Surgical Technique

Shoulder Prosthesis

AEQUALIS®
Spherical
Base Glenoid

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TORNIER
SURGICAL IMPLANTS

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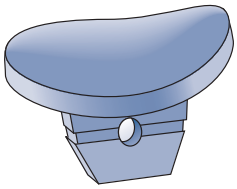
DESIGN FEATURES

1. DESIGN FEATURES

The Aequalis® Glenoid is a pear-shaped implant made from UHMWPE (Ultra High Molecular Weight Polyethylene), with a keel and a spherical base surface. The 4 mm thick Aequalis® Glenoid is available in 3 sizes: small, medium, large. Each size has its own height, width, and radius of curvature.
Precise anatomical data allowed us to determine ideal glenoid and humeral head combinations.

Glenoids	Humeral heads
Small (27.5 mm radius of curvature)	39/14
	41/15
Medium (30 mm radius of curvature)	43/16
	46/17
Large (32.5 mm radius of curvature)	48/18
	50/16 & 50/19

Our goal is to achieve a low degree of constraint between the glenoid and the humeral head while addressing the anatomic spectrum; this is why each humeral head size combines with any glenoid size.



PRE-OPERATIVE PLANNING

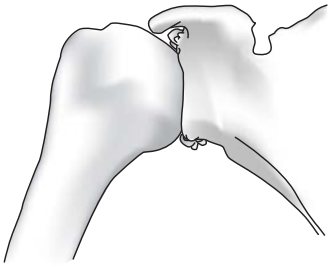
2. PRE-OPERATIVE PLANNING

Suggested pre-operative X-rays include:

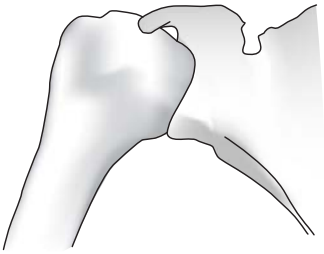
- 3 standard AP views (internal/external/neutral rotation) for assessment of inferior and superior glenoid osteophytes. These views will also reveal any asymmetrical wear of the glenoid in the frontal plane.
- Axillary lateral view provides information on the glenoid orientation and position of the humeral head.

A double contrast arthro-CT (or a standard CT) scans seems is needed for correct evaluation of:

- Glenoid retroversion which is usually between 0 and 8 degrees.
- Direction and dimensions of the medullary canal (the keel of the glenoid implant is 13 mm long).
- Glenoid wear (amount and location) particularly in the superior and posterior areas.
- Anterior and posterior glenoid osteophytes.
- Humeral head subluxation relative to the glenoid.



Superior and inferior glenoid osteophytes to be resected



Superior asymmetrical wear typical of rheumatoid arthritis

SURGICAL EXPOSURE

3. SURGICAL EXPOSURE

Adequate exposure of the glenoid is critical to achieve correct positioning of the glenoid implant.
Appropriate soft tissue releases are initiated early in the procedure.

1. Subscapularis

The subscapularis muscle tendon unit must be completely released (from the tendon superiorly, to the muscle inferiorly). The capsule is incised together with the muscle and tendon, and the incision is carried inferiorly over the anatomical neck as far as the surgical neck of the humerus.
The inferior and middle glenohumeral ligaments at the deep surface of the subscapularis are released.
The subscapularis is retracted into the subscapularis fossa and held in place by a z-retractor to provide adequate exposure of the anterior glenoid rim.

2. Anterior capsule

Release of the subscapularis must be completed by release of the inferior capsule between the 5 o'clock and 7 o'clock position. Release of the capsule and inferior labrum should be preferably performed by electro-cautery that has the advantage of remaining in contact with the bone, while allowing the gradual exposure of 2-3 cm of the inferior glenoid, at the insertion site of the triceps tendon.
Release of the posterior and superior parts of the capsule is rarely necessary (only in sequelae of fracture).

