GLOBAL® | ADVANTAGE®

SHOULDER ARTHROPLASTY SYSTEM

Surgical Technique

never stop moving™

DePuy Orthopaedics Inc.
a Johnson & Johnson company

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Design Rationale

The Design

The multiple sizes of the glenoids, humeral bodies and heads allow the Global® Advantage® Shoulder System to be used worldwide. Its design is based on the detailed investigations of the structure and mechanics of normal and prosthetic glenohumeral joints conducted at the University of Texas at San Antonio, University of Washington, University of Pennsylvania and DePuy Orthopaedics, Inc., Warsaw, Indiana.

The challenges encountered by shoulder arthroplasty surgeons include surgical exposure, soft tissue balancing and component fixation. The instruments, technique and components of this arthroplasty system are designed to address these challenges.

The Global Advantage Humeral Body

The Global Advantage humeral component achieves versatility through its two parts: the body and the head. Through extensive cadaveric evaluation, the body was designed to optimize the fit and fill of the proximal humerus. From this evaluation, a family of humeral body sizes has been designed to fit the wide range of humeral canals. A total of six body sizes are available with stem diameters ranging from 6 to 16mm. The humeral body is constructed of high strength titanium alloy, which affords exceptional biocompatibility.

Proper fit in the humeral canal aids in proper varus-valgus alignment. Proper fit in the metaphysis, combined with the collar, provides stability against subsidence. The four fins provide additional rotational control.

A unique system of humeral cutting and broaching instruments helps achieve optimal alignment and stability with minimal bone resection.

The Global Advantage Humeral Head

The Global Advantage shoulder offers a full range of 15 standard and 8 eccentric humeral head components designed to fit all body configurations. When impacted on the humeral body, the Global Advantage humeral heads fit over the collar. This feature optimizes the articulating surface area for a more anatomic replacement. The eccentric heads help ensure complete coverage of the cut surface of the proximal humerus and maintain the head 5 to 10mm above the top of the greater tuberosity. This is an important feature since proper selection of the head diameter and neck length is critical in balancing the soft tissue. The Global Advantage humeral head is constructed of cobalt chrome alloy, which provides excellent wear characteristics.

The head is joined to the body by a reverse Morse taper lock. By having the stem of this taper lock on the humeral head, the surgeon

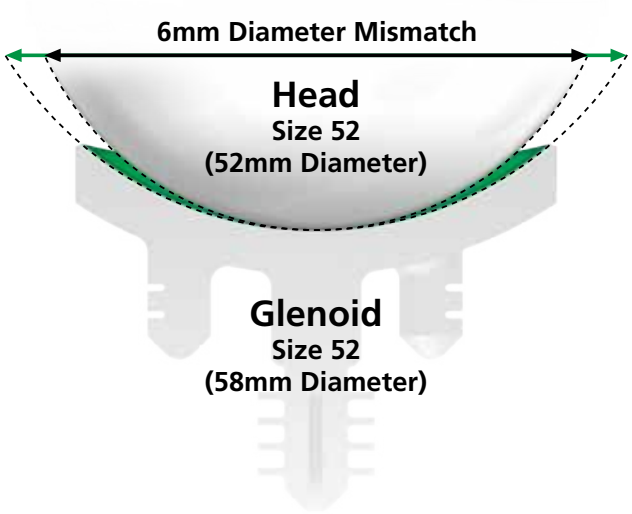
is afforded optimal working space in the joint after the humeral body has been implanted. This feature is particularly valuable in the revision of a hemiarthroplasty to a total arthroplasty.

The Glenoid

In a glenohumeral arthroplasty, the surgeon seeks to restore the glenoid articulating surface with minimal loss of of joint volume and glenoid bone stock. Overstuffing the joint (using prostheses that are bigger than the amount of bone removed) can contribute to impaired range of motion, loss of bone stock and the compromise of support afforded the component. The fit of the Global glenoid component to the bone minimizes the amount of bone cement needed. Direct support of the component by bone reinforces component stability.

Specialized techniques and instrumentation, including retractors, straight and angled drill shafts and reamers, facilitate the exposure, orientation and preparation of the glenoid. The combination of custom spherical reaming of the bony surface and anchor peg, or keel fixation provides excellent stability for the component with minimal sacrifice of bone stock.

Laboratory research indicates that having the diametral curvature of the glenoid slightly greater than that of the humeral head offers the advantages of allowing translation and shock absorption without loading the glenoid component rim. For this reason, the surface of all Global glenoids are designed with a 6mm larger diametral curvature than the corresponding humeral head. This degree of diametral "mismatch" was selected after extensive investigation of the mechanics of the normal joint as well as the mechanical properties of prosthetic materials.[1,2,3]



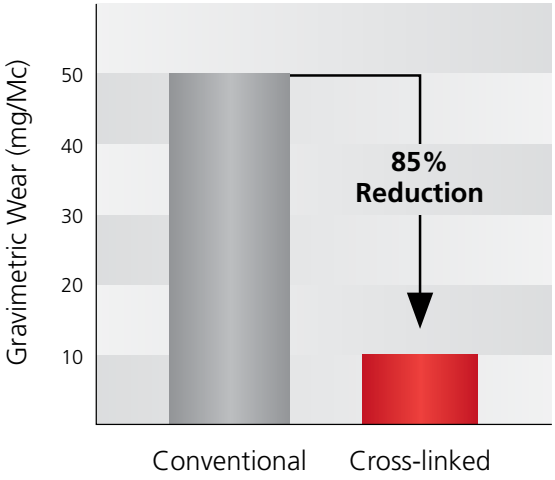
The nonconforming, diametrical mismatch also allows for enhanced wear reduction. In a study of 56 retrieved glenoid components, the nonconforming designs had less damage to the articulating surface and less radiolucency than conforming designs.[4] Impingement and edge abrasion occurred significantly more often with traditional conforming designs as compared to nonconforming designs utilizing diametric mismatch, which is featured in DePuy Glenoid Solutions implants.

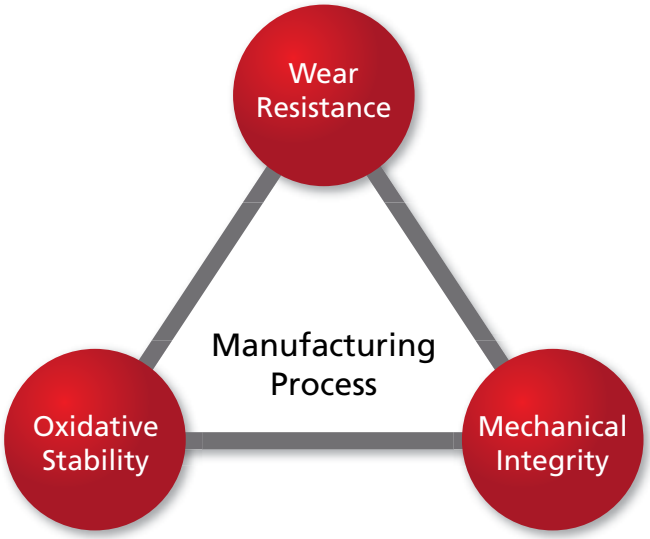
Premieron™ X-Linked Polyethylene

X-traordinary Wear Reduction

Proven Performance

DePuy Orthopaedics offers polyethylene solutions optimized for the unique demands of each shoulder joint. Pemieron™ X-Linked Polyethylene creates a technologically advanced shoulder implant that has demonstrated an 85% reduction in wear debris over conventionally manufactured and sterilized components.[5] In shoulder simulator testing, Premieron significantly lowered the calculated osteolytic potential, and thus the risk of aseptic loosening.[5]





Pemieron materals and process:

- GUR 1020 polyethylene resin
- 5 Mrad of irradiation induces moderate cross-linking
- Thermally treated to 155° to eliminate free radicals for an oxidatively stable material
- Gas plasma terminal sterilization

X-traordinary Mechanical Integrity

Optimal Balance

Today's shoulder patients demand more from their replacement than ever before. Their active lifestyles can benefit from the significant advances in wear reduction offered by moderately cross-linked polyethylene. Premieron balances wear reduction and mechanical integrity while maintaining oxidative stability through an exclusive scientific formulation that has been proven to provide improved resistance to the multidirectional wear typical of shoulder implants.[5]

X-acting Biomechanical Criteria

More Natural Range of Motion

The significant wear resistance of Premieron, coupled with the nonconforming design of DePuy Glenoid Solutions Implants, addresses the biomechanical concerns associated with glenoid loosening.

A constant 6mm diametrical mismatch with the glenoid-humeral head articulation replicates the biomechanics of a healthy shoulder, providing patients with a more natural range of motion.

The Technique

Recognizing that a successful shoulder arthroplasty is critically dependent on soft tissue balancing, this document provides a detailed guide to the techniques of tendon lengthening and capsular releases, which are integral parts of this procedure. These steps cannot be effected with jigs and guides, but rather require an understanding of the principles of shoulder mechanics.

Recognizing that each shoulder arthroplasty needs to be adapted to the patient's unique combination of soft tissue and bone anatomy, the system maximizes the surgeon's flexibility in matching a wide variety of anatomic requirements. Because patients have high expectations of the function and durability of the arthroplasty, a premium has been placed on secure fixation, conservation of bone and optimization of mechanics. Surgical technique is a critical variable in the success of any arthroplasty; this document seeks to optimize surgical technique through detailed technique descriptions and advanced instrumentation.

Surgical Technique

Charles A. Rockwood, Jr., MD

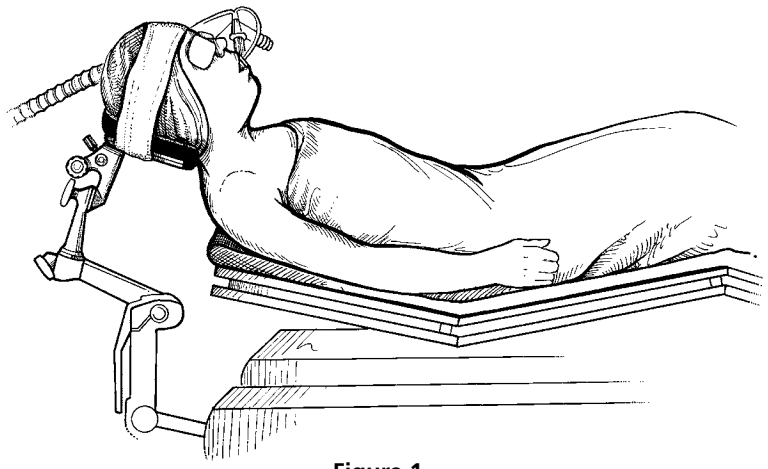


Figure 1

Patient Positioning

Place the patient in a semi-Fowler position on the operating table (Figure 1). Remove the standard headrest portion of the table and replace it with a special headrest such as the Mayfield or the McConnell (McConnell, Greenville, TX). Position the patient so that the involved shoulder extends over the top corner of the table (Figures 1, 2 and 3). Secure the patient's head with tape. Drape to isolate the anesthesia equipment from the sterile field.

Figure 2

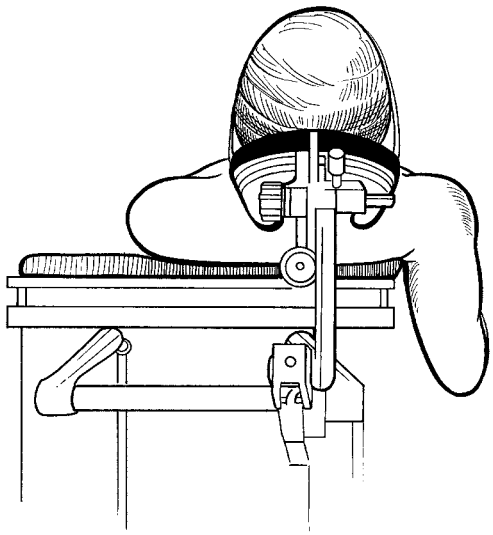


Figure 3

Surgical Incision:

MUSCULOCUTANEOUS AND AXILLARY NERVE IDENTIFICATION AND PECTORALIS MAJOR AND SUBSCAPULARIS TENDON RELEASE

Incision

Make an incision running from the clavicle over the top of the coracoid down the anterior aspect of the arm (Figures 4 and 5). Once the incision has been made, locate the cephalic vein on the deltoid muscle near the deltopectoral interval (Figure 6). The cephalic vein is usually intimately associated with the deltoid because there are many feeders from the deltoid into the cephalic vein. For this reason, it is recommended that the vein be taken laterally with the deltoid muscle.

Clamp and tie feeders coming from the region of the pectoralis major muscle, allowing retraction of the deltoid with the vein laterally. Free the deep surface of the deltoid from the underlying tissues, from its origin on the clavicle down to its insertion in the humeral shaft. To obtain more exposure, it may be necessary to partially free the insertion of the deltoid from the humeral shaft, but it rarely is necessary to release the deltoid from the clavicle.

When the anterior margin of the deltoid has been completely freed from its origin to its insertion, especially along its deep surface, abduct and externally rotate the arm, which will allow the deltoid to be gently retracted laterally with two Richardson retractors. Medially retract the conjoined tendon. It is not necessary to release the conjoined tendon or to divide the coracoid process for additional exposure.

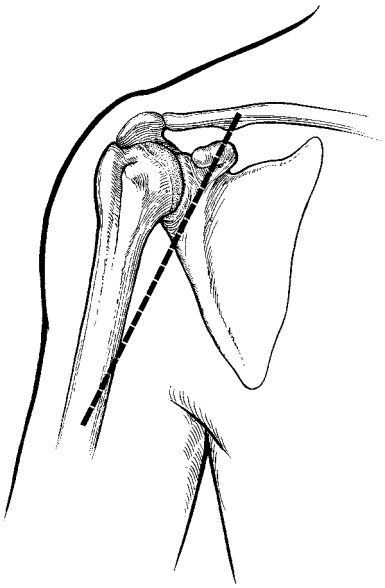


Figure 4

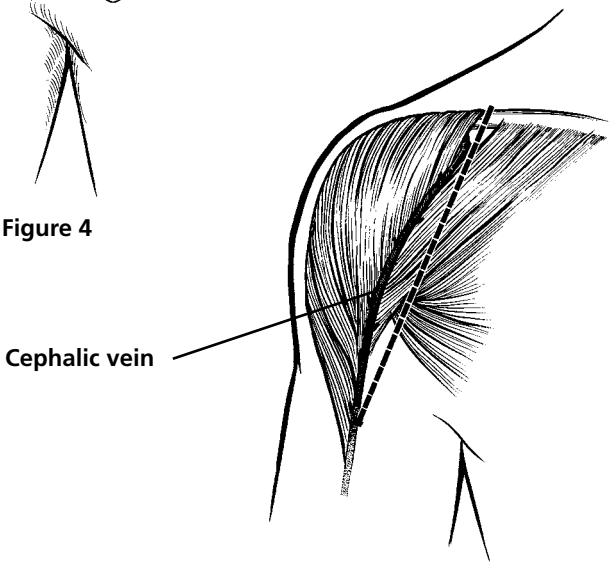


Figure 5

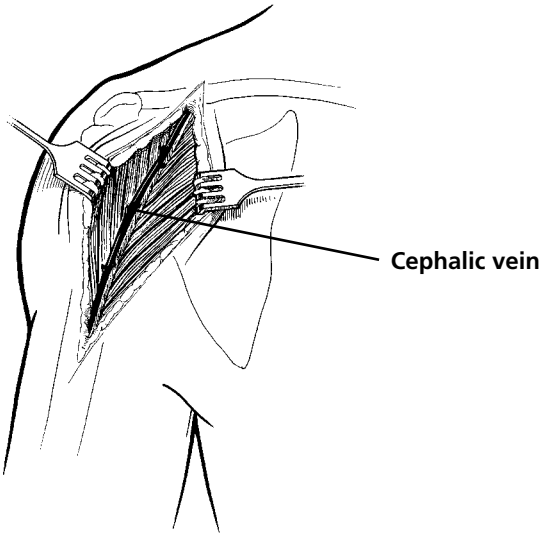


Figure 6

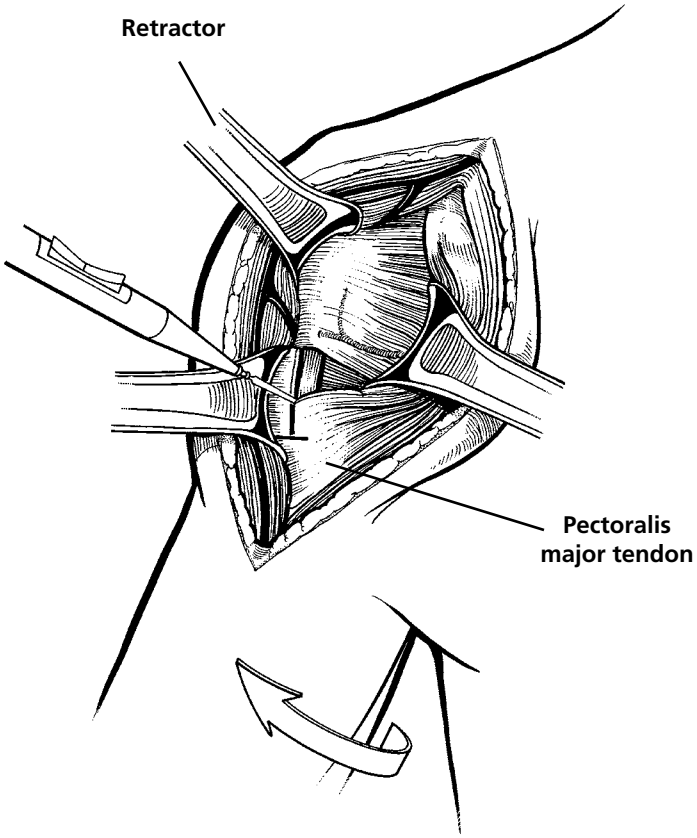


Figure 7

Pectoralis Major Tendon Release

Release the upper 25 percent of the pectoralis major tendon from its insertion on the humerus with an electrocautery cutting blade. This will aid in the exposure of the inferior aspect of the joint (Figure 7).

