Clinical References

1. J Shoulder Elbow Surgery Volume 14, Number 5 2005
   **Outcome of Copeland Surface Replacement Shoulder Arthroplasty**
   Simon R Thomas, FRCS, Adrian J Wilson, FRCS, Andrew Chambler, FRCS, Ian Harding, FRCS & Micheal Thomas, FRCS, Windsor, United Kingdom

2. J Shoulder Elbow Surgery Volume 14, Number 2 2005
   **Geometrical Analysis of Copeland Surface Replacement Shoulder Arthroplasty in Relation to Normal Anatomy**
   Simon R Thomas, MRCS, Giuseppe Sforza, MD, Ofer Levy, MD, MCh(Orth), and Stephen A. Copeland FRCS Reading United Kingdom

   Orthopaedic Proceedings - British Elbow and Shoulder Society (Wrightington Hospital, Lancashire, 15/16 May 2003)
   **The Cemented Copeland Shoulder Hemiarthroplasty - A Clinical And Radiological Review**
   A Ali, NADia, SA Shahane, O Stanley Department of Orthopaedics, Sheffield Teaching Hospitals NHS Trust, Northern General Hospital, Sheffield

   **Copeland Surface Replacement Arthroplasty Of The Shoulder In Rheumatoid Arthritis**
   Ofer Levy, MD, MCH(ORTH), Lennard Funk, MSc, FRCS (Tr and Orth), Giuseppe Sforza, MD, and Stephen A Copeland, FRCS Investigation performed at Reading Shoulder Unit, Royal Berkshire Hospital, Reading, United Kingdom

   **Resurfacing Arthroplasty Of The Shoulder**
   Stephen A Copeland, FRCS, Ofer Levy, MO and Harry C Brownlow, FRCS
   Reading Shoulder Unit, Berkshire Independent Hospital, Berkshire, United Kingdom

6. SECEC 2002 - Budapest (Presentation)
   **Geometrical Analysis Of The Copeland Cementless Surface Replacement Shoulder Arthroplasty With Correlation To Clinical Outcome**
   Thomas SRYW, Sforza G, Levy O, Copeland SA The Reading Shoulder Surgery Unit, The Royal Berkshire Hospital, London road, Reading, RG1 5AN United Kingdom

7. SECEC 2002 - Budapest (Presentation)
   **Surface Replacement Arthroplasty For Avascular Necrosis Of The Humeral Head**
   Kouty E, Funk L, Levy O, Copeland SA
   The Reading Shoulder Surgery Unit, The Royal Berkshire Hospital, London road, Reading, RG1 5AN, United Kingdom

8. SECEC 2002 - Budapest (Poster)
   **Copeland Hemiarthroplasty Of The Shoulder**
   Wilson A, Chambler A, Thomas S, Harding I, Thomas M
   Heatherwood and Wexham Park Hospitals Trust, Wexham, Slough, Berkshire, Windsor, United Kingdom

   **Cementless Surface Replacement Arthroplasty Of the Shoulder 5 To 10-Year Results With The Copeland Mark-2 Prosthesis**
   a Levy, S A Copeland Royal Berkshire Hospital, Reading, England

10. Master Techniques In Orthopaedic Surgery The Shoulder (Second Edition)
    Editor - Edward V Craig Series Editor - Roby C Thompson, JR
    **Part V-Arthroplasty And Arthroplasty Alternatives Surface-replacement Arthroplasty Of The Shoulder**
    Stephen Copeland

    **Cementless Surface Replacement Arthroplasty of the Shoulder -11 - Years Experience.**
    Levy O, Williams H, Bruguer j, Kelly C and Copeland SA
    Institution Department of Shoulder Surgery, Royal Berkshire Hospital, Reading, United Kingdom

12. The Antero-superior Exposure for Total Shoulder Replacement
    Donald B. Mackenzie, Port Elizabeth, Eastern Cape Province, South Africa

Disclaimer

The following are the opinions and surgical practice of Mr S A Copeland, FRCS, Consultant Orthopaedic Surgeon at the Royal Berkshire Hospital, Reading, England, U.K. and not Biomet UK Ltd.

