LRE

The Lateral Resurfacing Elbow™

Operative Technique

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LRE™

Lateral Resurfacing Elbow Operative Technique

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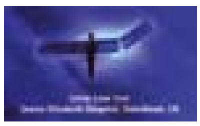

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Indications for Lateral Resurfacing Elbow (LRE) Arthroplasty

Why resurface only the lateral compartment of a degenerate elbow joint?

Because –

- *In many patients with elbow arthritis replacement of the medial compartment of the joint is unnecessary*
- *In some groups of patients excising the radial head and inserting a two component Total Elbow Replacement (TER) may be inappropriate and result in component maltracking.*

The pattern of articular cartilage degeneration in the elbow was first described almost forty years ago[1]. Since then the original post mortem studies have been repeated by others and all have shown that advanced degenerative changes can develop in the radio-capitellar (lateral) compartment of an elbow joint in which the humero-ulnar (medial) compartment remains remarkably well preserved[2,3,4]. However, as the medical history of the elderly subjects studied was not recorded, the clinical significance of these findings remained unknown.

We became aware of this pattern of degenerative change in younger symptomatic patients when carrying out elbow arthroscopy. We found articular cartilage degeneration in 68 of a consecutive series of 117 arthroscopies performed for elbow pain resistant to conservative treatments. In most patients (88%) the degenerative changes were confined entirely to the lateral compartment and contrasted with the normal appearances of the articular cartilage of the medial compartment[5].

We also found an identical pattern of degenerative change in the articular cartilage of patients undergoing open debridement procedures/arthrolysis[6] for elbow pain and stiffness.

Fig. a

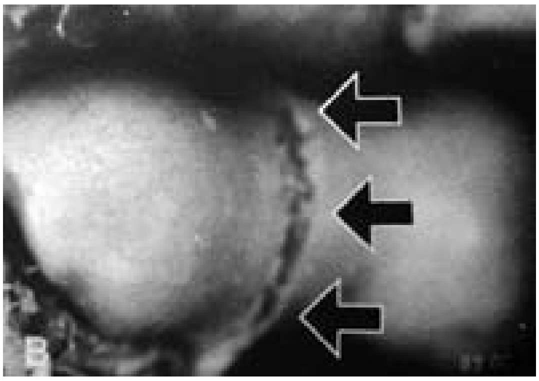
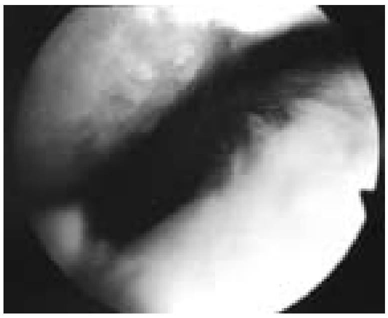


Fig. b



Full thickness loss of articular cartilage from the capitellum, normal trochlear articular surface in an elderly post mortem subject (Fig. a). Similar appearances seen during arthroscopy in a 47 year old patient with severe elbow pain (Fig. b).

The extent of lateral compartment degeneration, usually full thickness loss of the articular cartilage, was often surprising when compared with the minimal changes visible on the pre-operative x rays.

An identical pattern of articular cartilage loss was found in patients with rheumatoid arthritis (RA) whose elbows had not progressed to severe sub-chondral bone erosion.

Our inter-operative observations together with the reported post mortem studies indicate therefore that primary osteoarthritis (OA) begins in the lateral compartment of the elbow and then may remain confined to the lateral compartment throughout life. Furthermore, in painful arthritic elbow joints due to RA, in which severe bone erosion has not occurred, the articular cartilage can be entirely lost from the surfaces of the capitellum and radial head (lateral compartment) whilst the articular surfaces of the trochlea of the humerus and trochlear notch of the ulna (medial compartment) retain articular cartilage cover.

An identical pattern of articular cartilage loss is also seen as a result of trauma particularly following radial head fractures. We have found this in patients presenting with pain and stiffness requiring arthrolysis as early as six months after radial head fractures which had been thought to be innocuous.

The radiological appearances of elbow joints involved with both primary and secondary osteoarthritis are distinct from those involved with severe erosive rheumatoid arthritis. In OA the bone interface between the capitellum and trochlea of the humerus remains distinct and the joint retains its normal two compartment configuration. In severe erosive RA the interface between the capitellum and trochlea is destroyed, the ulna aligns with the anatomical axis of the humerus and the radial head subluxates laterally; the joint effectively takes on a uni-compartmental configuration. Consequently in severe RA, joint replacement can be successfully achieved by removing the radial head and inserting a two component TER with the humeral compartment aligned with the anatomical axis of the humerus which then aligns well with an ulnar component inserted along the anatomical axis of the ulna.

Fig. c

Fig. d

An arthrolysis procedure:- showing full thickness articular cartilage loss from the lateral compartment but well preserved articular cartilage in the medial compartment (Fig. c). Pre-operative x-ray demonstrating loss of joint space in the lateral compartment (Fig. d).

