Operative technique

ST.A.R.90 F4 Elbow

Articulated External Fixator

EXTERNAL fixation
monolateral fixator
articulations
This operative technique is intended for orthopaedic surgeons and describes the standard procedure suggested by the manufacturer. Surgeons should however decide on the best approach to be followed depending on their clinical judgment and the patient’s needs.

Before use please read the instruction booklet enclosed in the packaging.
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Elbow articulated external fixator

The telescopic body ensures that there are at least 10 cm between the epicondyle and the first humeral diaphyseal screw to avoid damage to the radial nerve. The articulating joint has a central hole for the insertion of the guide wire, which is positioned in the centre of rotation of the elbow joint. The articulation ranges from 0° to 180° and allows complete extension and flexion of the elbow.
Bone screws

A double diameter stainless steel bone screw, self-drilling and self-tapping, with no pre-drilling required. Ensures easier insertion, strength over time and the possibility of retraction, in case of excessive penetration, without loss of strength. In case of hard cortical bone it may be necessary to pre-drill. Also available with hydroxyapatite coating for patients with severe osteoporosis or when a long period of fixation is anticipated.

When the bone screw is inserted:
- the self-drilling tip creates a hole the size of the smaller diameter;
- the first self-tapping portion cuts the thread in the bone;
- the smaller diameter easily inserted into the bone;
- the second self-tapping portion cuts the thread for the larger diameter;
- the larger diameter is inserted creating a completely circular hole.
Indications and patient positioning

**Indications**

Acute bone and/or ligament joint lesions:
- dislocations unstable after reduction
- unstable fracture dislocations
- unstable osteosynthesis (comminuted fractures, osteoporotic fractures)

Chronic joint lesions:
- instability
- stiffness

**Patient positioning**

Patient supine, with limb on radiolucent arm rest.
Operative technique

K-wire insertion
Critical steps for a successful application of the external fixator

Before starting the operation, mark on the skin the regions from 6 to 9 cm from the epicondyle as a reminder to avoid injury to the radial nerve. Obtain a true lateral view of the elbow joint with the Image Intensifier and identify the center of rotation: the center of the circle corresponding to the lateral projection of the humeral trochlea and the lateral humeral condyle (capitellum) (Fig. 5.1). A further check for proper identification of the center of rotation is to verify that the lateral ridge of the humerus is visible between the anterior two-thirds and the posterior third of the humerus.

The tip of the guide wire must be positioned in the center of the circumference (Fig. 5.2).
Operative technique

K-wire insertion
Critical steps for a successful application of the external fixator

Position the wire horizontally and insert it in the center of the epicondyle in a direction parallel to the joint line.
Check under image intensifier in the antero-posterior view (Fig. 5.3).
Operative technique

Fixator application

Slide the articulating fixator over the guide wire, with the telescopic body proximally and the curved arm extending posterior to the joint. Extend the telescopic body so that the most proximal screw is at the level of the deltoid insertion, and lock it in position by tightening the body locking screw.

Humeral bone screw insertion

Insert two self-tapping and self-drilling humeral bone screws by using the drill brace or T handle. In each case make an incision down to the deep fascia and use blunt dissection down to the bone. The first screw must be perpendicular to the anatomical and mechanical axis of the humerus and the second one should be parallel to the first. Both screws should be inserted in the centre of the bone.

Position the fixator body about 2 cm from the skin without bending the guide wire, and tighten the screw clamps.
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Ulnar bone screw insertion

The K-wire and the humeral bone screws should be parallel, which will allow adjustment of the external fixator in the frontal plane to find the best position for the ulnar screws.
Keep the distal part of the fixator body parallel to the ulna, and insert the first ulnar screw, which should be 4 mm, perpendicular to the ulnar crest. The second 4 mm ulnar screw is inserted parallel to the first and perpendicular to the anatomical axis of the ulna. The screws must be inserted in the centre of the bone to avoid weakening it.
Tighten the bone screw clamps and the ulnar translator.
Check that the K-wire does not bend while flexing and extending the elbow.
Check in the lateral projection the congruence between the external fixator and the elbow during this movement. If the K-wire bends during the flexion-extension movement, loosen the ulnar translator screw and repeat flexion-extension movements to evaluate if this eliminates the K-wire bending.
If the K-wire remains straight, tighten the ulnar translator. If K-wire bending persists, loosen the ulnar and humeral bone screw clamps and repeat the same manoeuvres until the K-wire no longer bends. At this point lock the ulnar translator and the bone screw clamps.