If the patient has marked internal rotation contracture, release most of the pectoralis major tendon from its insertion. This tendon release should not be repaired at the completion of the operation since it will limit external rotation postoperatively.

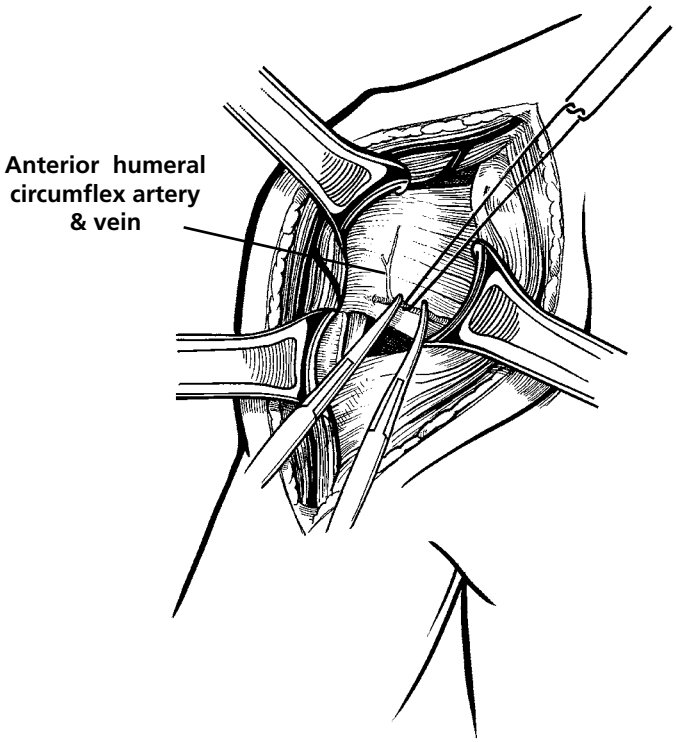


Figure 8

Anterior Humeral Circumflex Vessels Management

Isolate, clamp and ligate or coagulate the anterior humeral circumflex vessels lying across the anterior/inferior surface of the subscapularis tendon (Figure 8).

Nerve Identification

Musculocutaneous Nerve

It is important to identify the musculocutaneous and axillary nerves. Palpate the musculocutaneous nerve as it comes from the plexus into the medial and posterior aspect of the conjoined tendon (Figure 9). Usually, the nerve penetrates the muscle approximately 11/2 to 2 in. down from the tip of the coracoid, but in some instances the nerve has a higher penetration into the conjoined muscle tendon unit. Remember the proximity of this nerve to the tendon during the retraction of the conjoined tendon.

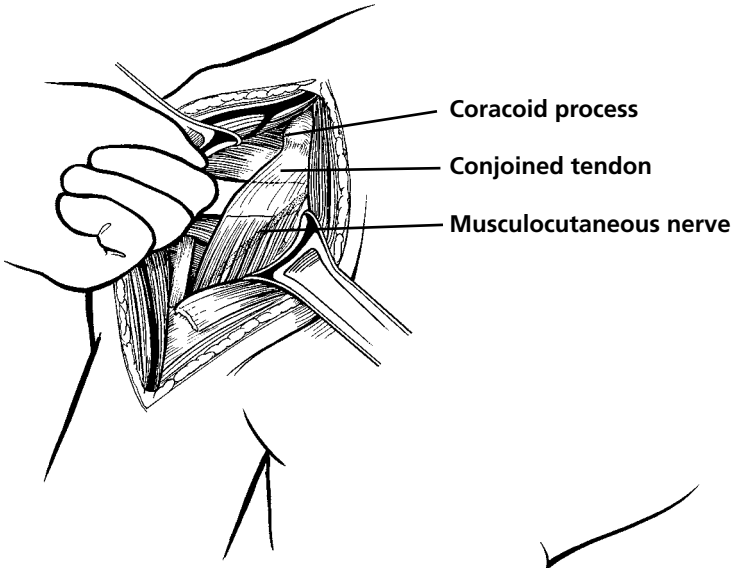


Figure 9

Axillary Nerve

Locate the all-important axillary nerve by passing the volar surface of the index finger down along the anterior surface of the subscapularis muscle (Figure 10). Rotate and hook finger anteriorly to identify the axillary nerve (Figure 11). Occasionally, secondary to previous dislocations, scarring and adhesions, the nerve will be plastered onto the anterior surface of the subscapularis and is difficult to locate. When this occurs, pass a periosteal elevator along the anterior surface of the muscle to create an interval between the muscle and the nerve. Always identify the axillary nerve and carefully retract it out of the way, especially during the critical steps of releasing the subscapularis tendon and resecting the anterior/inferior capsule. A retractor can be used for protecting the nerve.

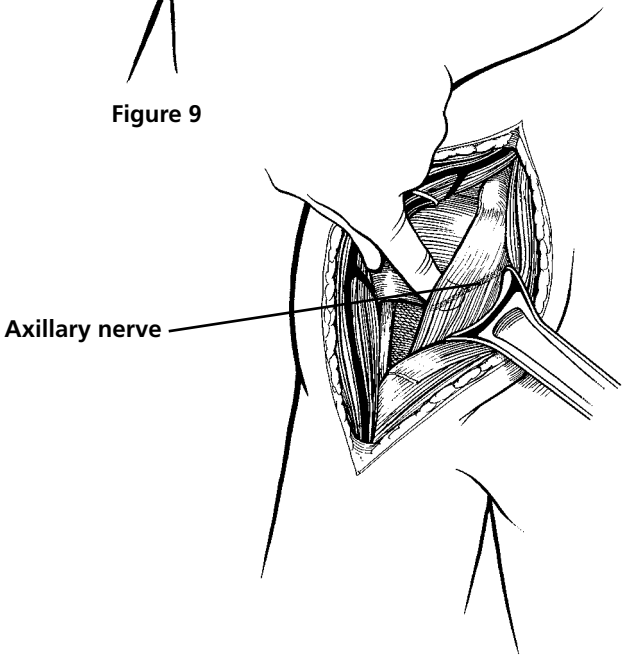


Figure 10

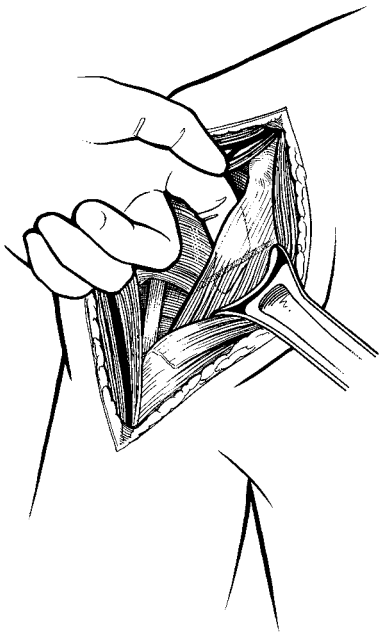


Figure 11

Subscapularis Tendon Release

There are different methods of taking down the subscapularis. Some surgeons prefer to perform a tenotomy while others prefer a lesser tuberosity osteotomy. Typically, a z-plasty is only performed in the event that the subscapularis was shortened by prior surgery.

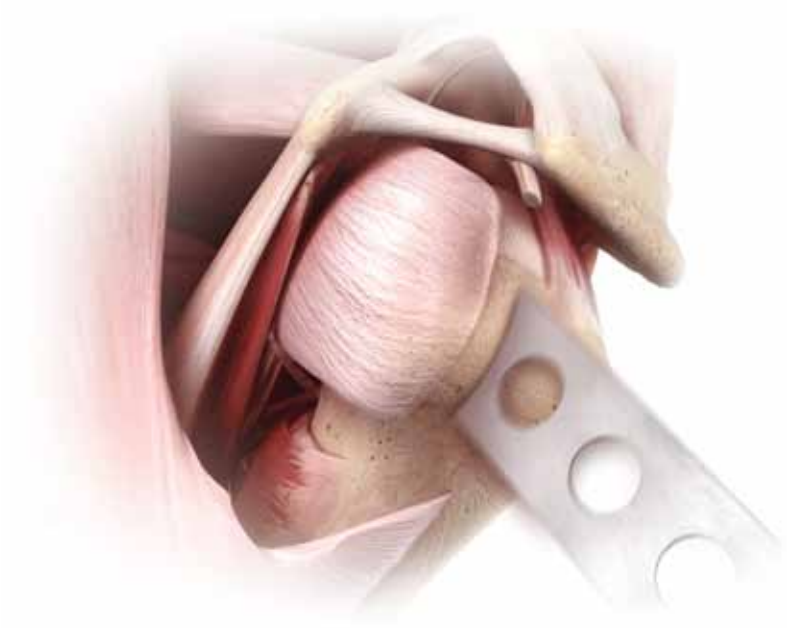


Figure 12

When performing a lesser tuberosity osteotomy, first move the arm into internal rotation to improve access to the lesser tuberosity. Introduce the saw blade (as shown) or a sharp curved 1/2 inch osteotome at the interval created at the insertion side of the subscapularis and resect approximately 4-5mm of the lesser tuberosity (Figure 12).

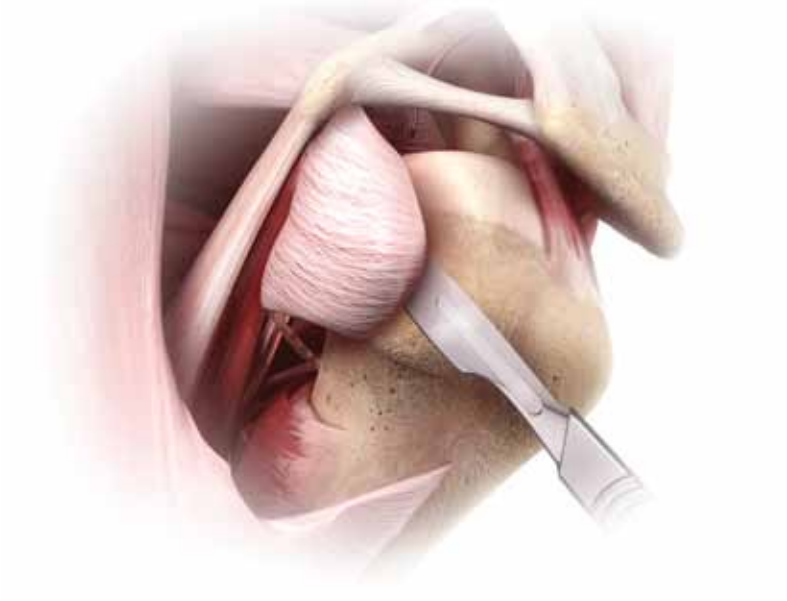


Figure 13

When performing a release of the subscapularis tendon without an osteotomy, the tendon is removed from its insertion with a cautery or scapel (Figure 13).

Capsule Release and Humeral Head Dislocation

Using a blunt dissection (Cobb) separate the capsule from the subscapularis, inferiorly and medially, using a scalpel. Release the rest of the anterior capsule from the subscapularis to the glenoid rim.

Release the coracohumeral ligament from the base of the coracoid (Figure 14).

Note: *Failure to sufficiently release the capsule from the humeral neck to its posterior inferior area will make it very difficult to bring the head up and out of the glenoid fossa.*

Figure 14

Place a Bankart retractor between the capsule and the subscapularis. Resect the anterior capsule in its entirety from the glenoid insertion sites (Figure 15).

Figure 15

Place a large Darrach retractor underneath the upper part of the humeral head and dislocate the humerus. Put a medium size retractor on the inferior part of the humeral head and continue to bring the arm into full external rotation. The entire humeral head should now be in vision, with all capsular tissues removed from around the neck to provide excellent exposure (Figure 16).

Note: *It is important to fully visualize the rotator cuff insertion site superiorly and posteriorly since this and the humeral neck will define the true, anatomic resection angle for the humeral head. Using a large rongeur, remove any osteophytes circumferentially.*

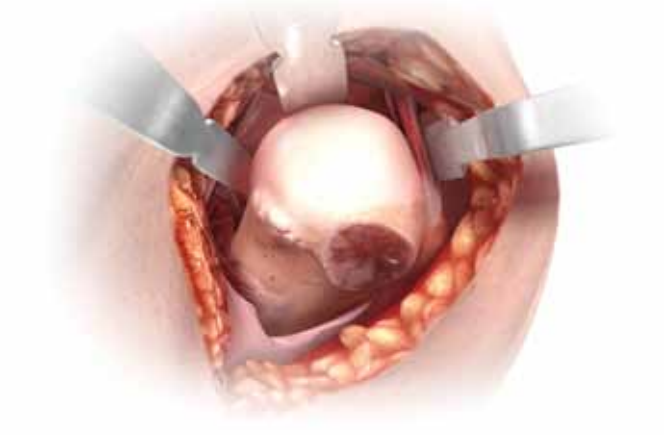


Figure 16

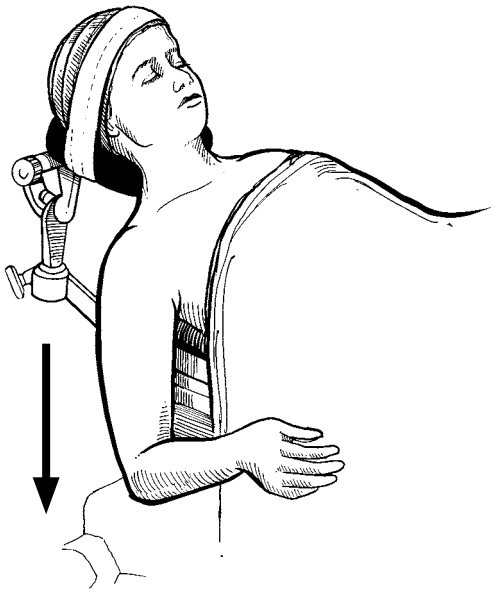


Figure 17

You may place the large Darrach retractor in the joint and use it as a skid. Remove the head out of the glenoid fossa so that the arm can be extended and externally rotated off the side of the operating table (Figures 17 and 18).

Note: *Remember to release the capsule all the way down inferiorly to the six o'clock position and sometimes a bit further. Failure to complete the inferior capsular release will make delivery of the proximal humerus up and out of the wound quite difficult. The combination of lifting with the bone hook and prying with the large Darrach retractor, along with externally rotating and extending the arm off the side of the table, will produce adequate exposure.*

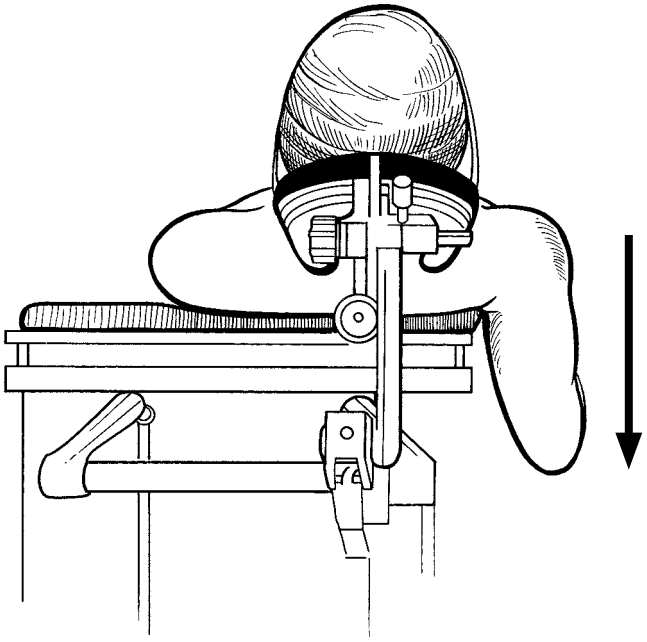


Figure 18

Humeral Head Resection

Preoperative evaluation of the humerus with templates helps determine the size of the prosthesis and level of head resection. The resection of the humeral head is a very critical part of the procedure. When there is no posterior glenoid erosion, remove the humeral head with the arm in 20 to 25 degrees of external rotation. Flex the elbow 90 degrees and then externally rotate the arm 20 to 25 degrees (Figure 19).

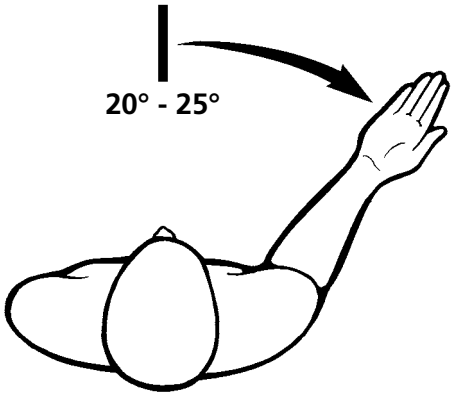


Figure 19

Determine the varus-valgus angle of the head to be removed by using the humeral osteotomy template. Place the template along the anterior aspect of the arm parallel to the shaft of the humerus, and mark the angle at which the head will be removed with an osteotome or the electrocautery blade (Figure 20).