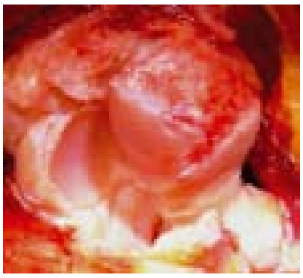


Fig. e

Fig. f

Inter-operative photograph of the elbow joint of a patient with rheumatoid arthritis. There has been complete loss of articular cartilage from the lateral compartment where the subchondral bone is visible (Fig. e). Pre-operative x-ray appearance showing narrowing of the joint space but no significant bone erosion (Fig. f).

Fig. g

Fig. h

Arthrolysis for pain and stiffness persisting following a radial head fracture 6 months earlier (Fig. g).
X-ray at the time of the original fracture (Fig. h).

However, inserting a two component TER and resecting the radial head in OA characteristically results in a degree of mal alignment of the prosthetic components, seen on x-rays as tilting of the ulnar component of an unlinked TER or mal tracking of the ulnar component of a linked TER. This then leads to eccentric wear of the UHMPE articular surface of an unlinked ulnar component and wear of the bushes of a linked system.

Fig. i

Fig. j

OA:- Degenerative changes involve the lateral compartment. The joint retains its normal two compartment configuration (Fig. i). Erosive RA:- the interface between the capitellum and trochlea is lost resulting in a 'uni compartment' configuration (Fig. j).

Fig. k

Fig. l

Mal tracking of the components of an unlinked TER (Fig. k) and a linked TER (Fig. l) inserted into elbow joints retaining their normal two compartment configuration prior to surgery.

Indications for Lateral Resurfacing of the Elbow – LRE Arthroplasty

An LRE elbow replacement is indicated in primary osteoarthritis and secondary osteoarthritis due to trauma or disease, including rheumatoid, in which the interface between the capitellum and trochlea of the distal humerus remains visible on an AP x-ray. The absence of articular cartilage in the lateral compartment of the joint and the presence of articular cartilage in the medial compartment can be verified during surgery prior to implantation of the components.

Primary OA

Secondary OA (Post traumatic)

Secondary OA (Rheumatoid disease)

In younger more active patients the LRE can be used as a hemi arthroplasty

Patient Positioning

We recommend the lateral position with the arm supported on a padded rest so that the elbow can be flexed to 90˚. *(fig. 1)*

A pneumatic tourniquet is applied.

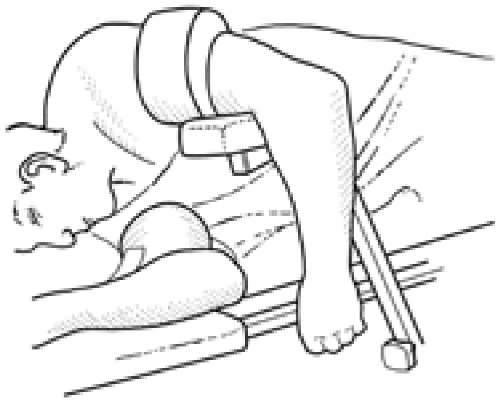


Fig. 1

Surgical Exposure

Skin incision begins in the midline, 10-12 cm proximal to the tip of the olecranon and ends 8-10 cm distally over the subcutaneous border of the ulna. *(fig. 2)*

The skin and the subcutaneous tissues are reflected together with the deep layer of the superficial fascia. We recommend stay sutures rather than retractors.

Although text books refer to the ‘triceps tendon’, the insertion of triceps is essentially muscular.

The muscle is covered by a thickening of the deep fascia. The triceps aponeurosis - a deep extension of this constitutes an intermuscular aponeurosis, which separates the lateral head of triceps from the medial and long heads.

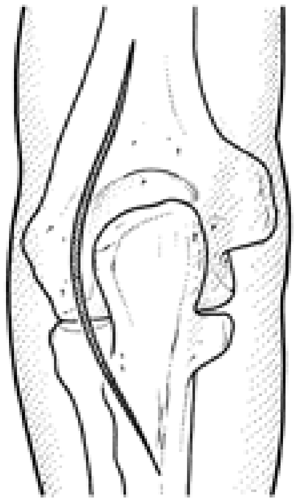


Fig. 2

The ulnar nerve is mobilised, beginning proximally. *(fig. 3)*

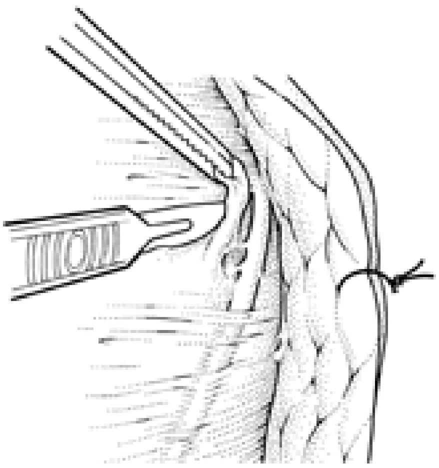


Fig. 3

The ulna nerve is decompressed by dividing the roof of the cubital tunnel between the two heads of the flexor carpi ulnaris. The nerve is then retracted and protected during the remainder of the procedure. *(fig. 4)*

A transverse incision is made through the triceps aponeurosis beginning at the intermuscular aponeurosis, 8-10 cm proximal to the tip of the olecranon.