This Operative Technique was written in conjunction with Mr S A Copeland and Mr O Levy at the Royal Berkshire Hospital, Reading, England, U.K.

Biomet UK Ltd, as the manufacturer of this device, does not practice medicine and does not recommend any particular surgical technique for use on a specific patient. The surgeon who performs any implant procedure is responsible for determining and utilising the appropriate techniques for implanting the prosthesis in each individual patient.

Biomet UK Ltd, is not responsible for selection of the appropriate surgical technique to be utilised on an individual patient.

© Biomet UK Ltd 2006
Clinical Background

Cementless Surface Replacement Arthroplasty (CSRA) of the shoulder differs in many ways from nonconstrained stemmed shoulder prostheses. The design concept is to replace damaged joint bearing surfaces and restore normal anatomy with minimal bone resection.

Historically, the early development of shoulder arthroplasty in Europe was associated with constrained designs of prostheses to cope with the problems of massive tissue loss secondary to infection and tumour. In the USA, Neer developed a stemmed unconstrained prosthetic replacement of the proximal humerus specifically to deal with the problems of acute four-part fractures. His stemmed unconstrained design of prosthesis was successful in providing a scaffold to rebuild the fractured proximal humerus. Only later was this used for arthritis and a glenoid prosthesis developed. Neer’s design of a stemmed humeral component was very similar to that very widely used for hip replacement. Neer had shown convincingly that the prosthetic shoulder joint did not need to be mechanically constrained.

Neither of these development paths were specifically directed to produce a design for use in shoulder arthritis.

In the early 1980’s the idea of developing a shoulder joint specifically for use in the less destroyed arthritic shoulder using a surface replacement arthroplasty was introduced.

The Copeland Shoulder Prosthesis was designed to address these problems. It offers cementless fixation, requires minimal bone removal, and is a surface replacement technique so that joint arthroplasty can now be considered for the less destroyed shoulder. It has been in clinical use since 1986.

The standard Copeland Shoulder prosthesis has been used for the treatment of rotator cuff arthropathy by implanting the prosthesis in a superior fashion which provides a smooth articulation for the humerus with the acromion, which will relieve pain. This, however requires a manual repositioning of the prosthesis.

The new Copeland EAS system uses the standard positioning of the prosthesis, and with one extra set of chamfer cuts the new prosthesis resurfaces the whole of the head and the greater tuberosity site.

The Copeland Shoulder or Cementless Surface Replacement Arthroplasty (CSRA) of the shoulder was developed by Mr S A Copeland, FRCS Consultant Orthopaedic Surgeon at the Royal Berkshire Hospital, Reading, England, U.K.
Introduction

Simple Instrumentation

Any procedure if it is to be successful, must be reliable and reproducible. The more complicated the instrumentation, the more scope for error in their use. Although most shoulder replacements are performed in specialised centres, a high proportion of shoulder replacement is done by surgeons who may do only a few replacements a year. Hence, complicated instrumentation may not be available to them on the grounds of cost and because of unfamiliarity of use may lead to wrong usage. Simple instrumentation was developed to shape the joint surfaces and to implant the prosthesis.

The Copeland EAS Shoulder prosthesis uses the same instrumentation as the standard prosthesis plus the additional instruments shown on pages 13 and 14. Non cannulated or cannulated instruments can be combined with the new EAS instruments.
Pre-operative Preparation and Patient Positioning

Pre-operative prophylactic antibiotics should be given intravenously either one hour prior to surgery or at the time of anaesthetic induction. In patients who are not sensitive to iodine a skin pre-preparation using povidone iodine is performed in the ward prior to surgery.

A povidone iodine soaked surgical dressing is placed into the axilla, which may be clipped no more than six hours before the operation.