SURGICAL EXPOSURE

3. SURGICAL EXPOSURE

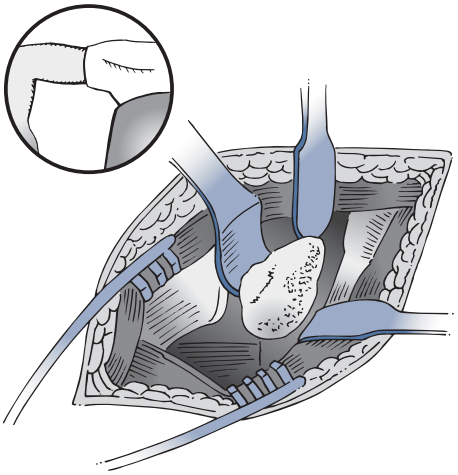
3. Humeral protector

Glenoid preparation is performed after the humeral head osteophytes (particularly inferior osteophytes) have been trimmed and the humeral head has been removed. The humeral protector is used to preserve integrity of the humeral epiphysis during posterior translation.

4. Inserting retractors

We recommend using three retractors to obtain adequate exposure of the glenoid fossa:

- A Kölbel retractor should be placed in the subscapularis fossa.
- A humeral head retractor should rest on the posterior glenoid rim, retracting the humeral head and allowing direct visualization of the glenoid, perpendicular to its surface. Again, a Kölbel retractor can be used, depending on surgeon preferences.
- A narrow Hohman retractor with a sharp tip should be inserted beneath the superior glenoid labrum, and rest on the superior glenoid rim.



4. GLENOID SIZING

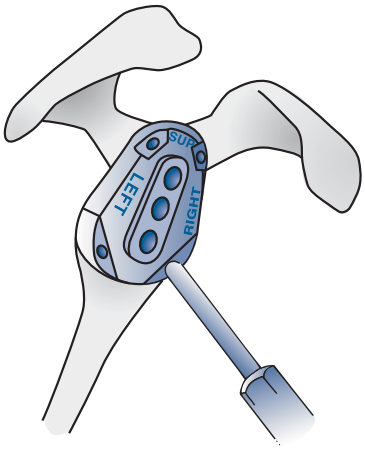
Once adequate exposure of the glenoid face has been achieved, resection of the superior, anterior, inferior and posterior osteophytes (seen on preoperative X-rays) is performed with a rongeur or a small bone chisel.

Three glenoid drill guides are available: small, medium, large, matching the three glenoid implant sizes.

It is recommended to select the drill guide that corresponds to the appropriate humeral head size to maintain a 10 to 16 mm difference in the radius of curvature of the glenoid and the humeral head.

Assemble the drill guide handle to the selected glenoid template and place the template on the articular surface of the glenoid; the upper edge of the template should be flush with the superior margin of the glenoid.

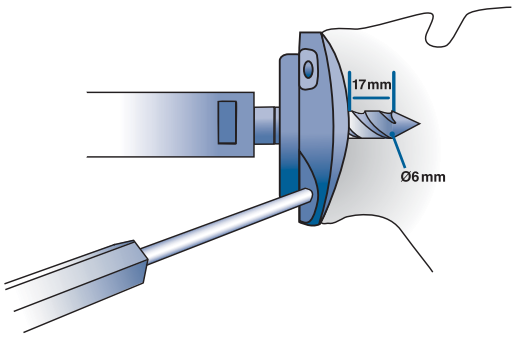
Should the vertical diameter of the glenoid be greater than that of the glenoid implant, always align the superior edge of the template with the superior margin of the glenoid.



DRILLING OF CENTRAL HOLE

5. DRILLING OF CENTRAL HOLE

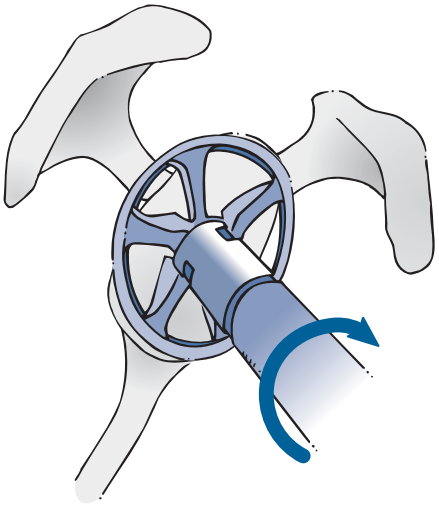
First, drill the central hole in the glenoid with a 6 mm drill bit inserted through the glenoid drill guide until the bit bottoms out. Proper drilling depth is 17 mm.