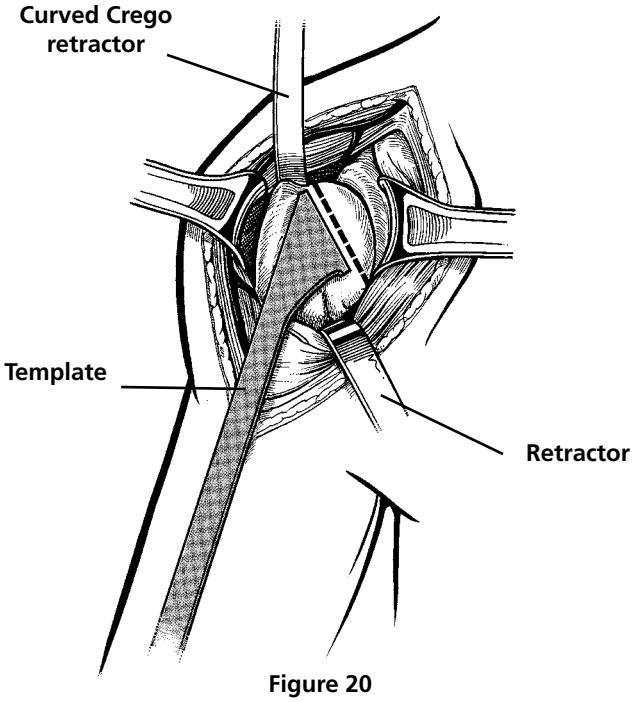


Figure 20

The plastic template prevents arcing from the electro-cautery knife. Use of the template ensures the proper seating of the prosthesis on the bone (Figure 21). In many instances, the inferior portion of the mark will be above the inferior osteophyte of the flattened and deformed head of the humerus.

If the resection is made in line with an articular surface which is in varus, support for the collar of the prosthesis will be compromised (Figure 22).

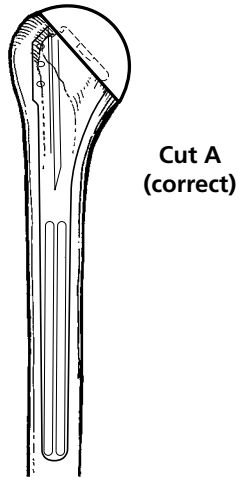


Figure 21

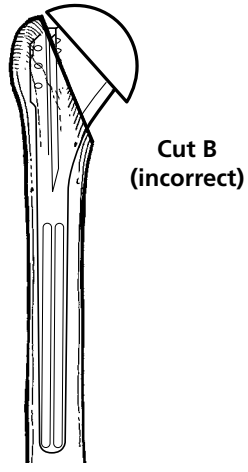


Figure 22

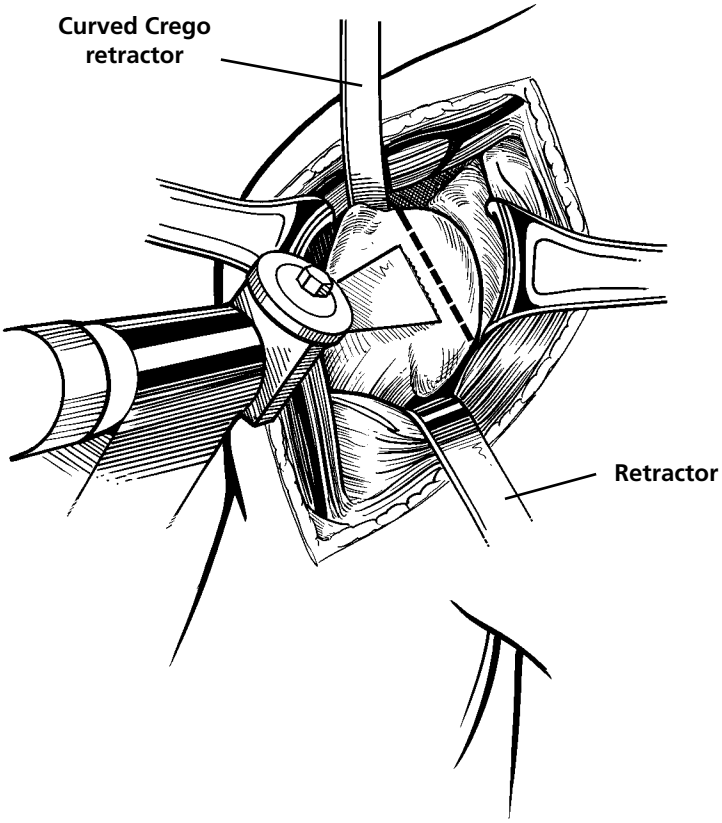


Figure 23

The superior lateral portion of the mark should be at the junction of the articular surface with the attachment of the rotator cuff on the greater tuberosity (Figure 23).

If the preoperative axillary lateral X-ray and/or the CAT scan demonstrates posterior glenoid erosion, several options are available. If the glenoid is concentric and consists of dense cortical bone and has only five to 10 degrees of posterior slope as compared to the normal glenoid, resect the head with the arm externally rotated only 10 to 15 degrees. Compensate for some of the posterior glenoid erosion by decreasing the amount of external rotation of the arm at the time of head removal.

If the posterior glenoid slope is 25 degrees or more and the glenoid has a flat surface and the head is posteriorly subluxated, ream the glenoid back to normal version and use a glenoid prosthesis. Glenoid replacement will usually be required when there is anterior or posterior erosion or flattening of the glenoid fossa. In this situation of posterior glenoid erosion, it will be necessary to use air burrs and rongeurs to remove the prominent anterior lip of the glenoid before the glenoid reamers can be used.

Before removal of the head, often surgeons remove the osteophytes from the head and neck of the humerus to allow better visualization of the anatomic neck. Before the oscillating saw or osteotome is used to remove the head, protect the biceps tendon and the insertions of the supraspinatus, infraspinatus and teres minor into the proximal humerus. Pass the modified Crego retractor under the biceps and curl it around posteriorly to protect these structures during humeral head removal (Figure 23). With the large Darrach retractor in the joint, use a sagittal power saw or osteotome to remove the humeral head at the predetermined angle.

Technique for Head Removal Using the Intramedullary Humeral Resection Guide

An alternative humeral resection guide has been developed to remove the head. It requires more extensive exposure, especially the release of the inferior capsule, to be able to deliver the proximal part of the humerus up and out of the wound (Figure 24). Create a pilot hole at the top of the humerus, in line with the long axis of the humerus just lateral to the articular surface of the head of the humerus and medial to the attachment of the rotator cuff. Use a 6mm reamer to ream the intramedullary canal under hand power, followed by subsequent reamers (i.e., 8mm, 10mm, 12mm, etc.) until one of the reamers begins to bite into the cortical bone (Figure 25).

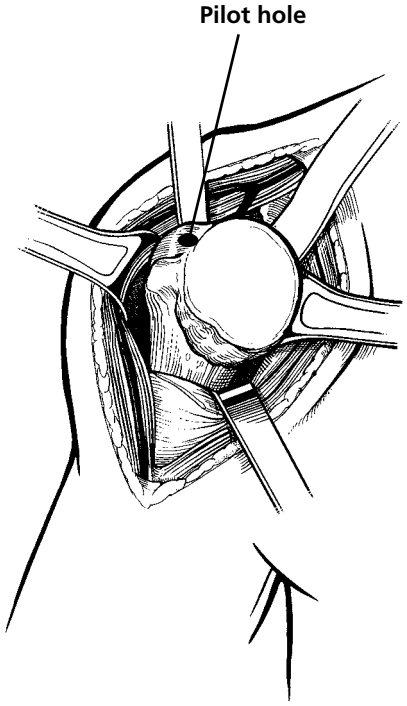


Figure 24

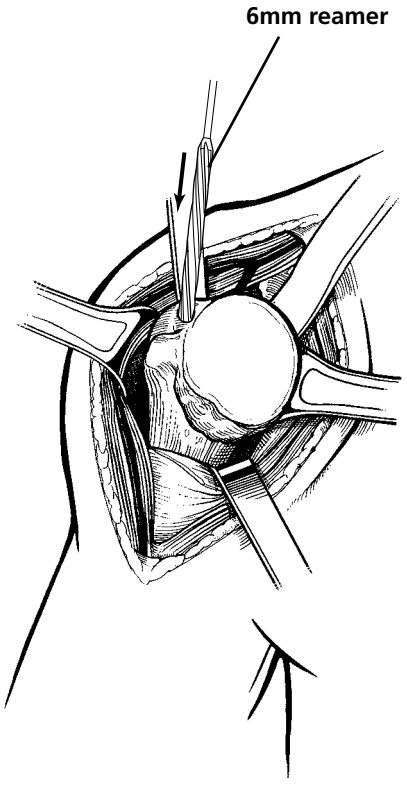


Figure 25

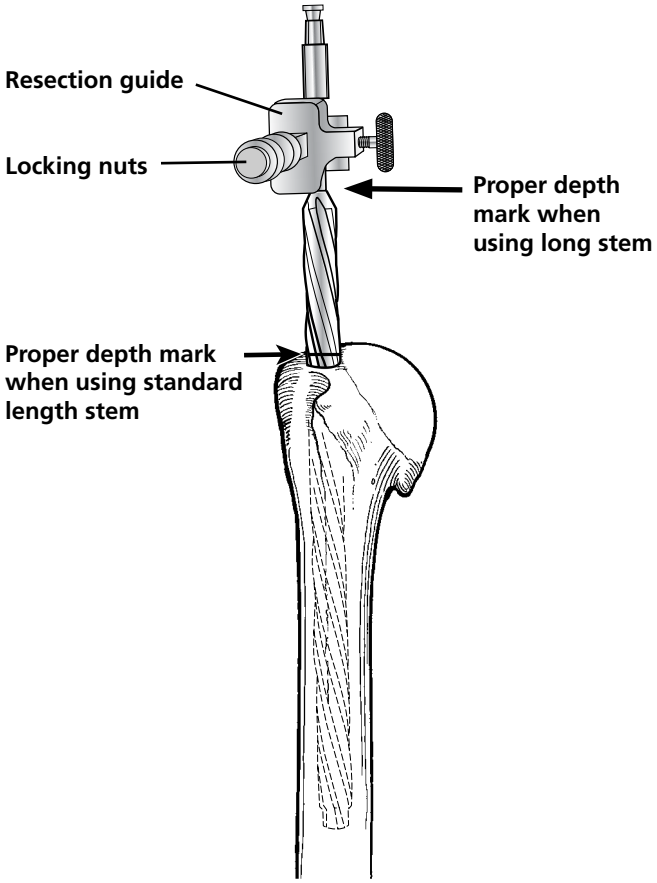


Figure 26

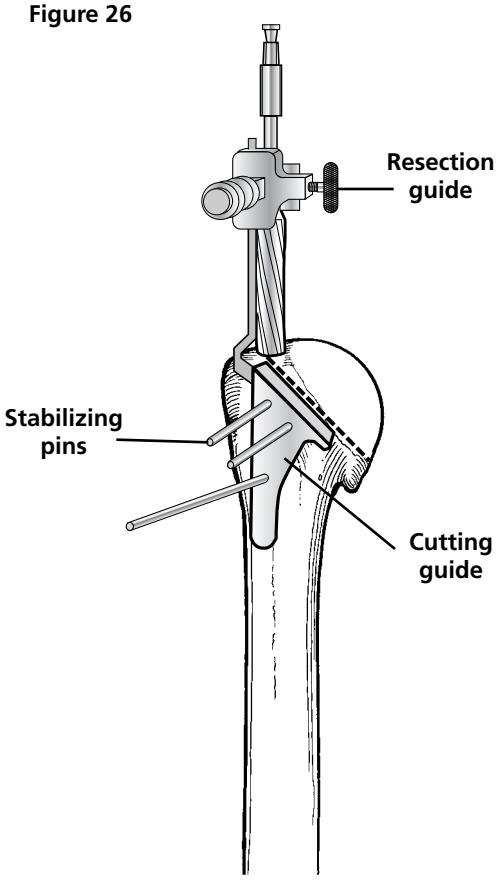


Figure 27

Pass the reamer down the intramedullary canal until the prominent circular mark on the reamer is at the level of the pilot hole. Leave the reamer in place and clamp the resection guide around the reamer shank above the cutting flutes (Figure 26). Tighten the resection guide to the reamer using the circular locking nuts. There are two saw cutting guides that are marked for use with either the right or the left shoulder. Insert the appropriate guide into the slot of the resection guide and adjust it up and down to the level where the head will be removed, which will be at the top of the varus-valgus angle of the 135 degrees (Figure 27).

The superior portion of the cut will be in the sulcus between the articular surface of the head of the humerus and the most medial aspect of the greater tuberosity. In order to remove the head in the proper amount of retroversion, externally rotate the forearm until it is in alignment with the version rod on the saw cutting guide (Figure 28). The rod is in 30 degrees of external rotation. If more or less retroversion is required, rotate the forearm in relation to the rod position. Before the saw blade (33 x 0.8mm) is placed along the flat surface of the saw cutting guide, drill two pins (3.2mm) (0.125 in.) through the saw guide and into the underlying bone which will stabilize the guide (Figure 28).

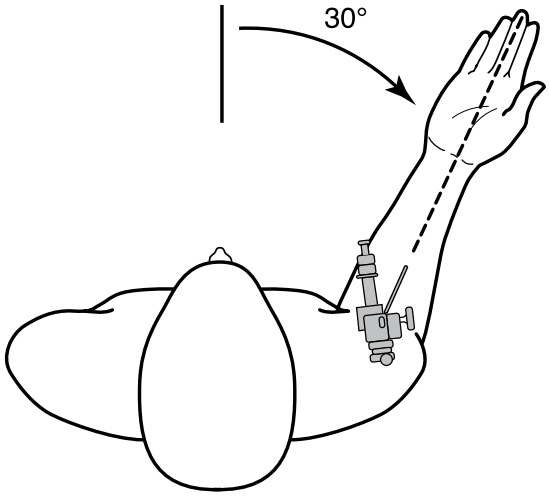


Figure 28

Place the oscillating saw blade along the flat surface of the guide and cut the bone down to the level of the retained intramedullary reamer (Figure 29). Then, two options exist. First, the entire intramedullary reamer, cutting guide, pins and saw guide can be removed and the saw cut completed freehand down through the remaining neck of the humerus. The second option is to remove the intramedullary reamer and resection guide clamp but leave the guide in place so that the blade can continue to pass along the flat surface of the guide (Figure 30).

Note: *Following removal of the head, be sure to pass the reamer down the intramedullary canal until the prominent circular mark on the reamer is at the cut surface of the bone.*

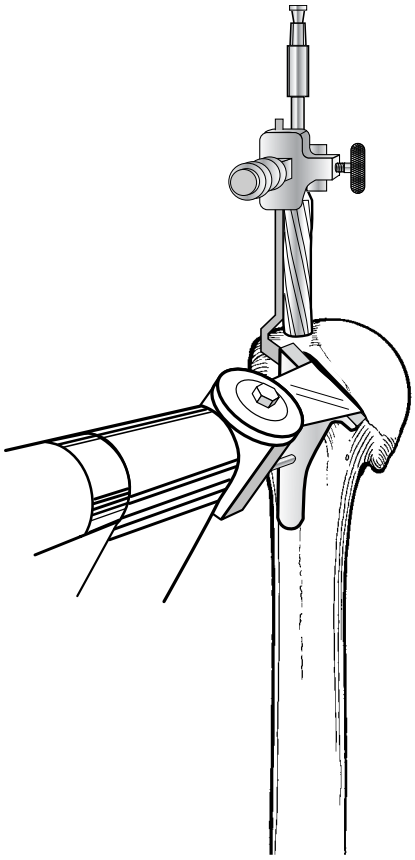


Figure 29

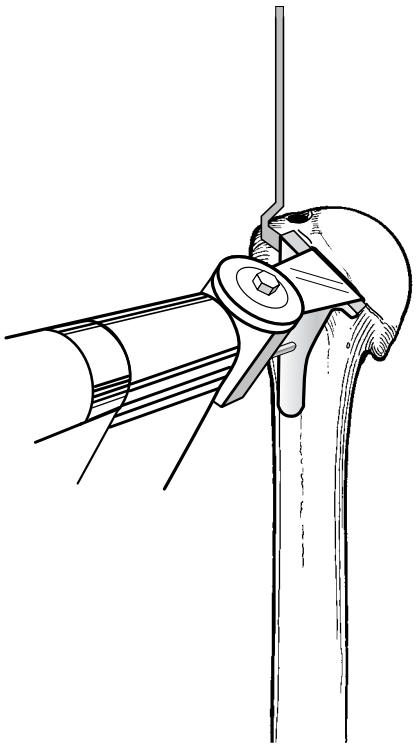


Figure 30

Sizing the Resected Humeral Head

Use the two templates available in the set of instruments to measure the resected head diameter and thickness (Figure 31). One will measure the common sizes of 44, 48 and 52mm heads and the second will measure the 40 and 56mm heads. After selecting the humeral head component, place the humeral head on the back table to remove the cancellous bone. Use the cancellous graft later in the procedure if impaction bone grafting is used for the humeral stem. In the case of a total shoulder arthroplasty (TSA), the humeral head size (40, 44, 48, 52 and 56mm), but not the height, is determined by the glenoid size.