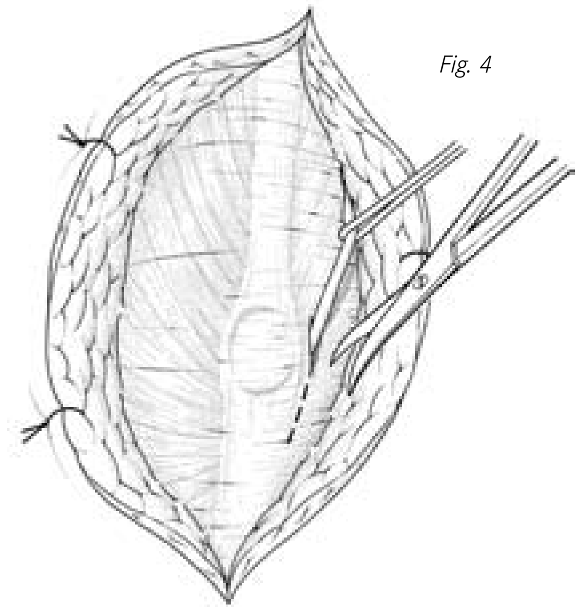


Fig. 4

The incision is then directed distally through the aponeurosis covering the lateral head of triceps and the fascia covering anconeus, to end at the subcutaneous border of the ulna. *(fig. 5)*

The triceps aponeurosis strips from the underlying muscle and can then be separated from the intermuscular aponeurosis by sharp dissection.

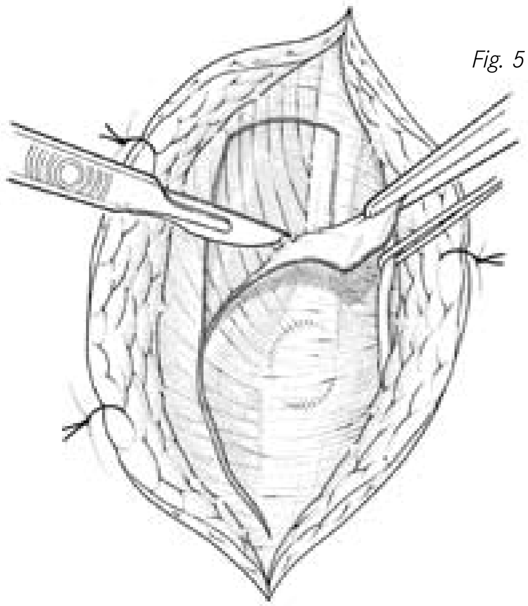


Fig. 5

The distally based flap of triceps aponeurosis can be secured with a stay suture. Anconeus is erased from its insertion into the subcutaneous border of the ulna by sharp dissection. Dissection is continued proximally by separating the insertion of the lateral head of triceps from the posterior border of the olecranon. *(fig. 6)*

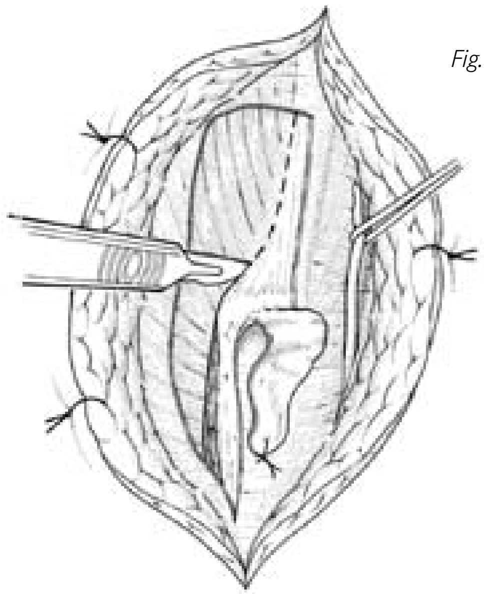


Fig. 6

The lateral head of triceps is then separated from the intermuscular aponeurosis. By directing the scalpel along the line of the fibres no muscle tissue is divided. *(fig. 7)*

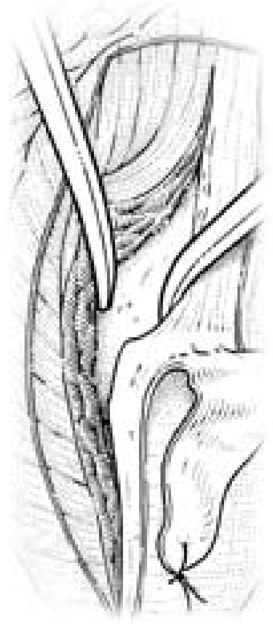


Fig. 7

At this stage the lateral head of triceps can be retracted with anconeus as a single unit. An incision is made along the medial aspect of the distal 2-3 cm of the intermuscular aponeurosis to separate this from the medial and deep heads of triceps. This incision is carried onto the olecranon. The intermuscular aponeurosis is divided 2 cm proximal to its insertion into the olecranon. The distal part of the intermuscular aponeurosis can be conveniently secured with a stay suture. *(fig. 8)*

A considerable degree of flexion contracture often persists at this stage.

