Introduction
Total elbow replacement has become a common procedure for treatment of the unstable elbow. Early elbow prostheses had a “constrained” hinge that only moved in one plane.\textsuperscript{1,2} Because these constrained prostheses experienced reported loosening, hinge laxity was introduced to allow for varus-valgus movement.\textsuperscript{3,6,7} These “semiconstrained” prostheses provide between five to seven degrees of varus-valgus laxity to minimize the stress on the implant and subsequently reduce the incidence of complication.\textsuperscript{2,5,6,7}

Design Rationale
Biomechanically, it is difficult to reproduce the normal kinematic motion of the elbow with a single axis prosthesis. Such a design cannot completely account for the translocation of the axis of rotation that occurs during normal articulation of the elbow.\textsuperscript{1–4} The Huene™ BiAxial prosthesis more accurately reproduces the anterior translocation of the ulna, resulting in exceptional motion of the elbow joint.

The Huene™ BiAxial prosthesis allows for 16 degrees of varus-valgus laxity and 10 degrees of rotational laxity to further reduce the chances of implant loosening, component fracture, and polyethylene wear. The ulnar axis of the Huene™ BiAxial implant is designed to allow greater varus-valgus laxity than the humeral axis. Consequently, less force is required to rotate the implant around the ulnar axis than the humeral axis. The result is more stability in the humeral axis, and a reduction of simultaneous movement of both axes. This contributes to more natural elbow motion.

Indications
Absolute indications include: 1) rheumatoid arthritis, 2) non-inflammatory degenerative joint disease including osteoarthritis and avascular necrosis, 3) correction of severe functional deformity, 4) revision procedures where other treatments or devices have failed, 5) treatment of acute chronic fractures with humeral epicondyle involvement which are unmanageable using other treatment methods, and 6) treatment of elbows presenting either intact or limited soft tissue structures about the elbow. Patient selection factors to be considered include: 1) need to obtain pain relief and improve function, 2) ability of patient to follow instructions, including control of weight, 3) a good nutritional state of the patient, and 4) the patient must have reached full skeletal maturity.

Contraindications
Absolute contraindications include: infection, sepsis, and osteomyelitis. Relative contraindications include: 1) uncooperative patient or patient with neurologic disorders who is incapable of following directions, 2) osteoporosis, 3) metabolic disorders which may impair bone formation, 4) osteomalacia, 5) distant foci of infections which may spread to the implant site, 6) rapid joint destruction or bone resorption apparent on roentgenogram, and 7) vascular insufficiency, muscular atrophy, and neuromuscular disease.

Preoperative Considerations
The Huene™ BiAxial elbow prosthesis incorporates design changes from traditional elbow implants. Templating the X-ray for proper size and alignment is indicated for all cases. Special attention should also be given to bone resection and trial reduction for proper insertion and articulation of the implant. Surgeons and surgical staff should take time to familiarize themselves with this technique and the mechanical function of the prosthesis prior to the surgery.

When unpacking the implant, care should be taken to remove all packaging materials from the implant. Additionally, the axle-locking clips should only be inserted one time, as multiple insertions and removals may compromise their mechanical strength. Spare clips are included with the implant.

The Huene™ BiAxial is indicated for use with bone cement only.

The Huene™ BiAxial Elbow was designed in conjunction with Donald R. Huene, M.D., of Fresno, CA.

This technique is presented to demonstrate the surgical technique utilized by Donald R. Huene, M.D. Biomet, as the manufacturer of this device, does not practice medicine and does not recommend this or any other surgical technique for use on a specific patient. The surgeon who performs any procedure is responsible for determining and utilizing the appropriate techniques for each individual patient. Biomet is not responsible for selection of the appropriate surgical technique to be utilized for an individual patient.
Surgical Technique

Step 1
Patient Placement & Incision
The patient is placed in the supine position. The arm is draped free to expose the posterior elbow. A 12 to 15cm longitudinal incision is made slightly posterior to the medial epicondyle (Fig. 1).

Step 2
Dissection of the Ulnar Nerve
The ulnar nerve is freed and placed anteriorly along the skin incision. A penrose drain is used to demarcate the position of the nerve (Fig. 2).

Step 3
Reflection of the Triceps
Dissect the medial 1/3 of triceps insertion away from the ulna (Fig. 3).

Step 4
Medial Elbow Dislocation
Expose the humerus using subperiosteal dissection, and release the collateral ligaments. The elbow is then dislocated to the posterior medial side (Fig. 4).
Step 5

Radial Head Resection

Use an oscillating saw to resect the radial head down to the proximal border of the annular ligament (Fig. 5). Occasionally, a second lateral incision may be necessary to remove large lateral osteophytes.

Step 6

Initial Bone Resection

An oscillating saw is used to remove the central trochlea (Fig. 6).

Step 7

Preparation of the Medullary Canal

A rotating burr is used to open the medullary canal, and T-handled reamers are used to progressively widen the canal (Fig. 7).