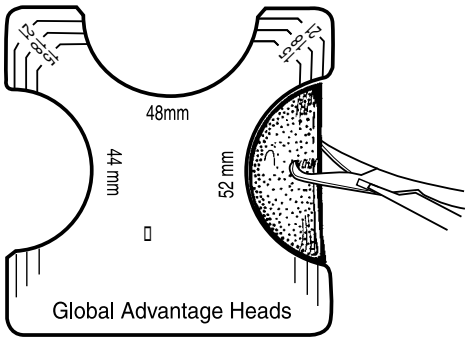


Figure 31

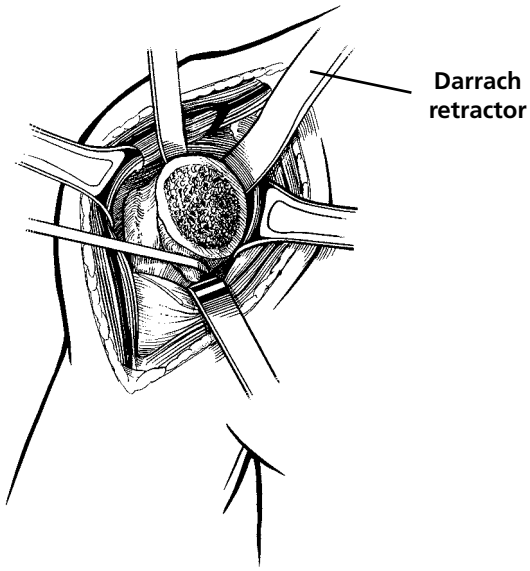


Figure 32

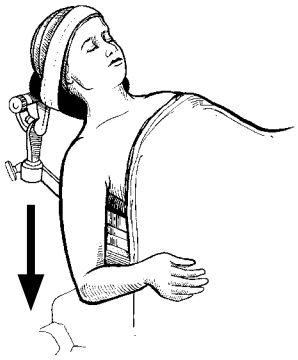


Figure 33

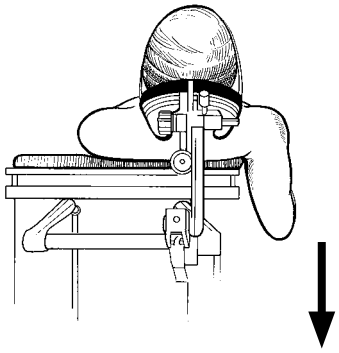


Figure 34

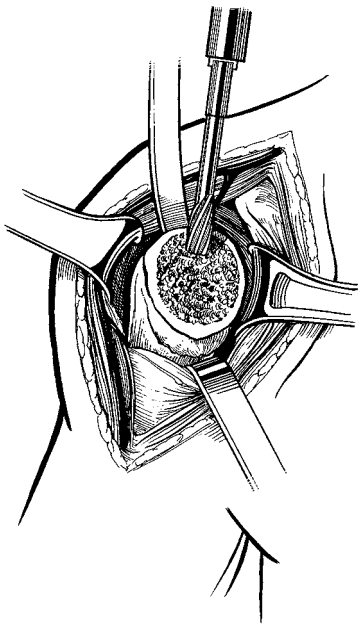


Figure 35

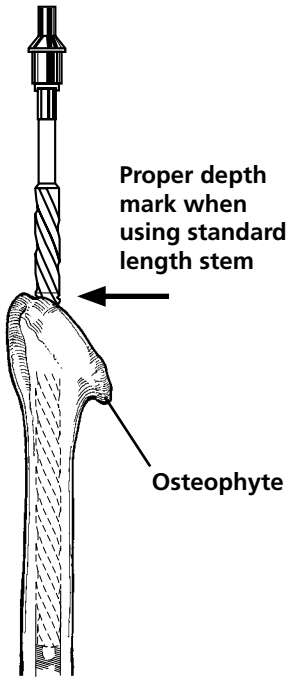


Figure 36

MEDULLARY CANAL PREPARATION AND BROACHING THE HUMERUS

Medullary Canal Reaming

Once the head has been removed, place a large Darrach retractor in the joint and place a bone hook under the neck of the humerus. Externally rotate and extend the arm off the side of the table, which will deliver the proximal humerus up and out of the incision (Figure 32). Unless the arm can be externally rotated and extended off the side of the table (Figures 33 and 34), it is very difficult to insert the medullary canal reamers as well as the body sizing osteotome and the prosthesis.

Note: *The primary reason for having difficulty in delivering and exposing the proximal humerus up and out of the incision is the failure to divide the inferior capsule as described in the section on capsular release.*

Using the 6mm reamer, make a pilot hole into the cancellous surface of the bone eccentrically and as superior as possible so that the reamer will pass directly down into the intramedullary canal (Figures 35 and 36). Perform the reaming of the medullary canal by using the T-handle on the reamer. **Power reaming of the canal should not be done as it may remove more bone than necessary.** When using the standard length of prosthesis, pass the reamer down the intramedullary canal until the prominent circular mark on the reamer is at the level of the cut surface of bone. When using the long stem prosthesis, pass the entire length of the cutting flutes down the intramedullary canal.

Following passage of the 6mm reamer down the canal, continue sequential reaming until a reamer begins to bite on cortical bone of the intramedullary canal of the humerus. The final reamer size chosen will determine the stem size of the body sizing osteotome, final broach and implant. For example, if the 12mm reamer begins to secure purchase in the intramedullary cortical bone, use a 12mm humeral trial and final component.

Using the Body Sizing Osteotome

Next, select the body sizing osteotome of the appropriate size. As in the previous example, if reaming stopped at 12mm, insert the 12mm body sizing osteotome into the reamed hole (Figure 37). To assemble the osteotome collar onto the osteotome, hold the collar at a 45-degree angle with the word "top" clearly visible, align the fins to the collar and slide the collar onto the osteotome (Figure 38). Use the body sizing osteotome collar to determine proper rotation prior to cutting the bone (Figure 39). When the lateral fin on the osteotome touches the greater tuberosity, slide the collar down the osteotome and rotate the entire unit until the collar lies flat on the cut bone surface (Figures 40 and 41).

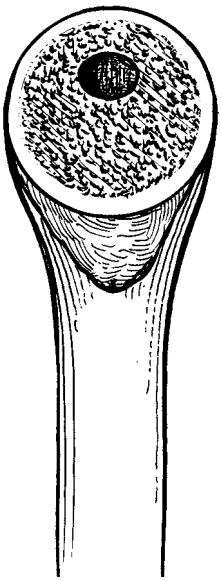


Figure 37

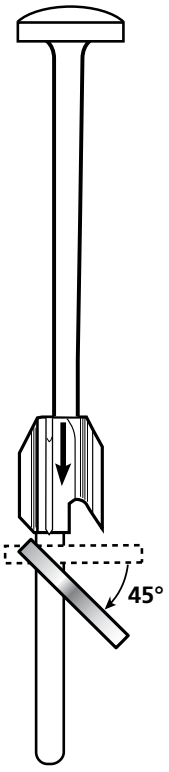


Figure 38

Body sizing osteotome

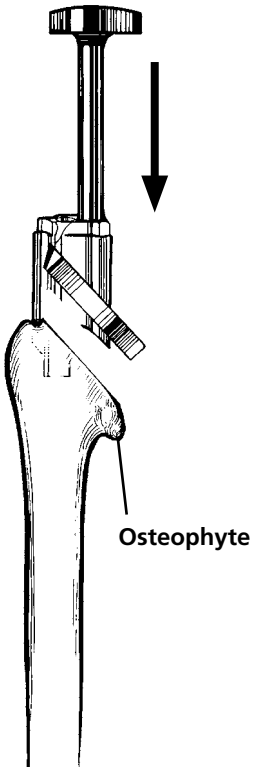


Figure 39

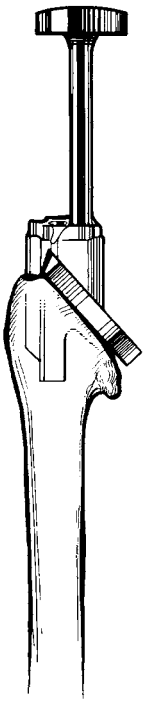


Figure 40

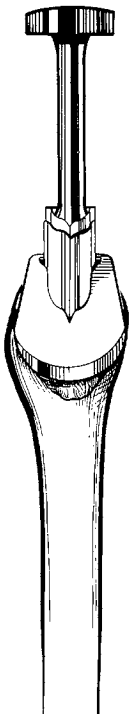


Figure 41

Anterior and posterior fin tips touch resection simultaneously.

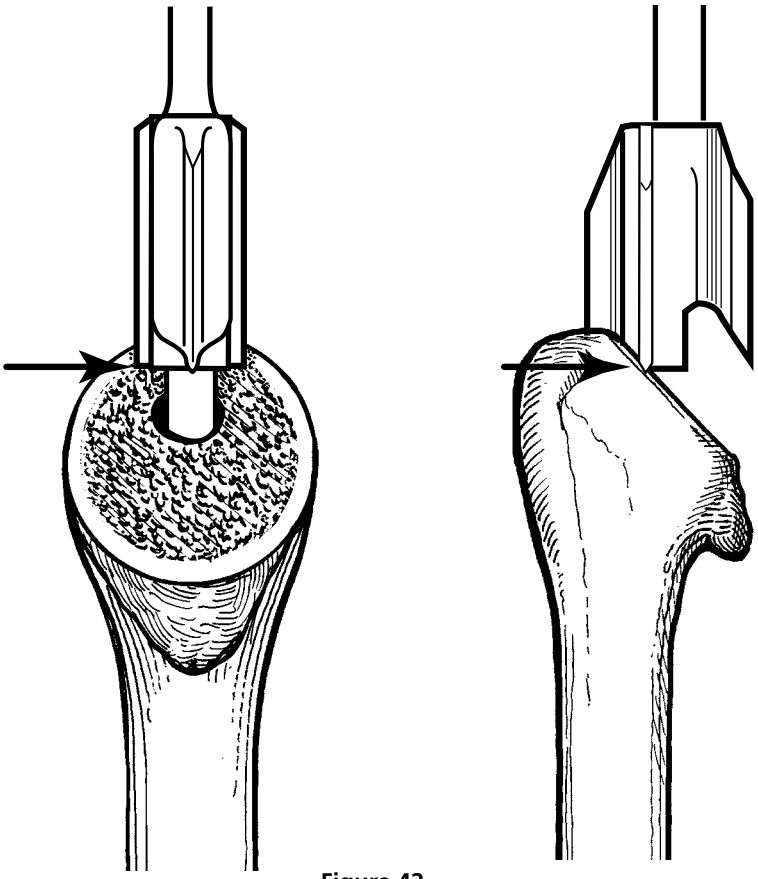


Figure 42

Slide the collar above the fins before driving down the osteotome. If the collar is not used, simply ensure that the anterior and posterior fin tips of the body sizing osteotome contact the cut surface simultaneously (Figure 42).

It is only necessary to drive the body sizing osteotome down a few millimeters into the cancellous bone, just enough to outline the amount of bone to be removed. Driving the body sizing osteotome down into the cancellous bone does three things. First, it cuts out the appropriate amount of bone to receive the lateral fin of the broach in the area of the greater tuberosity. Second, it creates the anterior, posterior and medial fin tracks. Lastly, it outlines the amount of bone that will need to be removed before seating the broach and the prosthesis.

Use a small osteotome to remove the cancellous bone prior to inserting the broach (Figure 43).

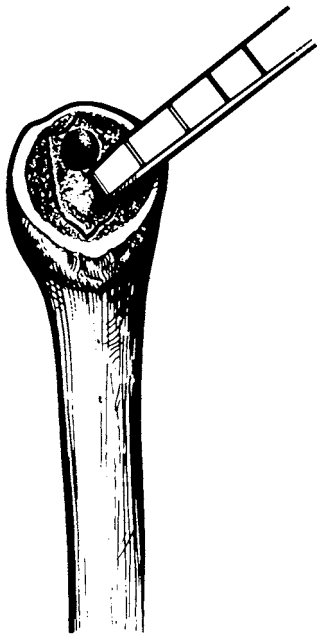


Figure 43

Broaching the Humerus

The correct stem and body size have already been determined from reaming and utilizing the body sizing osteotome. For example, if a 12mm intramedullary canal reamer and body sizing osteotome were used, use a 12mm broach. Attach the driver/extractor to the broach for this part of the procedure (Figures 44 and 45). While driving the broach into place, carefully follow the fins on the broach to the fin tracks created by the body sizing osteotome. The final humeral prosthesis is approximately 1mm larger than the corresponding broach size to obtain a press-fit. Seat the broach until the collar sits flush on the cut surface of the neck of the humerus. Do not drive the collar down into the cancellous bone.

Note: *If the broach collar does not sit flush on the cut surface, do not try to aggressively drive it down. Rather, remove the broach and then pass the reamer deeper into the canal. Then seat the broach again.*

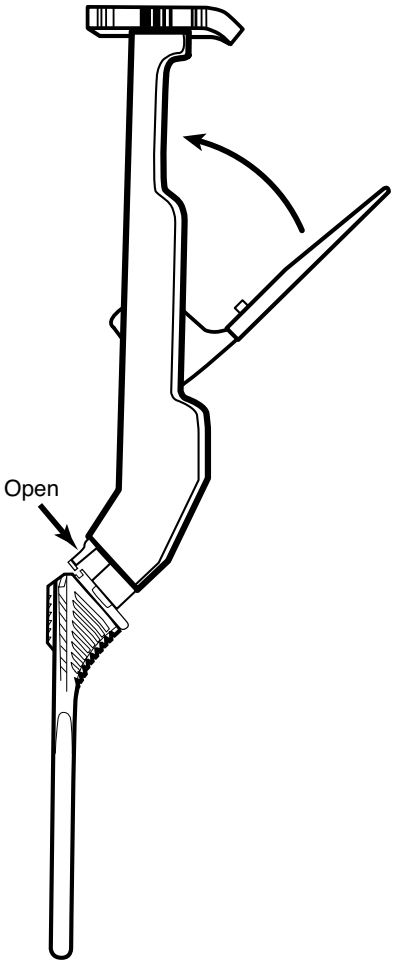


Figure 44

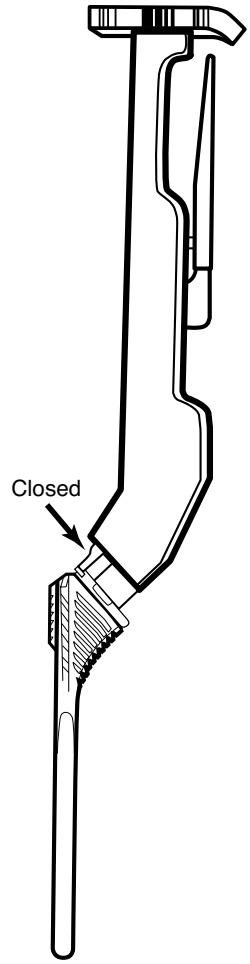


Figure 45

Removal of Osteophytes

With the broach in place, remove the osteophytes extending from around the cut surface of the neck of the humerus using an osteotome and/or rongeurs (Figure 46). During preparation of the glenoid, we recommend leaving the broach in place to protect the proximal humerus from compression fracture or deformation by the retractor.

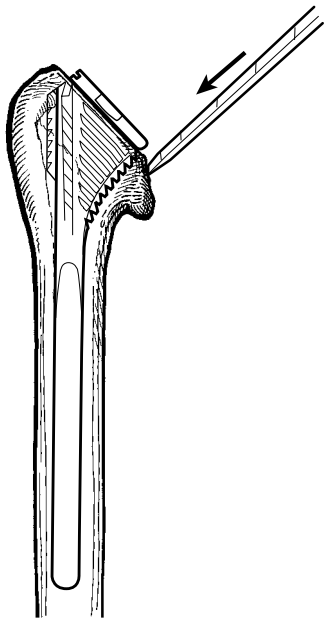


Figure 46

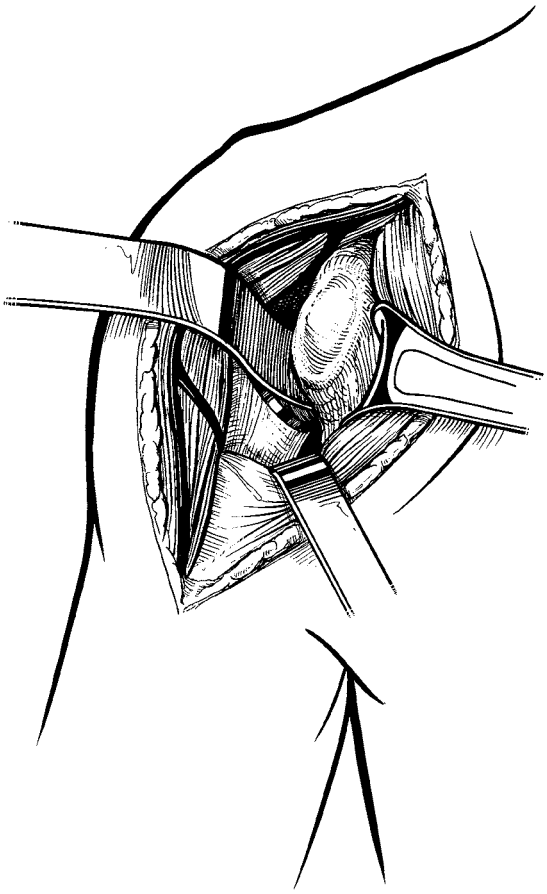


Figure 47

GLENOID PREPARATION

Note: *The decision to use the glenoid prosthesis is up to the discretion of the surgeon. If the glenoid, as determined by axillary and/or CAT scans, is concentric and consists of dense cortical bone, some surgeons perform a hemiarthroplasty while others routinely perform a total shoulder replacement. However, if the glenoid is eroded, flattened or grossly irregular, replace the glenoid. Anchor peg, and keeled type prostheses are available. In some patients, because of heavy muscle mass, previous scarring or previous arthroplasty procedures, it is impossible to insert the power instruments necessary for implanting the Anchor peg glenoid. In that case, use the keeled glenoid prosthesis (see keeled glenoid procedure on page 28).*

Using a humeral head retractor (Fukuda style), displace the proximal humerus posteriorly to expose the glenoid fossa (Figure 47). We recommend leaving one of the broaches in place to protect the proximal humerus from compression fracturing or deformation by the retractor.