The patient should be placed in a semi sitting or beach chair position at about 45° of head-up tilt with the head on a neurosurgical headpiece and the arm on a short arm board attached to the side of the operating table. (Fig. 1) It is important to have the patient close to the edge of the table and the short arm board to permit hyperextension of the arm during surgery to allow delivery of the humeral head into the anterior wound and to facilitate insertion of the humeral component. The shoulder blade is best stabilised by placing a small (500ml) plastic infusion bag or a sandbag under the medial border of the scapula. (Fig. 2)

Routine antiseptic preparation of the skin of the whole of the arm is carried out. The preparation is continued as far proximally as the ear and as far distally as the breast. The preparation should also be carried out as far medially as the midline anteriorly and as far as the infusion bag or sandbag posteriorly. The forearm and arm should be covered with a sterile stockinette and either an upper limb isolation drape or a “U” drape should be used to provide a safe sterile field. An adhesive plastic sterile drape is then applied and will ensure the drapes do not “migrate” during the operation.
Surgical Incision - *Option A*

**Deltopectoral Approach**

**Access**

This approach provides an exposure of the front of the gleno-humeral joint, the upper humeral shaft and the humeral head.

**Incision**

A 15 cm incision is made from the clavicle down across the tip of the coracoid and continued in a straight line to the anterior border of the insertion of the deltoide. *(Fig. 3)*

**Approach**

The cephalic vein is mobilised lateral in the deltopectoral groove. The vein is retracted laterally with the deltoid. The arm is abducted 40° to 60°. The clavipectoral fascia is incised. The subacromial space is cleared and a broad elevator is placed beneath the acromion as a retractor. At this stage improved exposure will be obtained by dividing the proximal 2 cm of the insertion of pectoralis major *(Fig. 4)*.

The shoulder is flexed and externally rotated to facilitate coagulation of the anterior circumflex humeral vessels. It is very important at this stage to insert stay sutures into the subscapularis muscle to control retraction *(Fig. 5)*. The tendon is divided 2 cm medial to the bicipital groove. If the subscapularis appears tight it should be divided in an oblique or “Z” manner to allow repair with lengthening of the tendon.

The joint capsule is then released anteriorly and inferiorly whilst taking care to protect the axillary nerve with a blunt elevator where it passes through the quadrilateral space. The glenohumeral joint may now be dislocated anteriorly by external rotation and extension, allowing a full exposure of the humeral head and neck.
Surgical Incision - *Option B*

Antero-superior “Mackenzie” Approach

**Access**

This approach provides an exposure of the Gleno-humeral joint, the humeral head and the tuberosities, as well as exposure of the acromion and AC joint.

**Incision**

The skin incision extends distally in a straight line from just posterior to the acromioclavicular joint for a distance of 9 cm (Fig. 6).

**Approach**

The anterior deltoid fibres are split for a distance of not more than 6 cm, and a loose No. 1 stay suture is placed in the distal end of the split to prevent further extension and possible injury to the axillary nerve. The acromial attachment of the deltoid is lifted with an osteo-periosteal flap to expose the anterior acromion and preservation of the superior acromioclavicular ligament (Fig. 7).

An anterior acromioplasty according to the technique of Neer is performed. If further exposure is needed, then excision of the lateral end of 1 cm of clavicle considerably enhances exposure.

**On both approaches:**

The rotator interval is identified and longitudinally incised along the line of the long head of biceps to identify the exact insertion of subscapularis. Subscapularis is held by stay sutures and dissected off the lesser tuberosity. (Fig. 8) The shoulder is dislocated anteriorly. Long head of biceps, if intact, is dislocated posteriorly over the humeral head. (Fig. 9)
Preparation of the Humeral Head

(Fig. 10) The anatomical neck of humerus is defined (the line of insertion of the cuff and capsule). This is important to determine the exact neck shaft angle. Osteophytes are nibbled away from the superior and the anterior aspect of the humeral neck. With further external rotation and positioning of the arm extensive inferior osteophytes can be removed. The pre-operative radiographs are helpful to assess the extent of these osteophytes.

Anterior osteophytes often contribute to loss of external rotation by relatively shortening subscapularis. Removal of these osteophytes also allows better positioning and rotation of the head to gain access to the posterior and superior osteophytes that also need removal. It is stressed at this stage that removing these osteophytes is essential to determine the anatomical neck and not to shape the humeral head which is done by the humeral surface cutter.