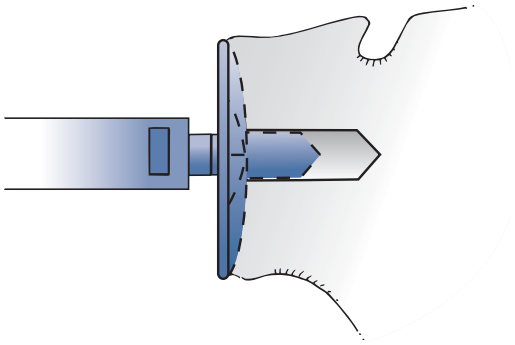
6. REAMING

Spherical reamers are available in three sizes (small, medium, large) matching the three implant sizes.

Insert the 10 mm pilot tip of the reamer into the drilled hole. It will serve as a guide during reaming.



Reaming should be performed with the reamer held perpendicular to the medullary canal, or slightly tilted inferiorly so that more bone is removed from the inferior surface of the glenoid orienting the implant slightly inferiorly.

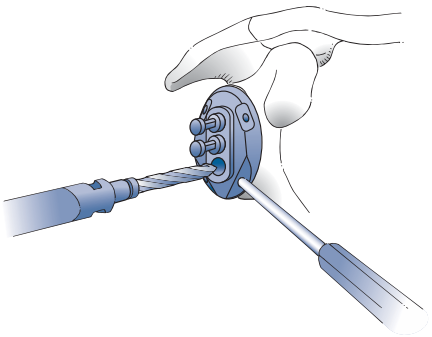


The reaming will create a concave surface that will ensure a congruence between the implant and bone surface.
We advise to not ream down to cancellous bone, considering the small quantity of bone stock available, and the hard osteophytic bone surface which might lead to over-reaming.

KEEL SLOT PREPARATION

7. KEEL SLOT PREPARATION

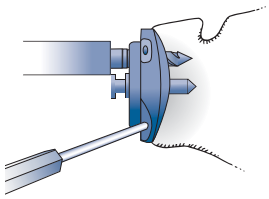
Position the selected drill guide to the glenoid surface, and insert a stabilization peg through the central hole to secure the drill guide to the bone.



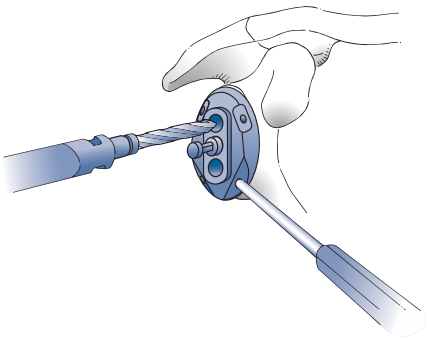
Drill the superior and inferior holes with a 6 mm drill bit through the glenoid drill guide until the bit is flush with the stabilization peg.

Remove the drill guide and connect the three holes using a rongeur.

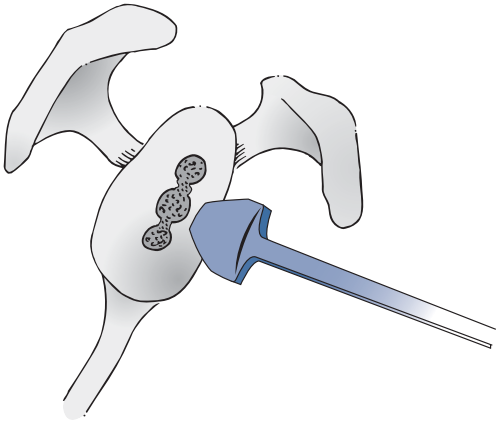
Use the glenoid keel punch to impact the cancellous bone into the keel configuration.