Before working on the glenoid fossa, remove the labrum and soft tissue scarring around the glenoid fossa. Since the capsule has already been resected from the humeral side, completely excise the anterior/inferior capsule from the glenoid rim and protect the axillary nerve. If the shoulder has limited external rotation and the capsule is left in place and reattached to the humerus, the capsule would again restrict external rotation. Usually, the capsule is thickened and scarred; moreover, its resection should not lead to any instability of the joint. If the posterior capsule is thickened and tight, it may be necessary to release it from the posterior rim of the glenoid.

The selection of the proper size glenoid is very important. A set of six or seven glenoid sizer disks (40XS, 40, 44, 48, 52, 56, 56XL) is available (Figure 48). These sizer disks determine the size of the glenoid, which also determines the size of the humeral head.

The 40XS glenoid (keeled only) is an extra small prosthesis that is required for the very small glenoid fossa in some juvenile rheumatoid arthritic shoulder cases. Select the sizer disk that best fits the size of the glenoid fossa. Since the normal shoulder joint allows translation of the head in the glenoid fossa, each of the glenoid prostheses have been developed with a 6mm larger diametral curvature than the corresponding humeral head (Figure 49). The number on the glenoid prosthesis does not indicate its size in millimeters. The number simply indicates that it should be used with the same size humeral head that is measured in millimeters. If a size 52 glenoid is selected, use a 52mm head, allowing for 6mm diametral mismatch between the prosthetic head and the glenoid (Figure 49).

Despite the variation in curvature of the articulating surface of the glenoid prosthesis, the nonarticulating back side of all sizes of glenoid components has the same diametral curvature, which is the same curvature as the glenoid reamer. If there is a question as to which size glenoid to use, use the smaller and not the larger size. A glenoid prosthesis that is just a bit too large irritates and interferes with normal rotator cuff function.

Note: *The optimal Head-Glenoid mismatch for the Global® System (6mm) occurs when the glenoid and head components are the same size. A Head-Glenoid mismatch of 1 size increment is allowable.*

Example:
48 *Head +* ***52*** *Glenoid =* ***10****mm Mismatch*
52 *Head +* ***52*** *Glenoid =* ***6****mm Mismatch*
56 *Head +* ***52*** *Glenoid =* ***2****mm Mismatch*

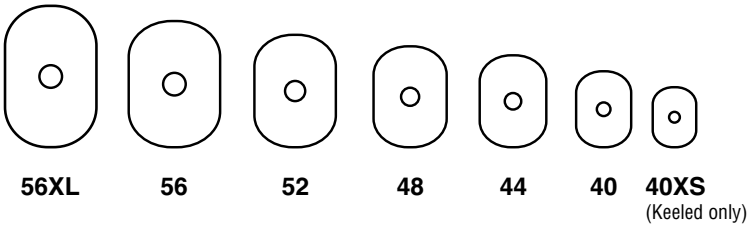


Figure 48

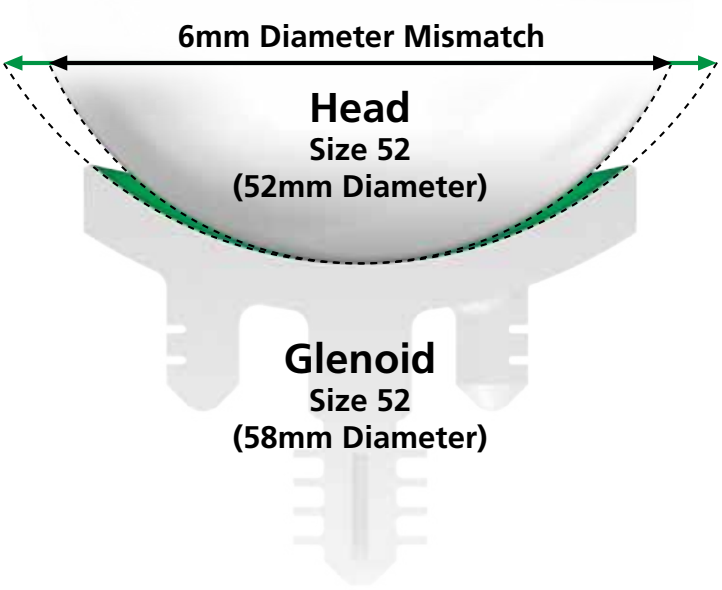


Figure 49

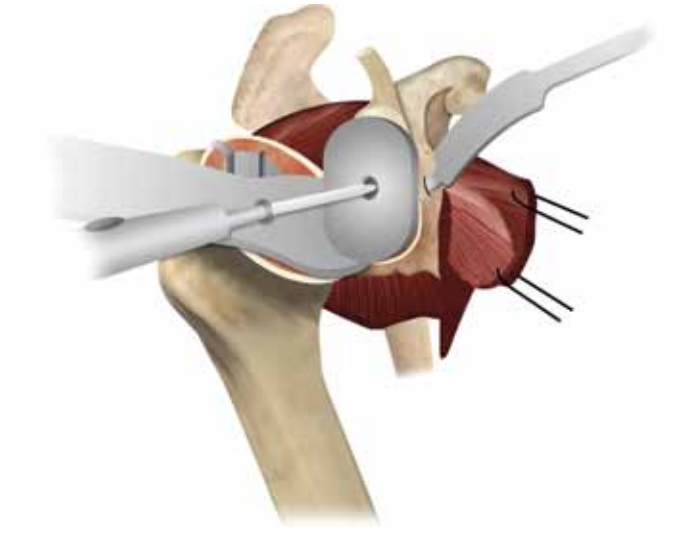


Figure 50

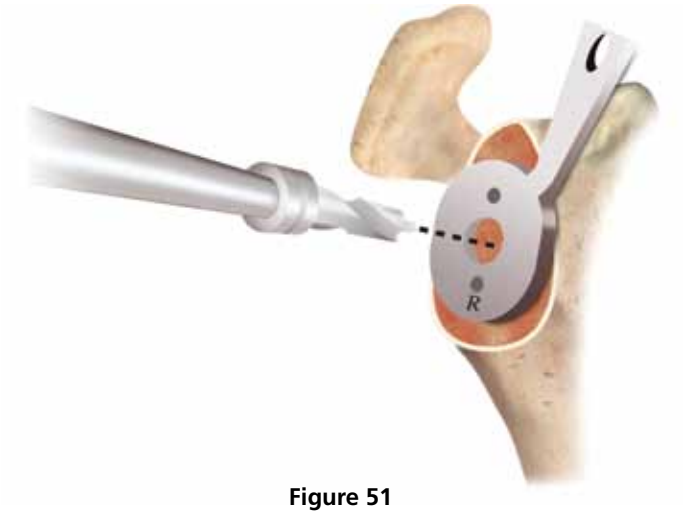


Figure 51

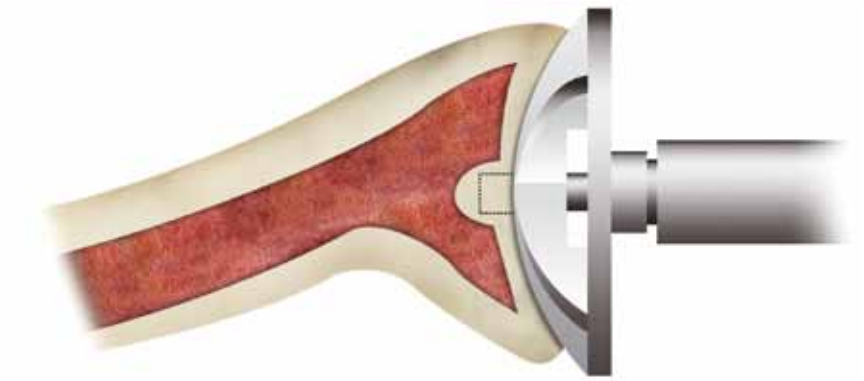


Figure 52

NOTE: No Anchor Peg Glenoid Instrumentation is contained in the Advantage System, and will be supplied separately.

Anchor Peg Trial

When exposure is deemed adequate for use of the Anchor Peg Glenoid instrumentation, use the appropriate glenoid sizing disc to help mark the center of the glenoid (Figure 50). Using the center pilot hole drill bit (Cat. No. 2128-61-007) (Figure 51) and the central hole drill guide, align the drill guide hole with the center mark just created. Drill the central hole. If increased retroversion is noted on preoperative radiographic studies, normalize the orientation of the glenoid face using a spherical reamer, which corresponds with the previously selected glenoid sizing disk (Figure 52). Insert the nub of the face of the reamer into the central hole. Ream accordingly. It is important to remember that over-reaming will both decrease the surface area of the glenoid face and reduce the depth of the glenoid vault and is to be avoided.

Note: *Removal of too much subchondral bone may affect secure fixation of the glenoid implant.*

Using the gold central guide and the appropriate size anchor peg center drill bit (Cat. No. 2236-80-075 for 40mm/44mm and Cat. No. 2236-80-070 for 48mm/52mm/56mm), align the drill guide hole with the previously created central drill hole that was used to ream the glenoid. Drill the central anchor peg hole (Figure 53). Insert the tip of the peripheral drill guide into the anchor peg hole. Use the smaller peripheral drill bit (Cat. No. 2236-80-090) to create the peripheral drill holes.

After each peripheral hole is drilled, insert an anti-rotation post (Cat. No. 2236-80-091) to maintain alignment of the guide while the subsequent holes are completed (Figure 54). Check each peripheral hole to determine whether it penetrates the scapula at its base. Cement the penetrating holes but the cement will not be pressurized. Check the quality of the glenoid bone preparation by determining if the component is directly supported by precisely contoured bone, which should prevent the component from rocking, even when an eccentric load is applied to the rim of the implant.

Note: *If a size 40mm or 44mm Anchor Peg Glenoid is to be used, use the 40 or 44mm center drill bit (Cat. No. 2236-80-075). If a 48, 52 or 56mm Anchor Peg Glenoid is to be used, use the 48, 52 and 56mm center drill bit (Cat. No. 2236-80-070).*

Note: *Component loosening or excessive wear may occur if the glenoid component lacks sufficient bone support.*

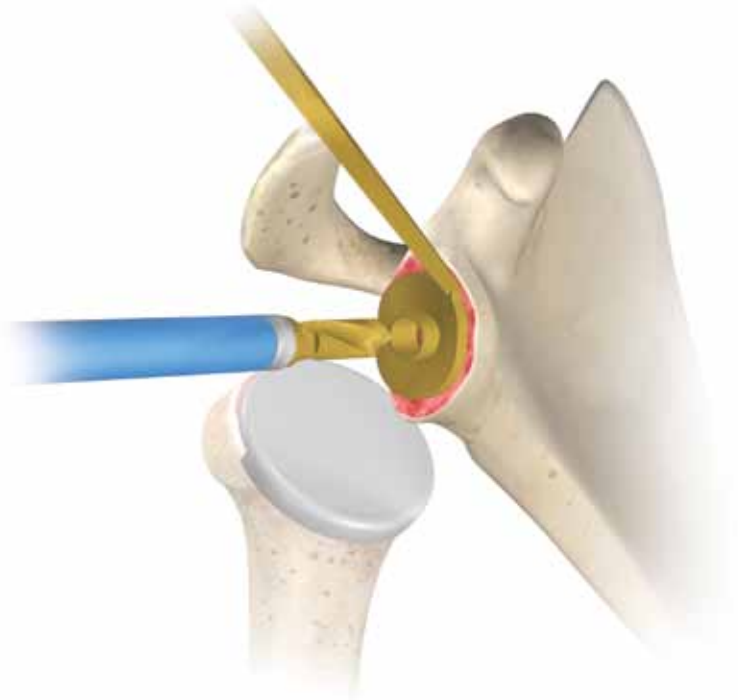


Figure 53

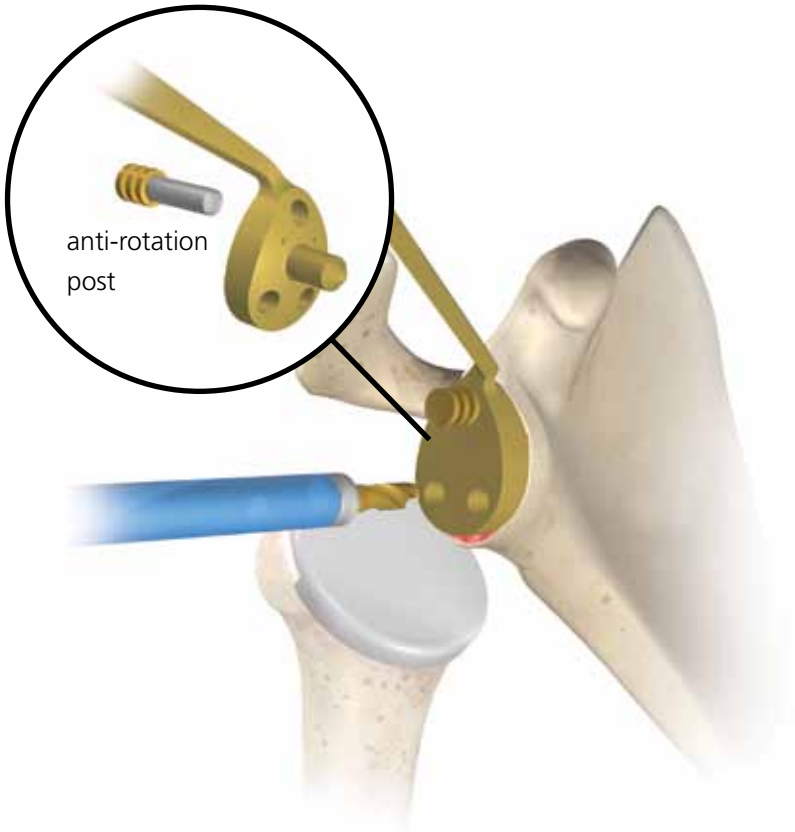


Figure 54

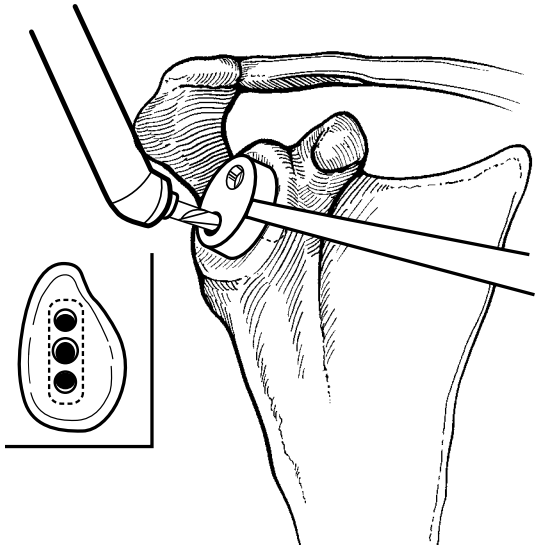


Figure 55

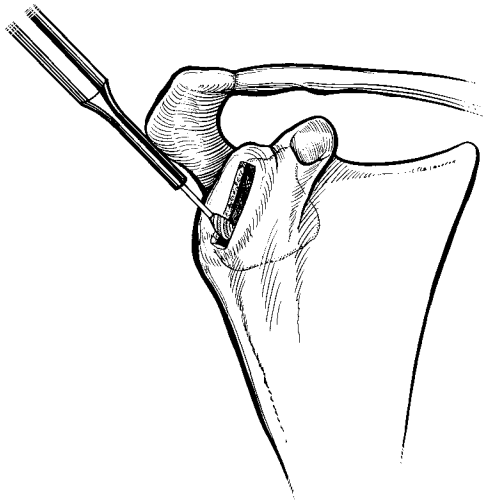


Figure 56

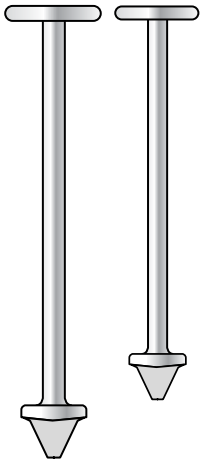


Figure 57

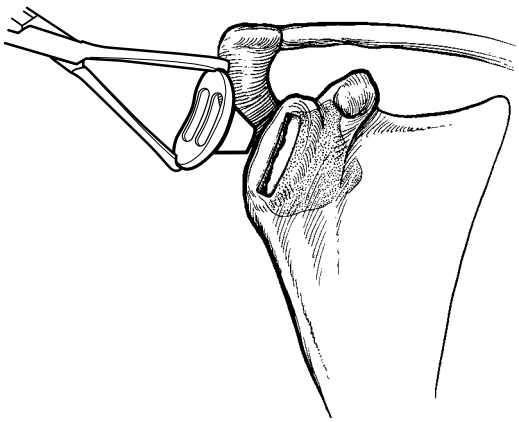


Figure 58

Keeled Glenoid Trial

If using the keeled glenoid, prepare the glenoid fossa as previously described. Drill the central hole and then ream the glenoid until it is smooth. To manage the patient with a hemiarthroplasty, use the glenoid reamer without the hub to smooth out the glenoid fossa.

Two glenoid templates are available to indicate the keel slot size to be made in the glenoid. Use one for the smaller glenoid sizes (40/40XS, 44 and 48) and the other for larger sizes (52, 56 and 56XL). Place the central hub of the appropriate sized template into the central hole in the glenoid. Place the pilot-tipped drill bit into the two holes in the template and drill out (Figure 55). Remove the template and use an air burr, rongeur or curette to connect the holes for the keel of the prosthesis (Figure 56). Excavate the bone in the base of the coracoid and down the lateral border of the scapula to help lock the keeled prosthesis with cement.