(Fig. 11) The humeral drill guide is then placed on top of the humeral head and the bottom edge of the humeral drill guide is oriented parallel to the anatomical neck. The drill guide is assessed for anterior posterior placement and is centered on the humeral head. This position automatically builds in the anatomical degrees of retroversion and inclination. A K Wire or Steinman pin guide wire (2.8mm) is then passed down the humeral drill guide into the humeral head and through to the lateral cortex to provide stability. The humeral drill guide is removed and the position of the guide wire checked to ensure that it is anatomically placed in the centre of the articulating surface. If not it can be easily repositioned.
The cannulated humeral surface cutter is passed over the guide wire. Whilst the reamer is rotating, light pressure on the humeral head will engage the cutting teeth and the surgeon will observe that while it is rotating, bone appears through all the holes in the surface cutter. This ensures complete bony apposition up to the undersurface of the prosthesis.

The teeth of the surface cutter delineates where the edge of the prosthesis will sit. As a consequence this also marks excess bone which can be removed using a small osteotome or bone nibblers. The edge of this cut will now appear beneath the normal surface of the bone. It is intended that the body of the prosthesis will correct the geometry of the shoulder joint. The cutter has a safety mechanism whereby it will only resect 3mm of bone per application.

The cannulated humeral spade cutter is passed over the guide wire and, with a power drill, used to create the central pilot hole. The safety stop on the spade cutter prevents over reaming. All morselised bone generated by making this drill hole is saved for later grafting and mixed with blood, scavenged from the patient’s wound.
(Fig. 14) Place the EAS cutting guide over the prepared surface, make sure that the central guide slot is over the superior portion of the greater tuberosity. Use the fixation pins to lock the cutting guide in position. To prevent movement of the block when cutting, insert one pin into the face of the cutting guide, parallel to the lesser tuberosity. Then insert an additional pin into one of the angled holes in the rim of the cutting block. Two angled anterior and posterior cuts and one lateral cut is made through the guide slot. The lateral cut is made first and the anterior and posterior cuts should be angled at 45 degrees to the lateral cut to minimise unnecessary bone resection.

(Fig. 15) The trial humeral prosthesis is then inserted into the pilot hole and a trial reduction made. The joint is tested for range of motion, i.e. that the hand can easily go to the opposite axilla and at least 30° of external rotation can be achieved before anterior translocation. The prosthesis is also checked for stability in flexion, extension and abduction.
The trial humeral component is now removed and the humeral head assessed. Irregularities in the humeral head are routinely grafted using bone from osteophytes that have previously been removed. Press fit the component by placing the resurfacing head onto the prepared humeral head and seating the component about two thirds of the way with finger pressure. The humeral prosthesis is then impacted until it is flush against the bone.
Closure

Antero-superior Approach (Mackenzie)

The subscapularis is repaired using No.1 suture material (absorbable (PDS) or non-non absorbable) without plicating the subscapularis or with through bone sutures. The rotator interval is closed. If there is any rotator cuff deficiency and this is repairable then full rotator cuff repair is made in the normal manner at this stage. Every attempt is made to close the rotator cuff completely.

The deltoid is reattached to the acromion with No. 1 absorbable sutures (PDS) through bone.

The deltoid split is approximated with 2/0 absorbable sutures.

Subcutaneous fat is opposed with absorbable sutures and appropriate skin closure undertaken with Intra-dermal continuous absorbable suture (N01 Monocryl).

Deltopectoral Approach

The subscapularis is repaired using No.1 suture material (absorbable (PDS) or non absorbable) without plicating the subscapularis or with through bone sutures. The rotator interval is closed. If there is any rotator cuff deficiency and this is repairable then full rotator cuff repair is made in the normal manner manner at this stage. Every attempt is made to close the rotator cuff completely.

The delto-pectoral interval is closed using 2 or 3 interrupted absorbable sutures.

Subcutaneous fat is opposed with absorbable sutures and appropriate skin closure undertaken with Intra-dermal continuous absorbable suture (W01 Monocryl).