Correct insertion depth is achieved when the scribe mark on the punch is flush with the surface of the glenoid.



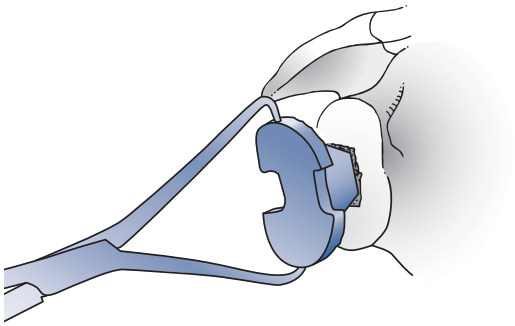
This impaction technique provides strong bone support that will resist shear forces. We no longer advocate curetting the glenoid cavity and the two fixation holes in the base of the coracoid process and the lateral edge of the scapula to remove the cancellous bone.

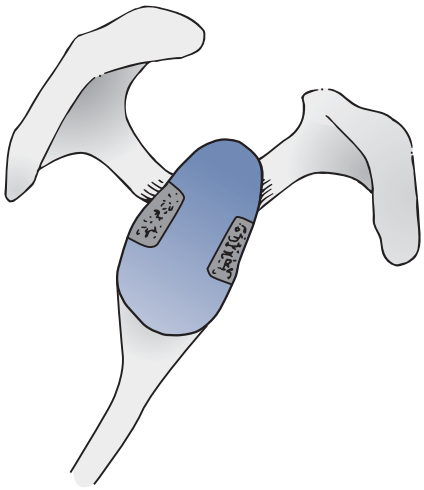


8. GLENOID TRIAL

Insert the appropriate size glenoid trial (small, medium, large) into the prepared cavity with the glenoid trial clamp.

Seat the glenoid trial with the glenoid impactor and check for proper fit and correct positioning of the keel.





TRIAL REDUCTION AND ASSESSMENT OF STABILITY

9. TRIAL REDUCTION AND ASSESSMENT OF STABILITY

If the preoperative CT scan reveals an abnormal orientation of the glenoid and humeral head (excessive wear, posterior subluxation of the humeral head), it is recommended to perform a trial reduction and assess the anterior-posterior stability of the joint.

Once the glenoid trial is in position, replace the humeral protector with the trial humeral head.

Perform another trial reduction to check for:

- congruency of the articular surfaces
- anterior-posterior stability during internal rotation (90°) and external rotation (30°)
- presence of a posterior drawer: at least 50% translation of the humeral head relative to the glenoid (with the shoulder in neutral rotation and the surgeon applying posterior forces to the humeral head).

IMPLANTING THE GLENOID

10. IMPLANTING THE GLENOID

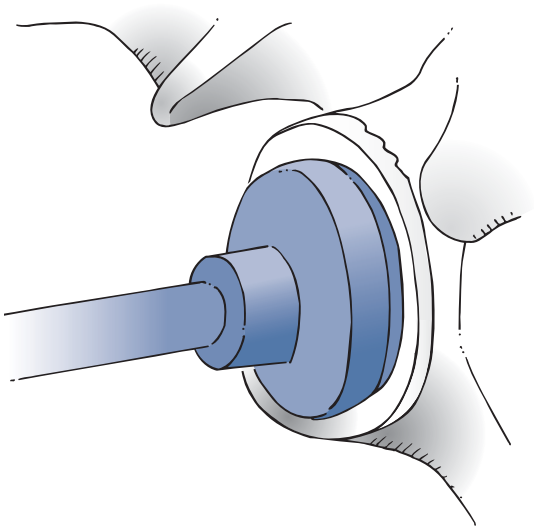
After range of motion and stability have been assessed, remove the glenoid trial in order to proceed to the definitive glenoid implantation.

The slot must be carefully cleaned, then dried with gauze stuffed in while the cement is being prepared.

Gauze is removed and the cement is inserted into the slot with a syringe.