Two different sizes of glenoid keel tamps are available which can be used to impact the bone in the glenoid fossa for proper fit of the trial keeled glenoid prosthesis (Figure 57). The keeled glenoid trials have slots in them to indicate that the back of the prosthesis will sit flush on the bone of the glenoid fossa (Figure 58). The keel on the trial prosthesis is larger than the keel on the final prosthesis, which allows for the appropriate cement mantle.

Humeral Head Trials

With the trial glenoid prosthesis and appropriate size humeral broach in place, select the appropriate trial humeral head (15, 18 or 21mm) (Figure 59). Each of the trial humeral heads is identified with a specific color code. Remember that the size of the head is determined by the glenoid sizer selection.

It is important to balance the soft tissue tension with the appropriate size trial humeral head. With the proper size trial head in place, it should be possible to fully internally rotate the arm across the chest so that the hand of the involved shoulder can easily rest on the top of the opposite shoulder without the involved shoulder being elevated off the table. It should also be possible to externally rotate the arm 30-40 degrees and be able to reapproximate the subscapularis tendons back to the cut surface of the neck of the humerus and sublux the humeral head 50 percent posteriorly out of the glenoid trial.

If the fit of the humeral head is so tight that the functional internal or external rotation or posterior subluxation cannot be obtained, use a smaller head. For example, if the 21mm size head does not allow the proper soft tissue balance, try the 18 or 15mm head. If the 15mm head also prevents proper soft tissue balance, it may be necessary to remove more of the neck of the humerus or release the entire posterior capsule from the glenoid.

Use of the Eccentric Trial Heads

If after reaming and broaching the proximal humerus the prepared cavity is centralized, a standard humeral head will cover the proximal humerus (Figures 60 and 61). However, if it is off center (Figure 62), a standard head will leave part of the proximal humerus uncovered (Figure 63). The eccentric head, with its 4mm offset taper, will allow the head to be rotated into an infinite number of dialable head positions to allow maximum coverage of the proximal humerus (Figure 64).

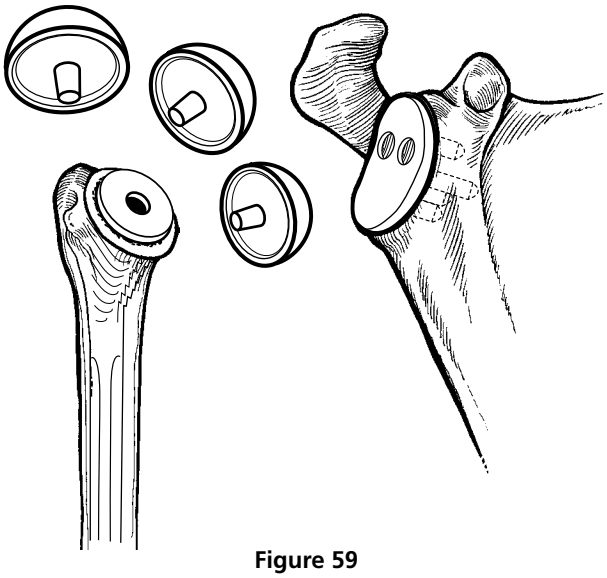


Figure 59

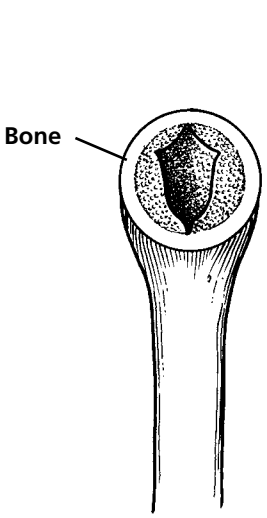


Figure 60

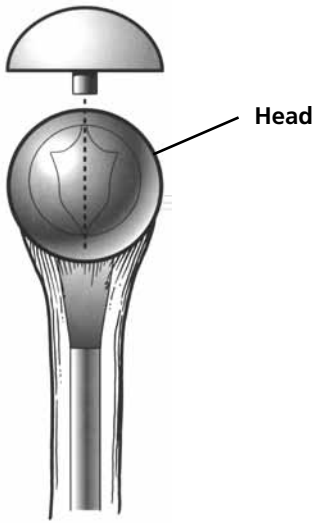


Figure 61

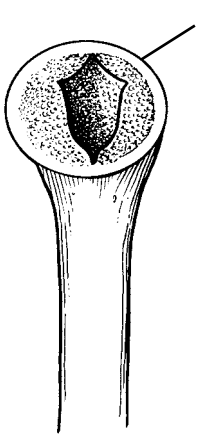


Figure 62

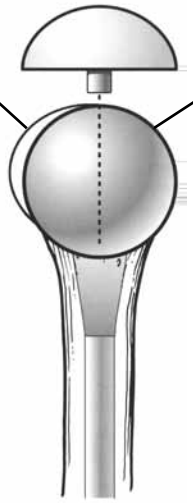


Figure 63

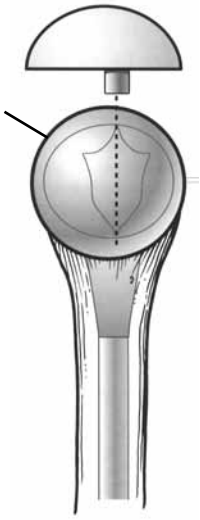


Figure 64

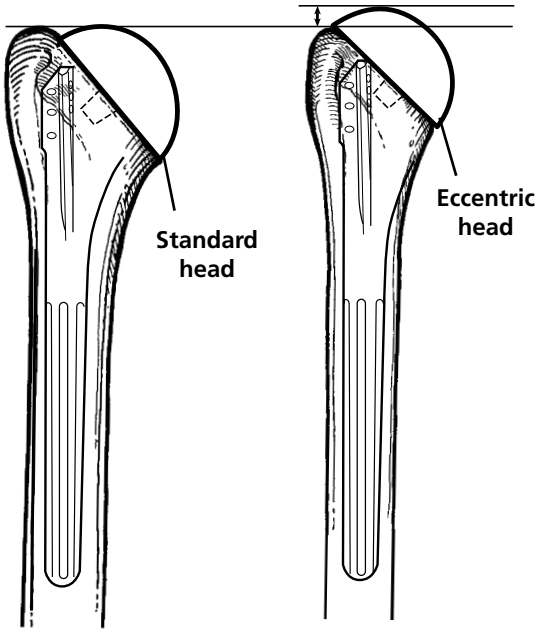


Figure 65 **Figure 66**

The head may be rotated superiorly to place the head (5 to 10mm) above the top of the greater tuberosity (Figures 65 and 66). There are four eccentric head sizes ranging from 44 to 56mm. In each size there is an 18 and 21mm head height.

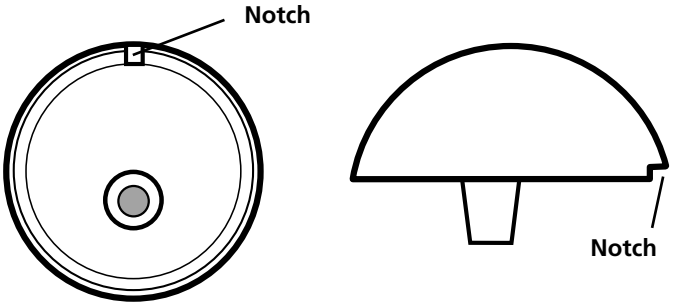


Figure 67 **Figure 68**

Each eccentric head has a 4mm offset taper. If the standard head prosthesis allows proper soft tissue balance but there is uncovered head or the greater tuberosity sits above the top of the standard head, use an eccentric head of the same size. For example, if the 52x18mm head gives a proper soft tissue balance, use a 52x18mm eccentric head. Each of the eccentric trial heads has a notch on the edge of the articular surface denoting the maximum offset (Figures 67 and 68).

There is a screw in the articular surface of the trial eccentric head. Using the 3.5mm hex driver, secure the head to the broach/ trial (Figure 69). Rotate the trial head to the approximate desired position and tighten the screw

(Figure 70). Trial the prosthesis into the glenoid and adjust as necessary. There are two options. If the arm can be externally rotated and the trial head easily accessed, simply loosen the screw, reposition the head and retighten the screw. If access is limited, remove the trial assembly and then adjust. When the final position of the eccentric head is achieved, tighten the head securely in place so that the head position can be similarly reproduced in the final prosthesis.

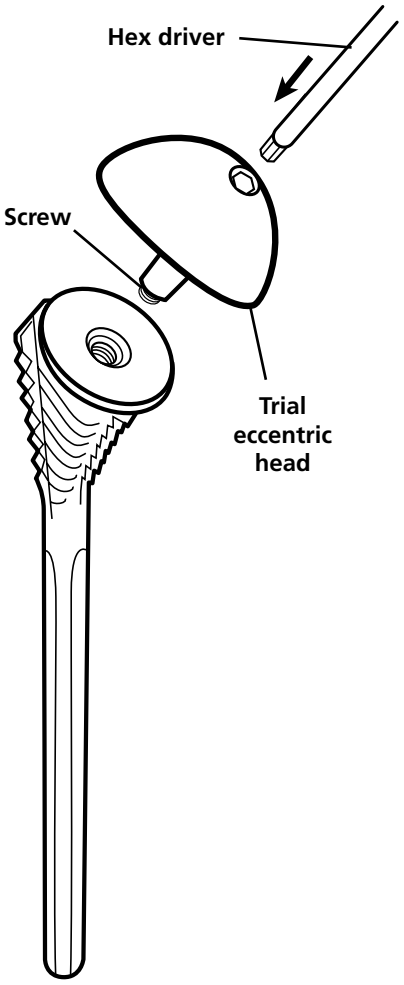


Figure 69

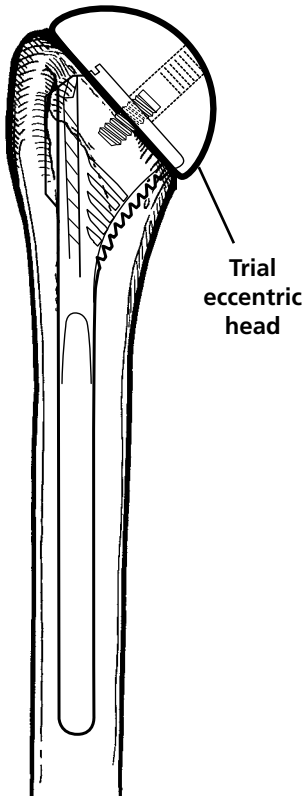
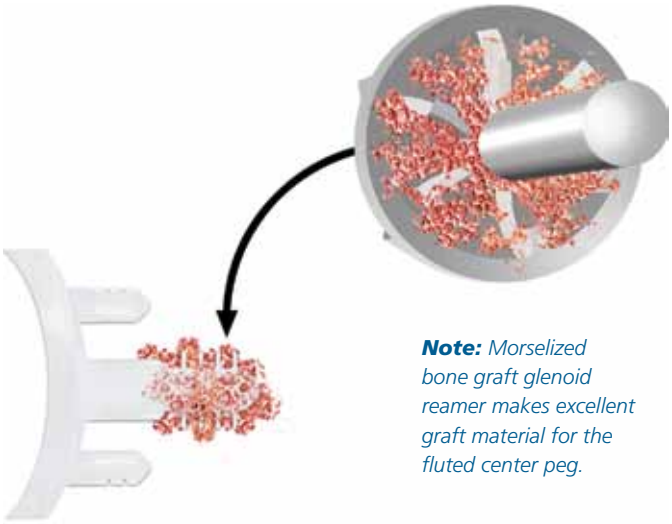


Figure 70



Note: *Morselized bone graft glenoid reamer makes excellent graft material for the fluted center peg.*

Figure 71

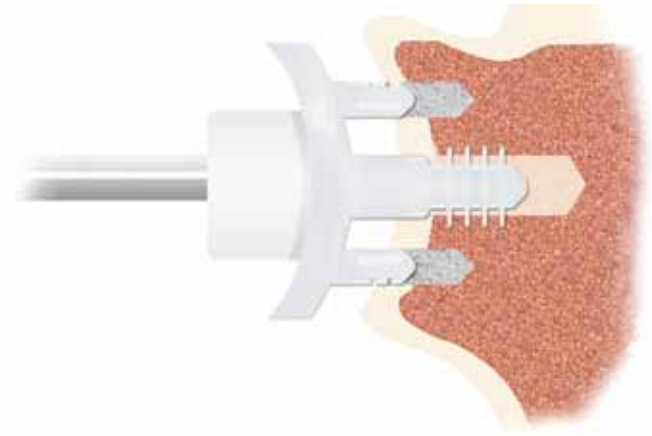


Figure 72

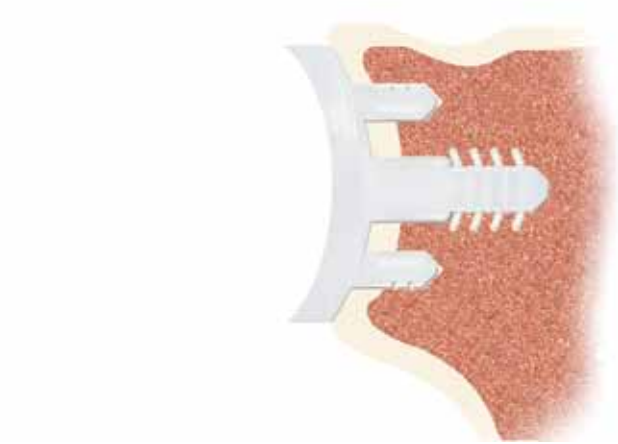


Figure 73

GLENOID PROSTHESIS INSERTION

Anchor Peg Glenoid Insertion

Reamed bone retrieved during the glenoid preparation (reaming and drilling) may be used to create a "bone paste." Interpose the bone paste between the flutes of the central anchor peg to help facilitate tissue integration (Figure 71).

Use pulsatile lavage or another means of thorough irrigation to remove any blood clots from the four drill holes. While cement is being prepared, obtain hemostasis by packing each of the three peripheral holes with thrombin and Surgicel® gauze (Surgicel® is a brand marketed by Ethicon, Inc.). Mix cement using SmartSet® GHV by manual or syringe application. When the cement has reached a "doughy" state and no longer sticks to the surgeon's gloves, remove the Surgicel gauze and pack a small amount of cement into each peripheral hole using a finger-tip. Only a small amount of cement is necessary in each hole to provide the proper 1mm cement mantle around each peripheral peg.

Note: *Excessive cement extruding from the holes and lying between the prosthesis and glenoid fossae is undesirable. It may create an uneven mantle for the glenoid prosthesis, and the cement may fragment with repetitive loading and become loose in the joint, causing damage to the high-density polyethylene surface.*

Insert the Anchor Peg Glenoid prosthesis and use the glenoid impactor to seat the component until there is complete contact with the perimeter of the glenoid (Figures 72 and 73). Maintain pressure directly on the glenoid component until the cement has hardened.

Note: *Cement injected under high pressure by a syringe technique may result in cement extruding from the cancellous walls of the peripheral holes into the central anchor peg hole, which could preclude proper seating of the component.*

Keeled Glenoid Insertion

If the keeled prosthesis is to be used, obtain hemostasis in the keel hole. Irrigate the slot to remove any clots and achieve hemostasis. Spray the slot with thrombin, pack with Surgicel gauze and press a lap sponge into place for pressure. Mix cement using SmartSet® GHV by manual or syringe application and, when the cement is ready for insertion, remove the gauze and sponge and pressurize the cement into the slot with finger pressure. Divide the cement into three or four small batches to allow firm compression of the cement into the bone by finger pressure. This will ensure a good cement mantle in the slot to receive and secure the keeled prosthesis.

Use an instrument to remove some of the cement in the trough to prevent the cement from extruding out of the trough when the prosthesis is inserted. Excessive cement extruding from the hole and lying between the prosthesis and the glenoid fossa is undesirable for two reasons. It may create an uneven seat for the glenoid prosthesis or the thin pieces of cement may become dislodged from between the prosthesis and the bone and enter the articulation, which can damage the polyethylene prosthesis.

Insert the keeled prosthesis and hold it in position with finger pressure until the cement is set and the prosthesis is secure (Figure 74). Alternatively, a glenoid pusher is available to hold the prosthesis in place while the cement is setting (Figure 75).