Flex the elbow in varus to visualise the medial aspect and retract the ulnar nerve.

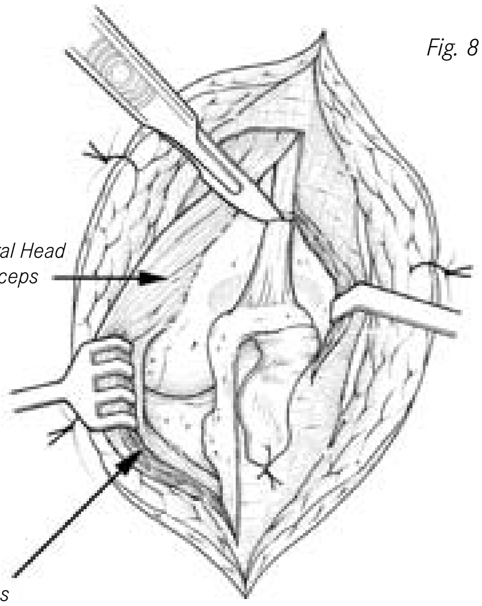


Fig. 8

Incise the medial capsule along the joint line as far as the base of the coronoid. *(fig. 9)* A bony spur, which is often present on the deep surface of the medial capsule can be removed. The joint can then usually be fully extended.

Return the elbow to the neutral position in 90% flexion and complete exposure of the medial supracondylar ridge by reflecting medial triceps which can be secured with a stay suture.

Dislocation can be achieved by flexing the elbow in valgus. A lever placed over the neck of the radius is used to retract the soft tissues from the lateral aspect of the joint.

The radial collateral ligament is then elevated from its capitellar origin until the anterior edge of the capitellum is seen.

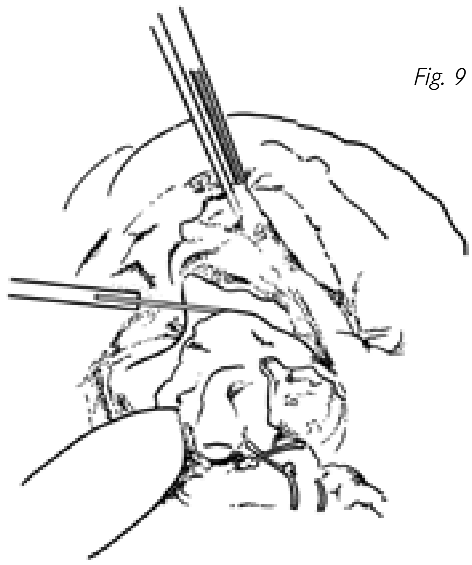
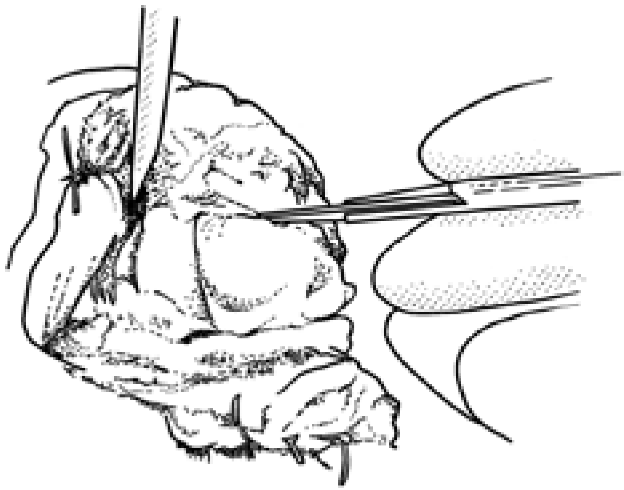


Fig. 9

Elbow flexed in valgus. Elevation of radial collateral ligament from capitellar origin. *(Fig. 10)*

Fig. 10

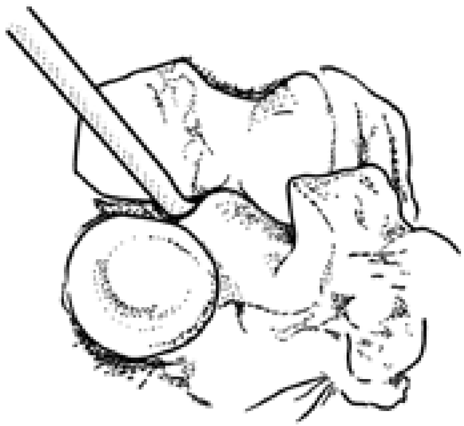


Ligament elevated until anterior margin of capitellum is seen. *(Fig. 11)*

Fig. 11

Full flexion of the joint then completes the dislocation which can be facilitated by distracting the joint surfaces with a lever placed over the tip of the coronoid. *(Fig. 12)* Dislocation is achieved by full flexion in valgus.