Step 8

Insertion of the Cutting Guide

The cutting guide is inserted into the medullary canal using the right and left markers to orient the medullary rod. Additional proximal resections may be necessary to seat the implant at the proximal end of the coronoid fossa. An oscillating saw is placed in the guide for the humeral cut (Fig. 8).
Step 9

Humeral Rasp/Trial
The humeral rasp is used to enlarge the humeral canal (Fig. 9). Standard or long extension rasps are then used to rasp further proximally if a standard or long stem is desired.

Step 10

Rasp Handle Disassociation
The rasp handle is removed and the humeral component is used as a trial (Fig. 10).

Step 11

Ulnar Resection
The ulnar resections are completed with an oscillating saw and rotating burr. The olecranon is resected along the plane of the ulnar canal, and 3mm of the coronoid process are resected to allow for full insertion of the ulnar component (Fig. 11).

Step 12

Preparation of the Medullary Canal
A rotating burr is used to open the medullary canal, and T-handled reamers are used to progressively open the diameter of the canal (Fig. 12).
**Step 13**

**Ulnar Rasp/Trial**
The ulnar rasp is inserted along the plane of the ulnar canal (Fig. 13). Care should be taken to be sure that the rasp is parallel to the ulna axis.

![Fig. 13](image)

**Step 14**

**Rasp Handle Disassociation**
The rasp handle is removed and the ulnar component is used as a trial (Fig. 14).

![Fig. 14](image)

**Step 15**

**Trial Components**
The trial components are assembled and a trial articulation is completed to assure free movement of the components (Fig. 15). The proximal ulna olecranon process resection should be sufficient to prevent interference with the central link in extension or flexion.

![Fig. 15](image)

**Step 16**

**Humeral Components**
After the humeral cement is in place, insert the humeral component until the anterior flange is fully seated against the anterior cortical surface of the distal humerus (Fig. 16). A bone plug may be necessary to prevent proximal cement migration.

![Fig. 16](image)
Step 17

Bone Graft

A bone graft is inserted under the anterior flange (Fig. 17).

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Step 18

Ulnar Component

After the cement is inserted, use the ulnar impactor to insert the ulnar component (Fig. 18).

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Step 19

Joining Components

The humeral component is joined with the ulnar component by assembling the axle bearing, saddle bearing, axle, and locking clip (Fig. 19), as illustrated in the next 3 steps.

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Step 20

Ulnar Bearing Assembly

Place the ulnar axle bearing through the round holes in the saddle bearing and connecting segment, and insert the assembly into the ulnar stem (Fig. 20).
Step 21
Axle Insertion
Align the central link of the humeral component with the ulnar component and then insert the axle through either side of the implant (Fig. 21).

Step 22
Clip Insertion
1. Place the locking clip in the clip inserter by sliding the retaining sleeve of the inserter rearward (Fig. 22a) and place the locking clip over the end post (Fig. 22b). Once the clip is in place, release the retaining sleeve to secure the clip on the clip inserter (Fig. 22c).
2. Using a finger to keep the axle seated, place the flat side of the clip inserter flush with recessed axle housing and push forward until the locking clip clicks into place over the axle. Slide the retaining sleeve rearward and disengage the clip inserter (Fig. 22).

Postoperative Considerations
A bulky compressive dressing is applied, and the elbow is splinted to maintain 90 degrees of flexion. The dressing is usually removed on the second or third day, and is replaced with an elastic dressing. At this point, the patient may begin passive or active range of motion exercises as indicated. The elastic dressing is then removed between seven to ten days postoperatively. No lifting is permitted during the initial eight weeks of movement. Thereafter, the patient should limit lifting to weights of five pounds or less.
Huene™ BiAxial Humeral Components

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<tr>
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Huene™ BiAxial Ulnar Components

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Huene™ BiAxial Central Link & Clip

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Huene™ BiAxial Bearing Kits*

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<tr>
<td>113354</td>
<td>Humeral</td>
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*Each kit includes two axle clips.

Humeral Stem Dimensions:
- **Small Cross Section** – 5x6mm (at the proximal tip)
- **Standard Cross Section** – 6x7mm (at the proximal tip)
- **Small Length** – 85mm
- **Medium Length** – 135mm
- **Long Length** – 185mm

Ulnar Stem Dimensions:
- **Small Length** – 8cm
  Cross Section – 3.3x3.35mm (at the distal tip)
- **Standard Length** – 10.5cm
  Cross Section – 4.0x4.2mm (at the distal tip)
### Huene™ BiAxial Humeral Rasp
- **407160** Small Short Right
- **407161** Small Short Left
- **407162** Small Med. R/L
- **407163** Small Long R/L
- **407170** Std. Short Right
- **407171** Std. Short Left
- **407172** Std. Med. R/L
- **407173** Std. Long R/L

### Huene™ BiAxial Ulnar Rasp
- **407180** Small Right
- **407181** Small Left
- **407185** Std. Right
- **407186** Std. Left

### Humeral Inserter/Extractor
- **407190**

### Ulnar Inserter/Extractor
- **407191**

### Templates
- **407155** Small X-ray Templates
- **407156** Std. X-ray Templates

### Humeral Resection Block
- **407192**

### References