Post-operative management

The patient is placed in a sling with bodybelt and brachial block analgesia used. Passive mobilising for the first 48 hours and passive assisted for five days. Active movements are then started as pain allows and the sling abandoned at three weeks. A stretching and strengthening programme is then advised standard for all shoulder replacements.
## Part Listings

**Copeland Shoulder EAS Heads**

<table>
<thead>
<tr>
<th>Size</th>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Copeland EAS Head HA</td>
<td>11-114671</td>
</tr>
<tr>
<td>2</td>
<td>Copeland EAS Head HA</td>
<td>11-114672</td>
</tr>
<tr>
<td>3</td>
<td>Copeland EAS Head HA</td>
<td>11-114673</td>
</tr>
<tr>
<td>4</td>
<td>Copeland EAS Head HA</td>
<td>11-114674</td>
</tr>
<tr>
<td>5</td>
<td>Copeland EAS Head HA</td>
<td>11-114675</td>
</tr>
<tr>
<td>6</td>
<td>Copeland EAS Head HA</td>
<td>11-114676</td>
</tr>
<tr>
<td>7</td>
<td>Copeland EAS Head HA</td>
<td>11-114677</td>
</tr>
<tr>
<td>8</td>
<td>Copeland EAS Head HA</td>
<td>11-114678</td>
</tr>
</tbody>
</table>
## Instrumentation - Top Tray

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Description</th>
<th>Colour</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>402661</td>
<td>Copeland EAS Provisional Size 1</td>
<td>Brown</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>402662</td>
<td>Copeland EAS Provisional Size 2</td>
<td>White</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>402663</td>
<td>Copeland EAS Provisional Size 3</td>
<td>Black</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>402664</td>
<td>Copeland EAS Provisional Size 4</td>
<td>Green</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>402665</td>
<td>Copeland EAS Provisional Size 5</td>
<td>Blue</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>402666</td>
<td>Copeland EAS Provisional Size 6</td>
<td>Red</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>402667</td>
<td>Copeland EAS Provisional Size 7</td>
<td>Orange</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>402668</td>
<td>Copeland EAS Provisional Size 8</td>
<td>Grey</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>32-486115</td>
<td>Pin Inserter/Extractor</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>402672</td>
<td>Quick Release Troc Pin</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>595214</td>
<td>Instrument Case</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

## Instrumentation - Bottom Tray

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Description</th>
<th>Colour</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>402651</td>
<td>Copeland EAS Cutting Guide Size 1</td>
<td>Brown</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>402652</td>
<td>Copeland EAS Cutting Guide Size 2</td>
<td>White</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>402653</td>
<td>Copeland EAS Cutting Guide Size 3</td>
<td>Black</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>402654</td>
<td>Copeland EAS Cutting Guide Size 4</td>
<td>Green</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>402655</td>
<td>Copeland EAS Cutting Guide Size 5</td>
<td>Blue</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>402656</td>
<td>Copeland EAS Cutting Guide Size 6</td>
<td>Red</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>402657</td>
<td>Copeland EAS Cutting Guide Size 7</td>
<td>Orange</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>402658</td>
<td>Copeland EAS Cutting Guide Size 8</td>
<td>Grey</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>32-486259</td>
<td>Quick Release Attachment</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>21</td>
<td>402950</td>
<td>Copeland EAS Instrument Set &amp; Case</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Top Tray

Bottom Tray
Cleaning Instructions

1. Copeland Shoulder Guide wires
   • Ensure wires are sharp, and are straight and can pass easily down the cannulated instruments

2. Alignment pin guides
   • Ensure that the cannulae are clear of any debris and the guide wire can run smoothly through the instrument

3. Cannulated Reamers
   • Ensure that the cannulae are clear of any debris and the guide wire can run smoothly through the instrument
   • Ensure that cutting teeth are aligned, sharp and are clear of any debris

4. Humeral Spade Cutters
   • Ensure that the cannulae are clear of any debris and the guide wire can run smoothly through the instrument
   • Ensure that there is no debris on the cutting edge of the spade and that the edges are sharp.

5. Humeral Peg Provisionals
   • Ensure that the wire is straight and that the coloured rings are free of any debris

6. Humeral Trials
   • Ensure that no debris adheres to the inner surface and holes in the provisional prosthesis
   • Ensure that the edges of the holes in the outer surface are not damaged

7. Humeral Provisional Grasper
   • Ensure that the arms of the grasper can move in a scissor-like fashion.
Notes