Fig. 12



Bone Preparation and Implant Insertion – Capitellar Component

The design of the LRE implants and instruments use the principles developed for the Copeland Resurfacing Shoulder (Biomet UK) by Mr Stephen Copeland.[10]

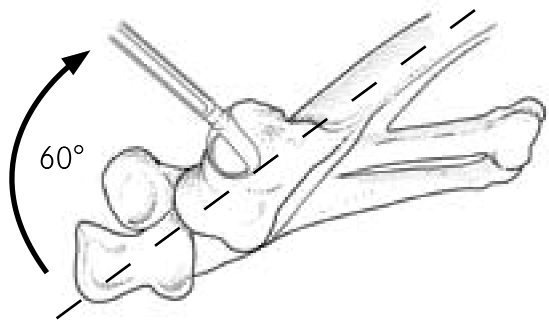
The LRE can be used as a hemi-arthroplasty to resurface the capitellum or as a total lateral resurfacing arthroplasty to resurface both the capitellum and the radial head. It is our practice to carry out hemiarthroplasty (capitellum resurfacing) in younger more active patients with severe degenerative change. This then reserves the option of converting to a total lateral resurfacing arthroplasty by inserting a radial head component in the future if pain reoccurs due to degenerative change.

The exposed capitellum is sized using a set of drill guides, which consist of a cannulated stem and a cup that is shaped to fit over the capitellum. The guides are universal. *(fig. 13)*

Fig. 13

The correct size of guide will have a conforming contact between its concave face and the surface of the capitellum. The rim of the guide is positioned parallel to the edge of the capitellar articular surface and the stem should be in line with the lateral epicondylar column, and at approximately 60° to the long axis of the humerus. *(fig. 14)*

Fig. 14

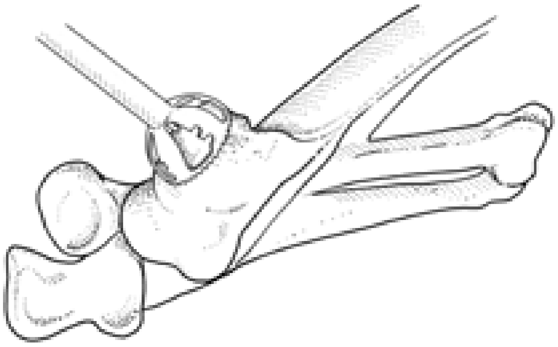


A guide wire is inserted into the capitellum via the cannulated stem of the guide, the capitellum guide is removed and the positioning of the wire is assessed. If the wire is incorrectly positioned it should be removed and the capitellar guide re-applied.

The surface of the capitellum is then prepared using the capitellar surface cutter *(fig.15)*

Fig. 15

Fig. 16



Each of the four sizes of capitellar implant has a corresponding size of surface cutter, which are all colour coded and cut to a controlled depth of 1.5mm.

The cannulated capitellar surface cutter is placed over the guide wire and with a power tool, used to ream the capitellum, *(Fig. 16)* alternatively a ratcheting handle supplied with the kit can be used. The capitellum should be reamed until resistance is met and bone contacts with the depth stop inside the reamer. This then ensures that sufficient bone has been removed to accomodate the prothesis without over stuffing the joint.

Fig. 17

The peg hole for the cruciform peg of the capitellar prosthesis is now created using the spade cutter. *(Fig. 17)*

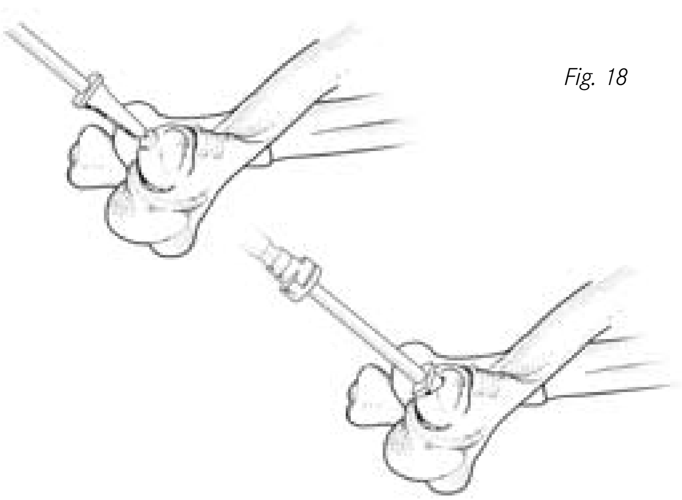


Fig. 18

There are two colour coded spade cutters, one of which prepares the hole for the small and medium sized components, while the other prepares the hole for the large and extra large components. *(Fig. 18)*

Capitellum Trial Reduction

The trial capitellar component is threaded onto the inserter and implanted onto the prepared surface. *(fig. 19)*

The trial capitellar component and its inserter *(fig 20)* are cannulated and can therefore be inserted over the guide wire if preferred.

