15mm
406816	16mm
406817	17mm



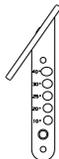
### Ratcheting T-Handle

406801



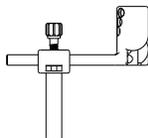
### E/M Humeral Resection Guide

406527



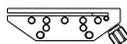
### I/M Humeral Resection Guide Boom

406625



### I/M Humeral Resection Guide Block

406627



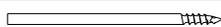
### Replacement Version Control Rod

406802



### Threaded Steinmann Pins (sterile)

406669



## Humeral Broach/Trials, Insertion and Extraction Instrumentation – Case #2

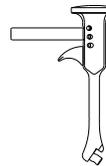
### Broach/Trial

406735	6x70mm
406736	6mm
406737	7mm
406738	8mm
406739	9mm
406740	10mm
406741	11mm
406742	12mm
406743	13mm
406744	14mm
406745	15mm
406746	16mm
406747	17mm



### Broach/Trial Handle

406730



### Fin Broach

406731



### Modular Broach Fin

406732



### Modular Broach Fin—Extra Screw

406769



### Broach Collar

406760	6/7mm
406761	8/9mm
406762	10/11mm
406763	12/13mm
406764	14/15mm
406765	16/17mm



### Humeral Extractor

406624



### Humeral Inserter

406623



### Low Profile Inserter/Extractor Replacement Bolt

406628



### Slide Hammer

31-473621



**Humeral Head Trials –  
Case #3**

**Head Trial**

406528	40x22
406530	40x15
406532	40x20
406533	44x15
406534	44x17
406536	44x22
406538	44x27
406529	48x19
406540	48x24
406531	48x27
406537	54x22
406535	54x24
406539	54x27



**EAS Head Trial**

406680	40x15
406682	40x20
406684	44x17
406686	44x22
406688	44x27
406690	48x19
406692	48x24
406694	54x22
406696	54x24



**Humeral Head Remover**

406515



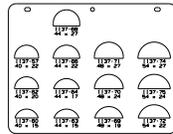
**Humeral Head Impactor**

406514



**Head Sizing Template**

406496



**Offset Head Trial**

406721	44x17
406722	44x22
406723	44x27
406724	48x19
406725	48x24
406726	48x27
406727	54x22
406728	54x24
406729	54x27



**3.0mm Hex Driver**

406698



**Offset Head Trial Alignment Pin  
(sterile)**

406718



**Offset Head Broach Collar**

406767



**Instrumentation Cases/  
Trays**

**Humeral Resection/Reamer  
Case #1**

595164

**Humeral Resection Reamer Tray**

595168

**Humeral Broach Case #2**

595165

**Humeral Broach Tray**

595169

**Humeral Head Trials Case #3**

595166

**Humeral Head Trials Tray**

595170

**Glenoid Instrumentation/Trials  
Case #4**

595167

**Glenoid Instrumentation/Trials Top  
Tray**

595171

**Glenoid Porous Glenoid Bottom  
Tray**

595172

**X-Ray Templates**

**Bio-Modular® Choice X-Ray  
Templates (16 pages)**

406850

# ORDERING INFORMATION – INSTRUMENTATION

## All-Poly Glenoid Instrumentation – Case #4a

### Modular Glenoid Guide Handle

406849 

### Glenoid Sizer/Center Hole Guide

406831 Small   
 406832 Medium  
 406833 Large

### Flexible Shaft

424400 

### Universal Drill Shaft

406636 

### Glenoid Center Hole Drill Bit

406588 

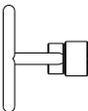
### Glenoid Reamer Shaft, Straight

402648 

### Glenoid Reamer Shaft, Angled

406521 

### Glenoid Reamer Shaft T-Handle, Angled

406596 

### Glenoid Reamer Wrench

406525 

### All Poly Glenoid Reamer

406632 Small   
 406633 Medium  
 406634 Large

### Keeled Glenoid Drill Guide

406837 Small   
 406838 Medium  
 406839 Large

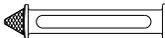
### Keeled Glenoid Trial, 4mm

406574 Small   
 406575 Medium  
 406576 Large

### Keeled Glenoid Trial, 7mm

406577 Small   
 406578 Medium  
 406579 Large

### Glenoid Keel Broach

406587 

### Pegged Glenoid Drill Guide

406843 Small   
 406844 Medium  
 406845 Large

### Pegged Glenoid Trial, 4mm

406597 Small   
 406599 Medium  
 406601 Large

### Pegged Glenoid Drill Bit

406630 

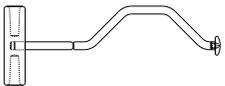
### Pegged Glenoid Drill Guide Alignment Pin

406631 

### Pegged Glenoid Drill Guide Alignment Pin (with groove)

406638 

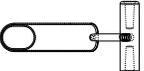
### Glenoid Pusher

406639 

### Ring Retractor, Bent

994500850 

### Ring Retractor, Large Fukuda

406699 

**Modular Glenoid  
 Instrumentation – Case #4b**

**Porous Glenoid Reamer**

406584	Small	
406586	Medium	
406589	Large	

**Porous Glenoid Trial, 4mm**

406640	Small	
406642	Medium	
406644	Large	

**Porous Glenoid Trial, 6mm**

406641	Small	
406643	Medium	
406645	Large	

**Drill Guide, 2.8mm**

424412	
--------	---

**Screw Forceps**

424417	
--------	---

**Universal Screw Driver**

424423	
--------	---

**Glenoid Drill Bit (sterile)**

25-424505	2.8x20mm	
25-424506	2.8x30mm	
25-424507	2.8x40mm	

**Porous Glenoid Tray Impactor**

406618	
--------	---

Bio-Modular® and ArCom® are trademarks of  
Biomet Manufacturing Corp., or one of its subsidiaries.

**BIOMET**

ORTHOPEDICS, INC.

**THE MOST RESPONSIVE COMPANY IN ORTHOPEDICS<sup>SM</sup>**

P.O. Box 587, Warsaw, IN 46581-0587 • 574.267.6639 • ©2004 Biomet Orthopedics, Inc. All Rights Reserved

web site: [www.biomet.com](http://www.biomet.com) • eMail: [biomet@biomet.com](mailto:biomet@biomet.com)

Form No. Y-BMT-827/051504/M