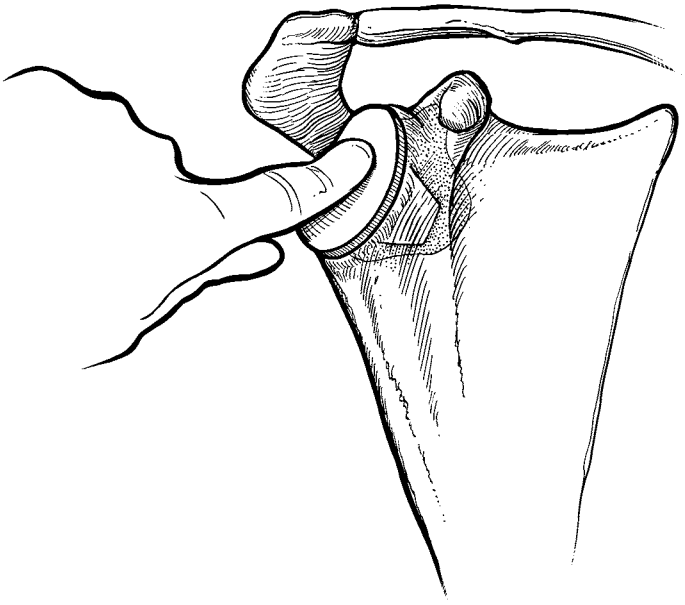


Figure 74

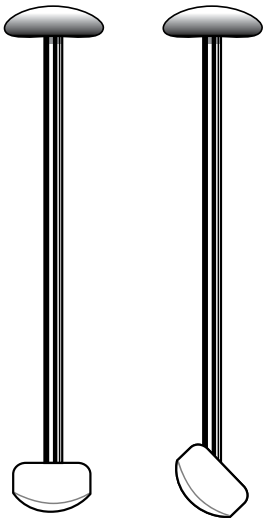


Figure 75

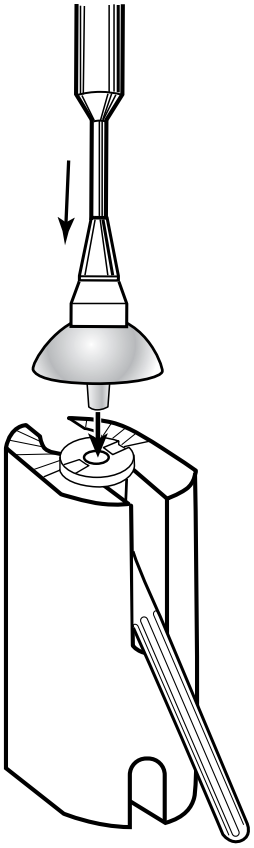


Figure 76

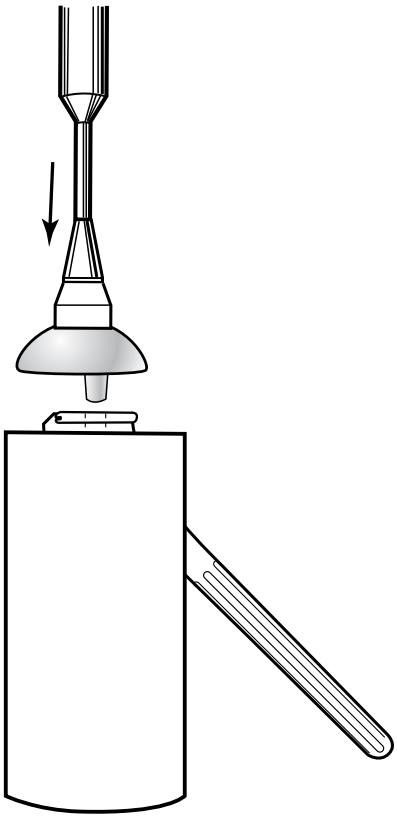


Figure 77

ATTACHING THE HEAD TO THE HUMERAL PROSTHESIS

Seating the Standard Head

When the final combination of the properly sized trial body and head has been determined, place the final body into the Delrin impaction stand. It is not necessary to do any trialing with the final body and head combination. Humeral body sizes 6, 8 and 10 fit into one end of the stand and sizes 12, 14 and 16 fit into the other end. If the long revision stem is used, move the impaction stand to the edge of the table so the stem of the prosthesis can hang off the table. With the prosthesis in the stand, the collar of the prosthesis will be parallel to the table top and allow the head to be driven down perpendicular to the table top, ensuring proper seating of the Morse taper (Figure 76). With the final head in place, impact it into the body using the Delrin tipped impactor and a one or two-pound mallet. Impact the head three to four times to ensure proper seating. The pull out strength of a properly inserted head exceeds 1,400 pounds.

Seating the Eccentric Humeral Head

Remove the broach/head assembly from the humerus with the trial extractor tool. Place the assembly into the impaction block. Reference the position of the notch on the edge of the articular surface to the nearest marking on the top of the impaction block

(Figures 76 and 77). Place the same sized final prosthesis into the impaction block and insert the same sized eccentric head into the humeral stem. There is an etching on the nonarticular surface on the final head that corresponds to the notch marking on the trial head. Line the etching up to the referenced position as noted. It may be helpful to use a skin marker to place a mark on the articular surface near the etching. This technique ensures that the final prosthesis will have the same orientation as the trial

assembly. Firmly impact the head by placing the Delrin tipped impactor on the humeral head and striking the impactor three to four times with a one to two-pound mallet.

INSERTION OF THE HUMERAL HEAD/STEM ASSEMBLY

Press-Fit, Impaction Bone Grafting or Cement

Before the final component assembly is inserted, plan how to repair the subscapularis tendon. If the tendon has been divided or a coronal Z-plasty lengthening the tendon has been done, proceed with the insertion of the humeral component. However, if the tendon was taken directly off its insertion into the lesser tuberosity, drill three or four holes into the anterior neck of the remaining humerus to use to reattach the tendon to bone. Use a suture passer to pull loops of the sutures through these drill holes and later use it to pull the heavy nonabsorbable sutures in the subscapularis out through the neck of the humerus (Figure 78).

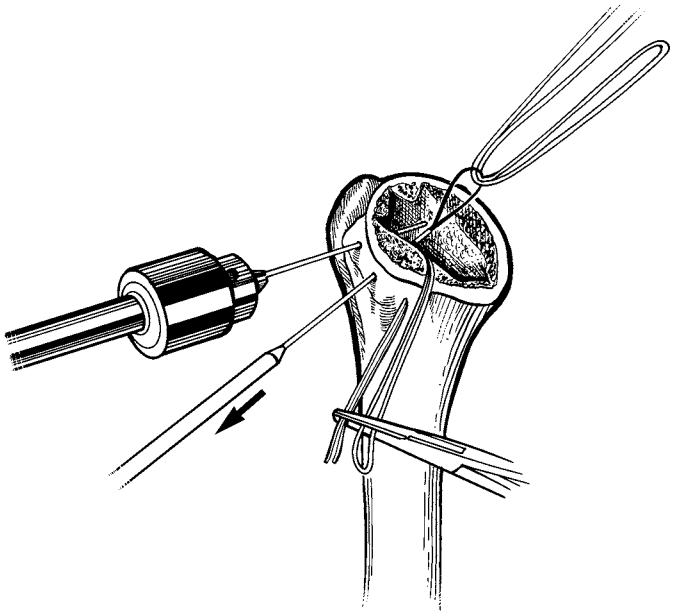


Figure 78

The final prosthesis is 1mm larger than the trial broach so that in the majority of cases, a firm press-fit without cement can be obtained. If the trial broach was slightly loose after humeral canal preparation, use either autogenous bone graft from the resected head of the humerus or cement for fixation of the final prosthesis. As a general rule following the resection of the head, we prefer that all of the cancellous bone be removed and saved on the back of the operating table. If bone graft is used, place the cancellous bone down in the medullary canal, particularly into the inter-tuberosity region, and repeatedly impact it in place using the broach/trial on the driver extractor tool. Do not advance the broach beyond the level of resection. In the case of the patient with severe osteoporotic humerus, use small pieces of the resected head as bone graft, which can produce a firm press-fit of the

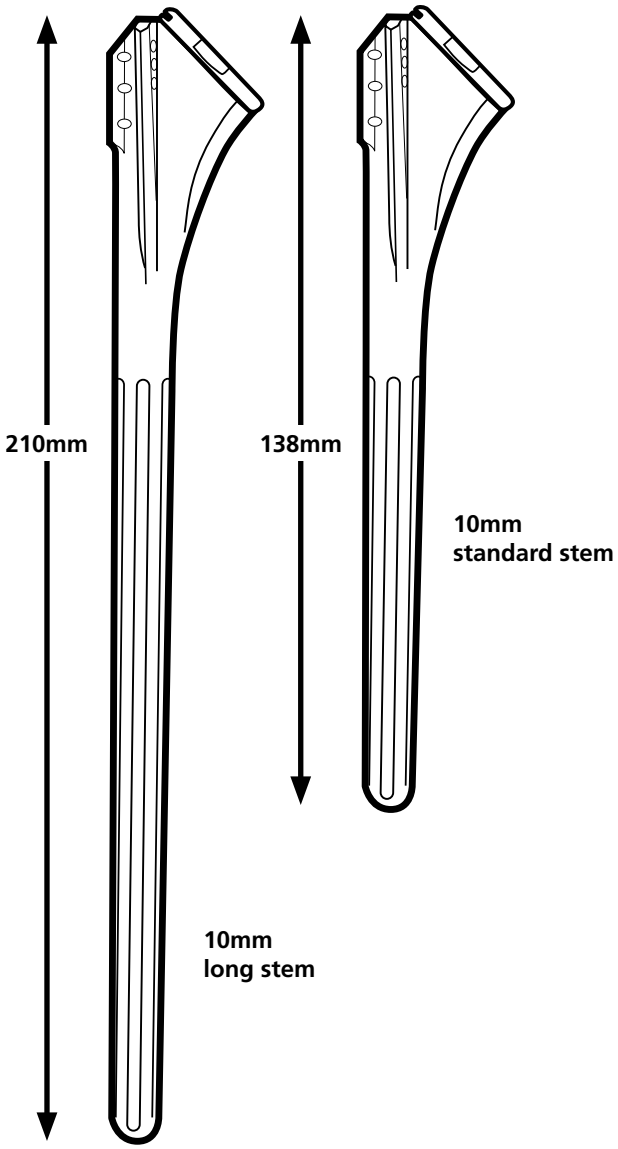


Figure 79

final prosthesis. The decision to use cement or a press-fit technique is up to the individual surgeon. In some instances, such as previous surgical procedures, fractures, osteoporosis or a degenerative cyst in the humerus, it may be necessary to use cement.

The cement technique will vary from case to case. Since the stem of the prosthesis fills the reamed out medullary canal, it is rarely necessary to place the cement deep down the canal of the proximal humerus. If defects exist in the proximal humerus and the fins of the prosthesis are not in contact with the bone, fill that area with cement.

Regardless of the method used, place the final humeral head/stem assembly down the intramedullary canal by hand. Use the Delrin tipped impactor to insert the assembly to the final seating position.

Note: *Long stem humeral components are available for revisions or fractures of the humeral shaft (Figure 79).*

Removal of the Prosthetic Humeral Head

If the humeral head needs to be removed, a head removal instrument is available. Place the wedged tipped driver into the slot anteriorly or posteriorly between the head of the prosthesis and the collar. Tapping on the end of the driver will pop off the humeral head.

Removal of the Cemented Humeral Body

If a cemented prosthesis needs to be removed, a special slap hammer is available. The top of the standard driver extractor tool incorporates a threaded coupling for attachment of a slap hammer (Driver Extractor Cat. No. 2046-10-000 and Slap Hammer Adapter Cat. No. 2128-01-025). First, remove the humeral head as described above. Remove the Delrin tip on the driver extractor and replace it with the steel tip (Figure 80). Attach the driver extractor onto the prosthesis, attach the slap hammer onto the driver extractor and remove the prosthesis. It may be necessary to use small osteotomes or specialized equipment to loosen the cement around the prosthesis.

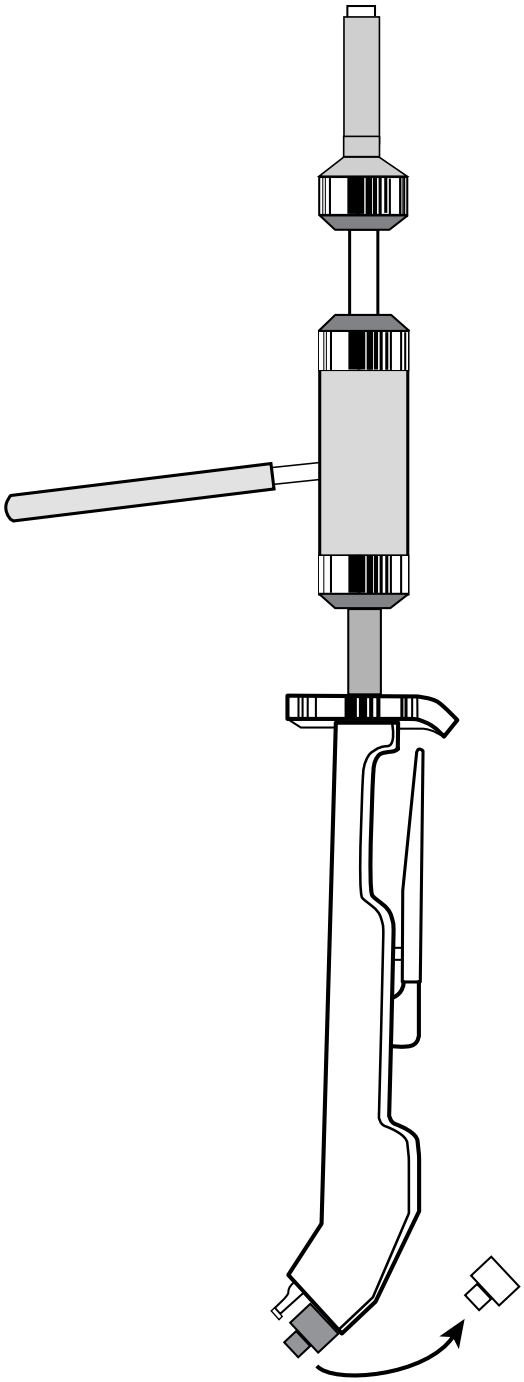


Figure 80

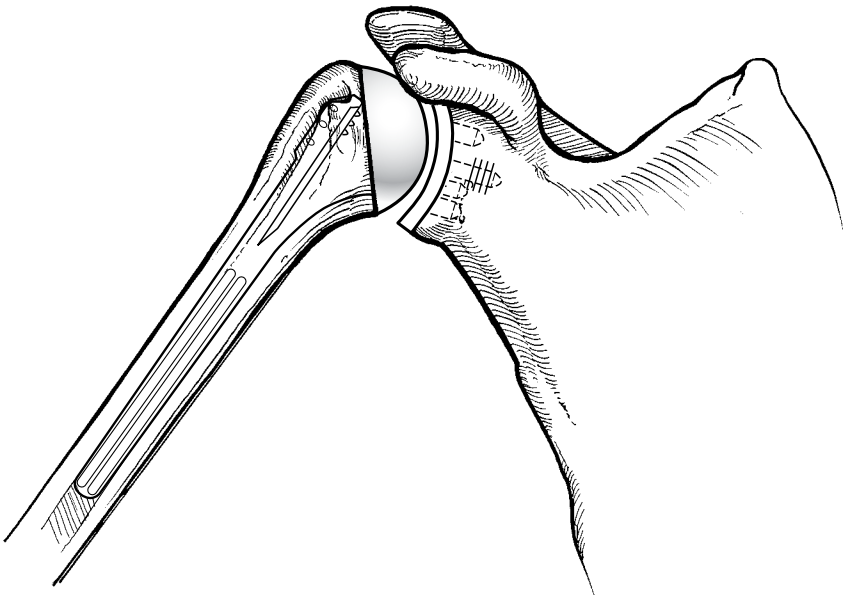


Figure 81

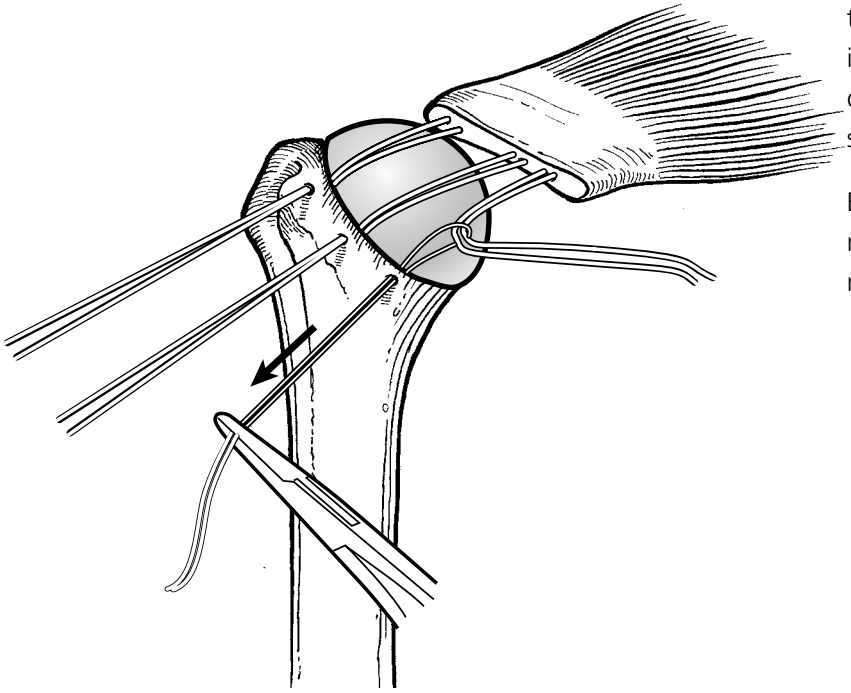


Figure 82

Joint Reduction and Repair of the Subscapularis Tendon

Using the plastic Darrach retractor as a skid, with gentle traction, internal rotation and finger pressure on the humeral prosthesis, reduce the head into the glenoid fossa (Figure 81). Following irrigation, pass the previously placed 1mm nonabsorbable tape in the subscapularis tendon into the loop of sutures in the proximal humerus. Pull the loops of sutures with the 1mm nonabsorbable tape out through the bone and use the tapes to secure the tendon back to the bone (Figure 82).

If the tendon was previously divided or was lengthened with a coronal Z-plasty technique, repair and secure it with 1mm nonabsorbable tape. Use of the heavy sutures allows immediate passive movement beginning the day of surgery without fear of detaching the subscapularis tendon.

Before wound closure, palpate the axillary nerve a final time to assure that it is in its normal position and is intact.

WOUND CLOSURE

Thoroughly irrigate the wound with antibiotic solution and infiltrate the soft tissue with a local anesthetic that will last six to eight hours (Figure 83).