The inserter and guide wire are removed and with the trial in situ, range of motion and stability can be assessed.

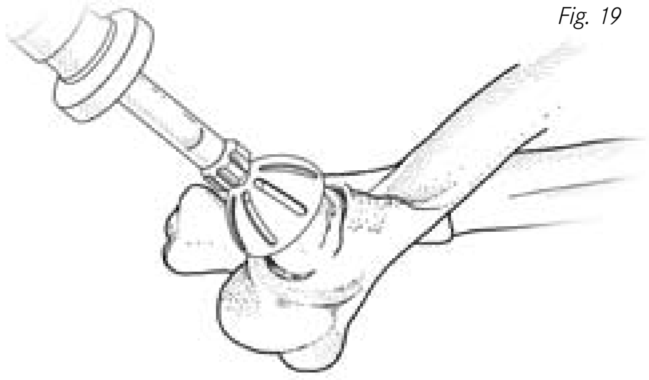
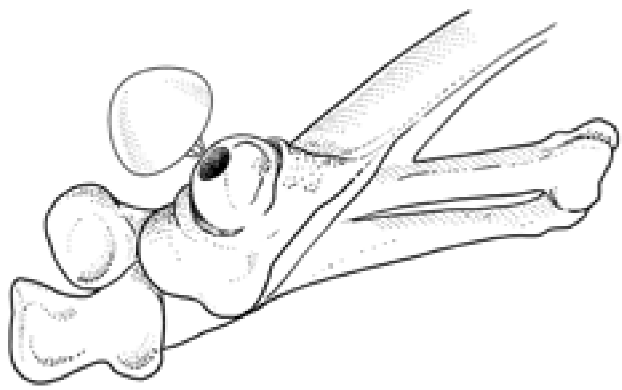


Fig. 19

Fig. 20



Bone Preparation and Implant Insertion – Radial Head

A guide wire is inserted squarely into the centre of the articular surface of the radial head, using a cannulated, button shaped drill guide *(fig 21)* held over the radial head surface. *(fig 22)*

Fig. 21

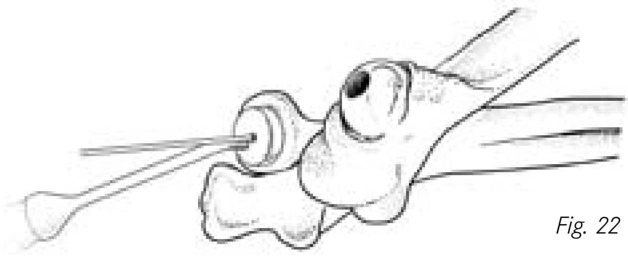


Fig. 22

The surface of the radial head face is shaped using a three bladed surface cutter, *(fig. 23)* which produces a concave face to a controlled depth of 3mm. *(fig. 24)* There are two sizes of radial head surface cutter, one for small and medium radial heads, one for large and extra large radial heads.

Fig. 23

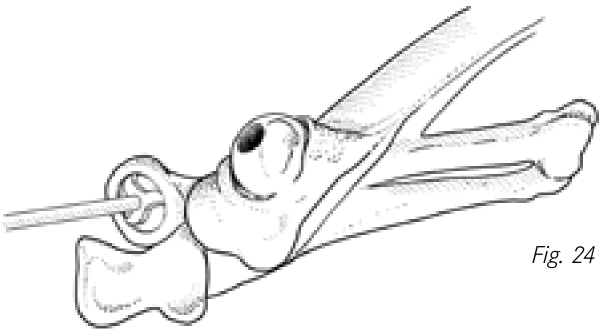


Fig. 24

The central peg hole is then created in the radial head, using the spade cutter (as used previously in the capitellar preparation). *(fig 25)* There are two sizes of spade cutter which are colour coded (peg size is common on the small and medium sizes, and on the large and extra large sizes). The guide wire is removed with the pin puller and the trial radial head inserted.

The colour coded trial radial head is positioned and the joint is reduced and checked for stability and range of motion. If the result is satisfactory the trials are removed and the definitive components are impacted using the dedicated impaction tools.