The glenoid implant is inserted and seated using the glenoid impactor. Maintain uniform compression of the implant until the cement is set. Then, reposition the humeral head retractor and remove any excess cement, paying particular attention to the superior and posterior aspects of the glenoid.

Once the glenoid implant is seated, the humeral component can be cemented.



11. TECHNIQUE TIPS AND TRICKS

1. Preoperative radiographic and CT scan assessment of the glenoid is critical. As a matter of fact, it is impossible to accurately evaluate the glenoid version and determine the position and size of the medullary canal intraoperatively (in some shoulders, the glenoid shows more than 50 degrees of retroversion).
In case of severe wear, position the glenoid template in a way that corrects the excessive retroversion while still being aligned with the medullary canal. Only the preoperative examination of the CT scan can provide this information.

2. In tight joints, the humeral head retractor may push the glenoid template forward without the surgeon noticing it. If necessary, change the position of the arm until adequate exposure is obtained. Should this not be sufficient, further release the **inferior** capsule as this is the **key to a good exposure.**

3. Where frontal plane asymmetric wear of the glenoid is revealed by the AP view (particularly superiorly), take care to remove more bone inferiorly during reaming so that the articulating surface of the glenoid implant slightly tilts (by a few degrees) downwards. Retrospective studies have shown that an upward-facing glenoid results in gradual ascent of the humeral head which eventually leads to rotator cuff tear.

4. During reduction if no posterior drawer is noted or there is less than 50% translation, the implanted shoulder will be stiff. In this situation, it is important to check for:
- glenoid version (too anteversed),
- humeral cut (insufficient).

In the absence of bony abnormalities, slowly release the posterior capsule until the desired amount of posterior translation is achieved.

Whenever posterior instability is noted intraoperatively, it is recommended to immobilize the patient's shoulder in neutral rotation for one month, and to avoid active elevation exercises, particularly in the supine position. Codman's pendulum exercises are prescribed during the first postoperative month, after which a standard rehabilitation program is begun. Exercises should be preferably performed in the prone position, taking care to avoid internal rotation of the arm.

In case of excessive posterior drawer translation, and above all, if spontaneous reduction of the humeral head fails to occur during the stability test, there is a high risk of later posterior dislocation of the implant. In this event, orientation of the glenoid and humeral head (excessive retroversion) must be checked and additional bone cuts considered.

In the absence of bony abnormalities, remove the glenoid trial and expose the posterior capsule by inserting of a Meary retractor. Plication of the posterior capsule may be performed using 2 or 3 absorbable sutures. The necessary amount of plication is dictated by the amount of posterior instability when using the trials to reduce the gleno-humeral joint.

INSTRUMENTS

Glenoid drill guide handle
Ref. MWA 210

Contra-angle
Ref. MWA 211

Orientation guide, left
Ref. MWA 212

Orientation guide, right
Ref. MWA 213

6 mm Drill bit
Ref. MWA 215

Stabilization peg
Ref. MWA 216

Reamer holder
Ref. MWA 219

Glenoid drill guide, small
Ref. MWA 222

Glenoid drill guide, medium
Ref. MWA 224

Glenoid drill guide, large
Ref. MWA 226

8 mm Open end wrench
Ref. MKL 010

4 mm Open end wrench
Ref. MWA 214

Glenoid trial clamp
Ref. MWA 231

Glenoid impactor
Ref. MWA 107

Posterior glenoid retractor
Ref. MWA 117

Glenoid keel punch, curved
Ref. MWA 163

Glenoid keel punch, straigh
Ref. MWA 164

Glenoid trial, small
Ref. MWB 001

Glenoid trial, medium
Ref. MWB 002

Glenoid trial, large
Ref. MWB 003

Hemispherical reamer, small
Ref. MWB 004

Hemispherical reamer, medium
Ref. MWB 005

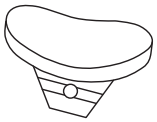
Hemispherical reamer, large
Ref. MWB 006

Burr
Ref. MWA 001

IMPLANTS

Glenoid

Size	Cat. No.
Small	DWB001
Medium	DWB002
Large	DWB003



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