The Hemo-Drain® LC (Cat. No. 5421-04-000 for 1/8 in.) is recommended to prevent formations of postoperative hematoma.

The wound may be closed according to surgeon preference. Our preference is to close the deep layer of fat with a 2-0 Vicryl® suture (Vicryl® is a brand marketed by Ethicon, Inc.); the subcuticular fat as a separate layer and finally the skin with a running subcuticular nylon structure. Careful attention to wound closure will result in a cosmetically acceptable incision (Figure 84).

After the dressing and shoulder immobilizer are in place, the use of a cold wrap is recommended. This prefrozen wrap can be placed on the shoulder in the operating room and replaced with another unit every three hours. The combination of the local anesthetic and the immediate cooling seems to decrease the amount of postoperative pain.

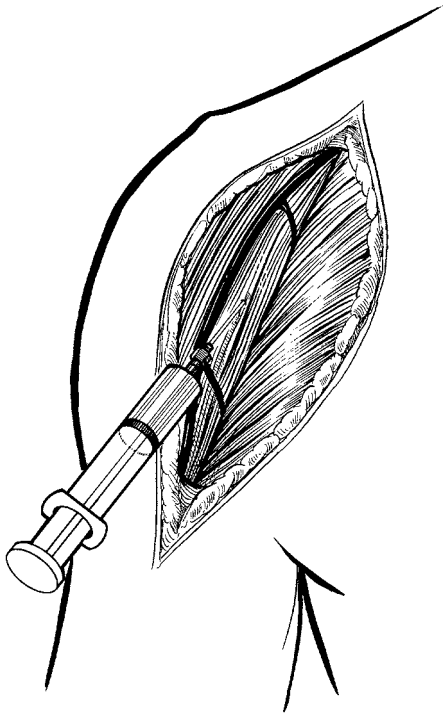


Figure 83

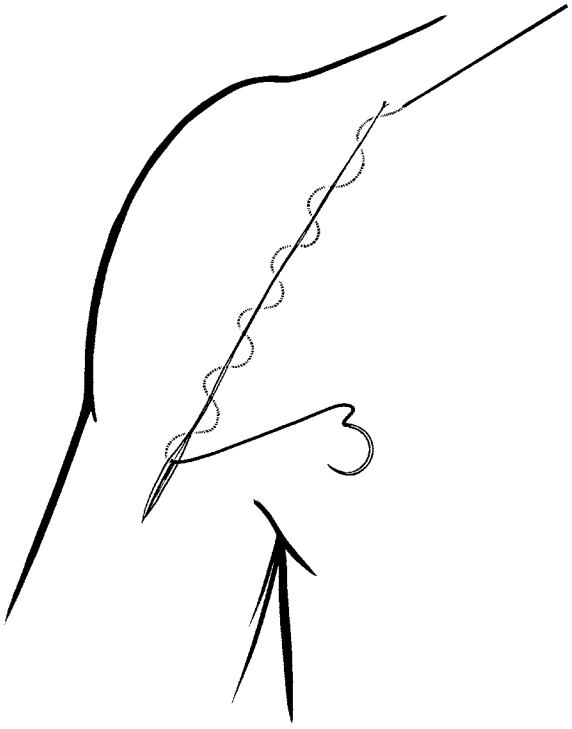


Figure 84

Postoperative Protocol

1. Beginning the Afternoon of the Day of Surgery:

a. Remove the shoulder immobilizer on the afternoon of the day of surgery. With the shoulder sling immobilizer removed, the patient may gently move the arm into comfortable positions.

b. Perform passive flexion of the patient's arm up to 90 or 120 degrees or as far as is comfortable for the patient.

c. An alternative technique uses CPM, which is instituted when the patient is transferred off the operating room table onto the recovery room bed. This allows continuous passive flexion of the arm up to 90 or 120 degrees or more.

2. On the First Postoperative Day:

a. Instruct the supine patient on how to perform passive flexion of the arm using the other arm as a power source and/or through the use of a pulley and rope system attached to the overhead bed frame. At the extreme of flexion, hold the arm for a count of five. Each passive exercise should include five repetitions and be performed three to four times per day.

b. Instruct the supine patient in how to develop passive external rotation stretching exercises with a three-foot stick.

c. Instruct the erect patient in performing the pendulum exercises three to four times per day.

d. Encourage the patient to use the hand and arm for gentle everyday activities such as eating, brushing teeth, drinking liquids, etc.

3. On the Second and Third Postoperative Days:

a. Continue the patient with passive flexion and external rotation exercises. In the erect position, the patient can use an overhead pulley to increase passive flexion and continue to use the arm for gentle living activities.

b. Usually, dismiss the patient on the third day or when 90 to 120 degrees of passive flexion and external rotation of 10 to 15 degrees are achieved. Instruct the patient to continue exercises three to four times per day, seven days a week.

c. Encourage the patient to continue using the arm for gentle daily living activities.

4. Remove the running subcutaneous sutures at two weeks.

5. First Follow-up Visit (Four to Six Weeks):

a. If the patient does not have sufficient passive motion, institute more stretching exercises, such as wall climbing, more overhead stretching with the pulley, the three-foot stick, etc.

b. Encourage the patient to use the arm for progressive everyday activities.

c. If the patient has weakness of the anterior deltoid, institute a specific exercise program which will strengthen the anterior deltoid in the supine position.

6. Subsequent Follow-up Visit (Six to Eight Weeks):

a. Continue the stretching exercise of the shoulder three to four times per day.

b. When the patient has sufficient passive range of motion, such as 120 to 140 degrees of flexion and 20 to 40 degrees of external rotation, institute strengthening exercises of the deltoid and rotator cuff muscles with Therabands. Gradually increase the resistance by using the different colors and strengths of Therabands. Strengthen the scapular stabilizer muscle, such as the trapezius muscle, by performing shoulder shrug exercises against weight. Strengthen the serratus anterior and rhomboid muscles by using wall push-ups and progressing to knee push-ups as indicated.

7. Carefully instruct the patient that keeping the shoulders loose and strong is a life-long, ongoing rehabilitation program.

Ordering Information

Global Advantage Implants

Part Number	Product Description
1137-06-000	6mm Stem, Standard
1137-08-000	8mm Stem, Standard
1137-10-000	10mm Stem, Standard
1137-12-000	12mm Stem, Standard
1137-14-000	14mm Stem, Standard
1137-16-000	16mm Stem, Standard
1137-08-010	8mm Long Stem, Standard
1137-10-010	10mm Long Stem, Standard
1137-12-010	12mm Long Stem, Standard
1137-14-010	14mm Long Stem, Standard
1137-06-050	6mm Porocoat® Stem
1137-08-050	8mm Porocoat® Stem
1137-10-050	10mm Porocoat® Stem
1137-12-050	12mm Porocoat® Stem
1137-14-050	14mm Porocoat® Stem
1137-16-050	16mm Porocoat® Stem
1128-40-000	Humeral Head 40 x 15mm
1128-40-010	Humeral Head 40 x 18mm
1128-40-020	Humeral Head 40 x 21mm
1128-44-000	Humeral Head 44 x 15mm
1128-44-010	Humeral Head 44 x 18mm
1128-44-020	Humeral Head 44 x 21mm
1128-48-000	Humeral Head 48 x 15mm
1128-48-010	Humeral Head 48 x 18mm
1128-48-020	Humeral Head 48 x 21mm
1128-52-000	Humeral Head 52 x 15mm
1128-52-010	Humeral Head 52 x 18mm
1128-52-020	Humeral Head 52 x 21mm
1128-56-000	Humeral Head 56 x 15mm
1128-56-010	Humeral Head 56 x 18mm
1128-56-020	Humeral Head 56 x 21mm
1128-44-110	Ecc Humeral Head 44 x 18mm
1128-44-120	Ecc Humeral Head 44 x 21mm
1128-48-110	Ecc Humeral Head 48 x 18mm
1128-48-120	Ecc Humeral Head 48 x 21mm
1128-52-110	Ecc Humeral Head 52 x 18mm
1128-52-120	Ecc Humeral Head 52 x 21mm
1128-56-110	Ecc Humeral Head 56 x 18mm
1128-56-120	Ecc Humeral Head 56 x 21mm

Keeled Glenoid Implant (Premieron™)

Part Number	Description
1137-93-026	Cross-linked Keeled Glenoid 40xs
1137-94-026	Cross-linked Keeled Glenoid 40
1137-95-026	Cross-linked Keeled Glenoid 44
1137-96-026	Cross-linked Keeled Glenoid 48
1137-97-026	Cross-linked Keeled Glenoid 52
1137-98-026	Cross-linked Keeled Glenoid 56

Anchor Peg Glenoid Implants (Premieron™)

Part Number	Description
1136-40-026	Cross-linked Anchor Peg Glenoid 40mm
1136-41-026	Cross-linked Anchor Peg Glenoid 44mm
1136-42-026	Cross-linked Anchor Peg Glenoid 48mm
1136-43-026	Cross-linked Anchor Peg Glenoid 52mm
1136-44-026	Cross-linked Anchor Peg Glenoid 56mm
1136-45-026	Cross-linked Anchor Peg Glenoid 56mm XL

NOTE: No Anchor Peg Glenoid Instrumentation is contained in the Advantage System, and will be supplied separately.

Ordering Information

Global Advantage Instruments

Part Number	Product Description
2001-65-000	Head Impactor Handle
2001-66-000	Head Impactor Tip
2128-01-006	6mm Reamer
2128-01-008	8mm Reamer
2128-01-010	10mm Reamer
2128-01-012	12mm Reamer
2128-01-014	14mm Reamer
2128-01-016	16mm Reamer
2128-01-020	Inserter/Extractor Handle
2128-01-021	Humeral Head Distractor
2128-01-036	Eccentric Trial Hex Driver
2128-01-041	Eccentric Trial Extractor Mod
2128-02-040	Head Gauge 40, 56
2128-02-041	Head Impaction Stand
2128-02-044	Head Gauge 44, 48, 52
2128-08-021	Extractor Poly Tip
2128-12-020	Extractor Metal Tip
2128-20-000	6mm Osteotome
2128-20-010	6/8mm Osteotome Collar
2128-21-000	8mm Osteotome
2128-22-000	10mm Osteotome
2128-22-010	10/12mm Osteotome Collar
2128-23-000	12mm Osteotome
2128-24-000	14mm Osteotome
2128-24-010	14/16mm Osteotome Collar
2128-25-000	16mm Osteotome
2128-40-000	Humeral Head 40X15 Trial
2128-40-010	Humeral Head 40X18 Trial
2128-40-020	Humeral Head 40X21 Trial
2128-44-000	Humeral Head 44X15 Trial
2128-44-010	Humeral Head 44X18 Trial
2128-44-020	Humeral Head 44X21 Trial
2128-44-110	Eccentric Humeral Head 44X18 Mod Trial
2128-44-120	Eccentric Humeral Head 44X21 Mod Trial
2128-48-000	Humeral Head 48X15 Trial
2128-48-010	Humeral Head 48X18 Trial
2128-48-020	Humeral Head 48X21 Trial
2128-48-110	Eccentric Humeral Head 48X18 Mod Trial
2128-48-120	Eccentric Humeral Head 48X21 Mod Trial
2128-52-000	Humeral Head 52X15 Trial

Global Advantage Instruments

Part Number	Product Description
2128-52-010	Humeral Head 52X18 Trial
2128-52-020	Humeral Head 52X21 Trial
2128-52-110	Eccentric Humeral Head 52X18 Mod Trial
2128-52-120	Eccentric Humeral Head 52X21 Mod Trial
2128-56-000	Humeral Head 56X15 Trial
2128-56-010	Humeral Head 56X18 Trial
2128-56-020	Humeral Head 56X21 Trial
2128-56-110	Eccentric Humeral Head 56X18 Mod Trial
2128-56-120	Eccentric Humeral Head 56X21 Mod Trial
2128-60-006	6mm Broach
2128-60-008	8mm Broach
2128-60-010	10mm Broach
2128-60-012	12mm Broach
2128-60-014	14mm Broach
2128-60-016	16mm Broach
2128-61-040	Humeral Case and Inserts
2128-61-070	Ratchet T Handle
2128-61-071	Celcon Humeral Head Cutting Guide
2128-62-001	Left 1M Cutting Guide
2128-62-002	Right 1M Cutting Guide
2236-26-000	Modified Crego Retractor
2236-31-000	Plastic Darrach Retractor
2236-59-000	1M Cutting Guide Clamp

Keeled Glenoid Instruments

Part Number	Product Description
212861000	Reamer Size 40
212861001	Reamer Size 44
212861002	Reamer Size 48
212861003	Reamer Size 52
212861004	Reamer Size 56 XL/56
212861005	Nubless Reamer
212861006	Center Drill Guide
212861007	Drill Bits
212861010	Anti Rotation Pegs
212861011	Anti Rotation Peg Grasper
212861012	Straight Drill Driver
212861013	Universal Drill Driver
212861014	Keeled Glenoid Drill Guide
212861015	Keeled Glenoid Tamp-Small
212861016	Keeled Glenoid Tamp-Large
212861017	Glenoid Grasper
212861024	Keeled Glenoid Trial Size 40 XS
212861025	Keeled Glenoid Trial Size 40
212861026	Keeled Glenoid Trial Size 44
212861027	Keeled Glenoid Trial Size 48
212861028	Keeled Glenoid Trial Size 52
212861029	Keeled Glenoid Trial Size 56
212861050	Global Adv Glenoid Case and Inserts
223488000	Glenoid Sizer Disc Size 40 XS
223489000	Glenoid Sizer Disc Size 40
223490000	Glenoid Sizer Disc Size 44
223491000	Glenoid Sizer Disc Size 48
223492000	Glenoid Sizer Disc Size 52
223493000	Glenoid Sizer Disc Size 56
223495000	Glenoid Sizer Disc Size 56 XL
223572000	Drill/Reamer Wrench
223575000	Angled Driver
223603000	Glenoid Pusher Handle
223621000	Small Glenoid Pusher
223622000	Large Glenoid Pusher

Anchor Peg Glenoid Instruments

Part Number	Product Description
2236-80-000	Anchor Peg Glenoid 40mm Trial
2236-80-010	Anchor Peg Glenoid 44mm Trial
2236-80-020	Anchor Peg Glenoid 48mm Trial
2236-80-030	Anchor Peg Glenoid 52mm Trial
2236-80-040	Anchor Peg Glenoid 56mm Trial
2236-80-050	Anchor Peg Glenoid 56mm Trial XL
2236-80-060	Anchor Peg Glenoid Center Drill Guide
2236-80-070	Anchor Peg Glenoid Center Drill Bit 48, 52, 56
2236-80-075	Anchor Peg Glenoid Center Drill Bit 40/44
2236-80-080	Anchor Peg Glenoid Peripheral Guide
2236-80-090	Anchor Peg Glenoid Peripheral Drill Bit
2236-80-091	Anchor Peg Glenoid Anti-rotation Post
2236-80-095	Anchor Peg Glenoid Case
2236-80-098	Anchor Peg Glenoid Overlay
2128-61-007	Center Pilot Hole Drill Bit

NOTE: No Anchor Peg Glenoid Instrumentation is contained in the Advantage System, and will be supplied separately.

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.

Indications
Total shoulder or hemi-shoulder replacement is indicated for:

1. A severely painful and/or disabled joint resulting from osteoarthritis, traumatic arthritis or rheumatoid arthritis;
2. Fracture-dislocations of the proximal humerus where the articular surface is severely comminuted, separated from its blood supply or where the surgeon's experience indicates that alternative methods of treatment are unsatisfactory;
3. Other difficult clinical problems where shoulder arthrodesis or resection arthroplasty are not acceptable (e.g., revision of a failed primary component).

Hemi-shoulder replacement is also indicated for:

1. Ununited humeral head fractures;
2. Avascular necrosis of the humeral head;
3. Rotator cuff tear arthropathy. **Global® CAP® is indicated for intact or repairable rotator cuff.**
4. Deformity and/or limited motion.

Porocoat® Porous-Coated Components
Porocoat porous-coated humeral stem prostheses are indicated for cemented or cementless use with fixation provided by biological tissue in-growth into the porous coating.

Global CAP is intended for cementless use only.

Cemented Components
Humeral stem and Glenoid components labeled "For cemented use only" are indicated only for use with bone cement.

Press-fit or Cemented Components
Humeral stem prostheses without porous coating and labeled "for press fit or cemented use only" are indicated for press-fit uncemented use or for use with bone cement.

Contraindications
The following conditions are contraindications for total shoulder and hemi-shoulder arthroplasty.

1. Active local or systemic infection.
2. Inadequate bone stock in the proximal humerus or glenoid fossa for supporting the components.
3. Poor bone quality, such as osteoporosis, where there could be considerable migration of the prosthesis and/or a chance of fracture of the humerus or glenoid.

The following condition is a contraindication for total shoulder arthroplasty.

1. Absent, irreparable or nonfunctional rotator cuff or other essential muscles.

Warnings and Precautions:
The use of a glenoid prosthesis in patients with cuff tear arthropathy could increase the risk of glenoid component loosening due to non anatomic loading conditions. The following conditions tend to adversely affect shoulder replacement implants: excessive patient weight, high levels of patient activity, likelihood of falls, poor bone stock, metabolic disorders, disabilities of other joints.

Adverse Events:
The following are the most frequent adverse events after shoulder arthroplasty: change in position of the components, loosening of components, dislocation, infection, hematoma, pneumonia, and cardiovascular disorders.

Revised 7-1-09

References

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2. Karduna, A.R., Williams, G.R., et. al. "Glenohumeral Joint Translatons before and after Total Shoulder Arthroplasty." *Journal of Bone and Joint Surgery* Vol. 79, 1997.
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