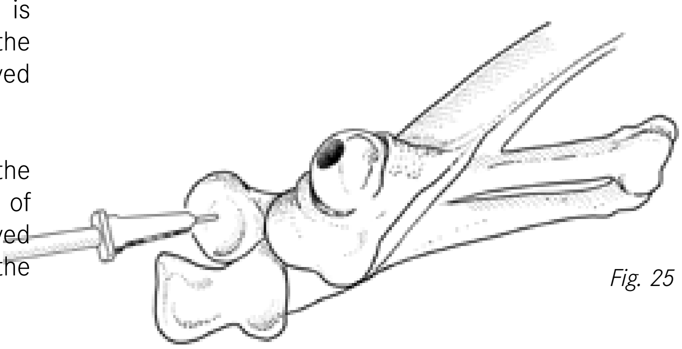


Fig. 25

If more reaming is required, ensure that the use of the radial head or capitellar surface cutter is always followed with the use of the selected spade cutter, to ensure both cuts are kept relative to each other.

Soft Tissue Reconstruction

The first step in obtaining correct soft tissue tension and therefore optimum function, is to repair the divided intramuscular septum of triceps *(fig. 26)*. Particularly in rheumatoid patients, correctly tensioning the triceps will overcome the joint laxity which results from more advanced degenerative changes.

Fig. 26

Repair of the Divided Intramuscular Septum of Triceps

Anconeus is reattached to the subcutaneous border of the ulna by sutures passed through the free edge of the muscle, then the deep fascia and back through the free edge of the muscle again. This repair is continued proximally by suturing the lateral head of triceps to the lateral head of the intramuscular septum. Closure is completed by suturing the free edge of the medial triceps to the intramuscular septum. *(fig. 27)*

a. Anconeus is reattached to the subcutaneous border of the ulna.

b. The muscle closure has been completed by suturing triceps to the edges of the intramuscular septum.

The deep fascia covering triceps and anconeus is then closed together with the skin and subcutaneous tissues.

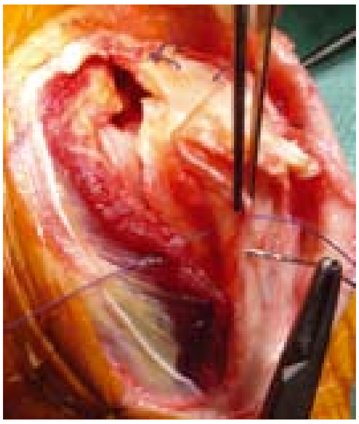
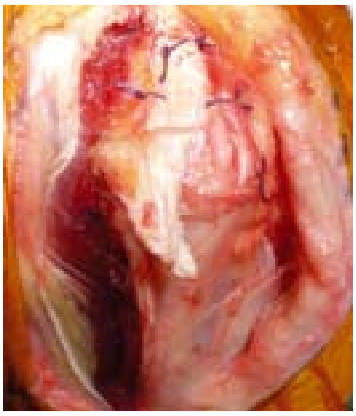
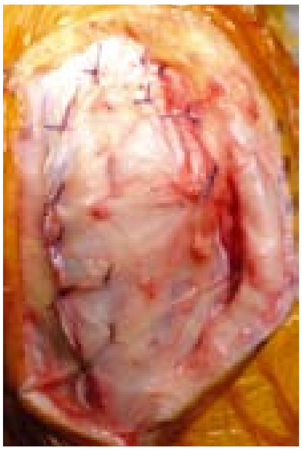


Fig. 27

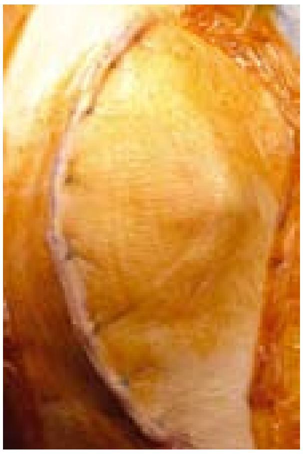
a.



b.



The deep fascia has been closed.



Skin closure is completed.

Postoperative Management

We apply a wool and crepe pressure bandage which is removed on the first post operative day. A resting splint is then applied (in 30° – 40° of flexion) to be worn for 4 – 6 weeks in order to protect the triceps repair. During this time active elbow flexion and gravity assisted elbow extension is carried out under the supervision of a physiotherapist. Unrestricted essential activities of daily life are then permitted but more vigorous activities are deferred until the patient is 3 months post operative.

Implant List

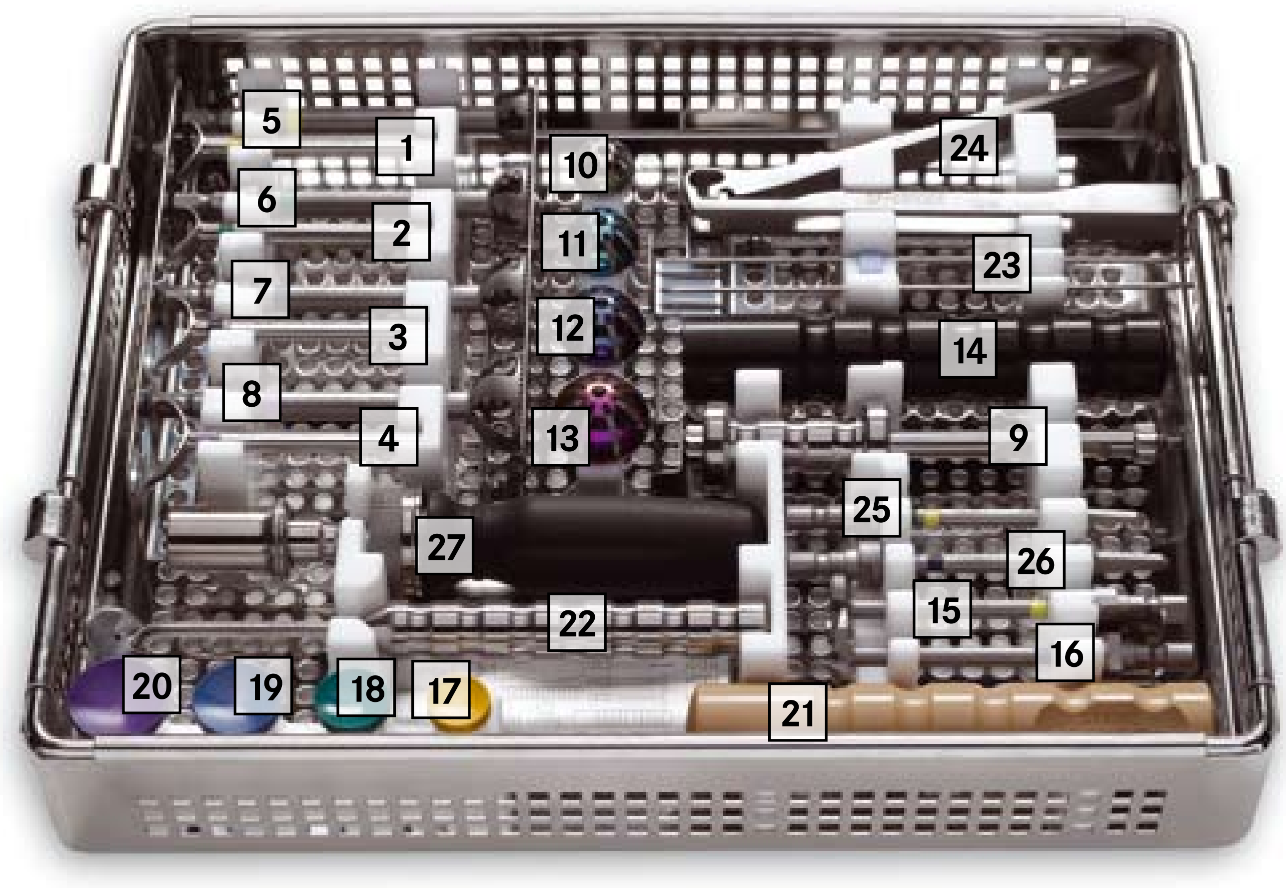
Cat. Nos.	Implants
114476	L.R.E. CAPITELLAR COMPONENT, SMALL
114477	L.R.E. CAPITELLAR COMPONENT, MEDIUM
114478	L.R.E. CAPITELLAR COMPONENT, LARGE
114479	L.R.E. CAPITELLAR COMPONENT, X-LARGE

Cat. Nos.	Implants
114481	L.R.E. RADIAL HEAD COMPONENT, SMALL
114482	L.R.E. RADIAL HEAD COMPONENT, MEDIUM
114483	L.R.E. RADIAL HEAD COMPONENT, LARGE
114484	L.R.E. RADIAL HEAD COMPONENT, X-LARGE

Instrument Tray List

No.	Code	Description
1	407236	Capitellar drill guide, small
2	407237	Capitellar drill guide, medium
3	407238	Capitellar drill guide, large
4	407239	Capitellar drill guide, extra large
5	407241	Capitellar surface cutter, small
6	407242	Capitellar surface cutter, medium
7	407243	Capitellar surface cutter, large
8	407244	Capitellar surface cutter, extra large
9	407231	Capitellar trial component inserter
10	407247	Capitellar trial, small
11	407248	Capitellar trial, medium
12	407249	Capitellar trial, large
13	407250	Capitellar trial, extra large
14	407251	Capitellar impactor
15	407252	Surface cutter for small & medium radial heads
16	407232	Surface cutter for large & ex-large radial heads
17	407254	Radial head trial, small
18	407255	Radial head trial, medium
19	407256	Radial head trial, large
20	407257	Radial head trial, extra large
21	407258	Radial head impactor
22	407259	Radial head drill guide
23	4111-118-150	1.8mm Dia x 150mm Kirschner wire with trocar
24	37-100002	Pin Puller
25	407245	Spade cutter for small & medium implants
26	407233	Spade cutter for large & extra large implants
27	407234	Ratcheting screwdriver
	407261	Complete Kit & instrument tray
	407260	Instrument Tray

LRE Instrument Tray



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Notes

Notes

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The Lateral Resurfacing Elbow™

FLU051 / 02.07

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