Ulnar translator

The system has an integral ulnar translating mechanism which can compensate for possible errors in the positioning of the K-wire in the elbow centre of rotation.
By unlocking the ulnar translator (gold coloured pin), the correct position of the K-wire can be found with flexion-extension manoeuvres to avoid impingement or subluxation.
Once the correct position is obtained the pin is locked.
Operative technique

Additional bone screw insertion

In patients with bulky muscles, with osteopenic bone or in case of stiff elbow, insert two additional screws: one in the distal humerus just above the olecranon fossa (Fig. 10.1) and one immediately distal to the olecranon, making sure they are outside the joint capsule (Fig. 10.2).

Check the fixator position

Check that there is no impingement or subluxation between the articular surfaces during the flexion and extension (Fig. 10.3, Fig. 10.4). If all is well the guide wire can now be removed.
Operative technique

Articular distraction

Turning the micrometric screw C with the 6 mm Allen wrench produces distraction at the joint. The amount of articular diastasis can be seen with the image intensifier in the frontal plane. The distraction force will act on the olecranon and ulna, without changing the center of rotation of the elbow joint. The external fixator is supplied with the distraction micrometric screw completely closed.
Elbow flexion-extension

Confirm that adequate soft tissue release has been performed around the humeral screws to allow free movement during flexion and extension.

At the end of the operation, insert the articulation locking screw to lock the joint in the desired position: the device has a range of movement from 0° to 180° with possible locking each 10°.
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Induced flexion

In patients with a stiff elbow, it is possible to induce joint movement by using the helical screw mechanism in the articulated clamp. In case of flexion deficit, insert the flexion-extension unit posteriorly in the articulated clamp and secure it with the ring nut. Rotating it clockwise with a 6 mm Allen wrench will induce progressive flexion in the joint. After gaining some flexion, the fixator can be locked with the locking bar. It is possible to remove the bar sequentially and increase the amount of flexion in stages until it is complete.

Induced extension

If there is an extension deficit, insert the flexion-extension unit anteriorly, and secure it with the ring nut posteriorly. Turn the 6 mm Allen wrench clockwise to recover extension, in stages as before, locking the joint at intervals as required. Alternate gains in flexion and extension can be achieved on different days. It is very important that recovery of the joint range of motion is carried out as part of a rehabilitation programme controlled by a physiotherapist.
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Extension insertion

The external fixator has an extension that allows distal positioning of the ulnar screw clamps. It is indicated where internal fixation, or soft tissue injuries, prevent ulnar screw insertion in the standard positions. The extension is single use, in sterile packaging, and in one size. It allows distal displacement of the ulnar screws up to 7 cm. The extension is attached as follows.

Extension insertion

Take off the outer clamp on the ulnar rod by removing the locking screw. Remove the screw from the black end of the extension device.
## Ordering information

### Code | Description
--- | ---
F4-2250 | RIGHT Elbow Articulated External Fixator  
Contents:  
1 articulated external fixator  
1 guide wire  
1 locking pin

F4-2260 | LEFT Elbow Articulated External Fixator  
Contents:  
1 articulated external fixator  
1 guide wire  
1 locking pin

F4-2748 | Elbow External Fixator Extension

<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>F4-134080*</td>
<td>ø4 mm cortical bone screw - L. 80-20 mm</td>
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<tr>
<td>F4-134095</td>
<td>ø4 mm cortical bone screw - L. 95-34 mm</td>
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<tr>
<td>F4-134120</td>
<td>ø4 mm cortical bone screw - L. 120-34 mm</td>
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<tr>
<td>F4-145080</td>
<td>ø5 mm cortical bone screw - L. 80-22 mm</td>
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<tr>
<td>F4-145100</td>
<td>ø5 mm cortical bone screw - L. 100-34 mm</td>
</tr>
<tr>
<td>F4-145120**</td>
<td>ø5 mm cortical bone screw - L. 120-34 mm</td>
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* Recommended for ulna  
** Recommended for humerus

*Are also available bone screws with hydroxyapatite coating or in Nickel-free stainless steel alloy*
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<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>F4-0230</td>
<td>Flexo-extension elbow device</td>
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Instrument set

<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>66021</td>
<td>ø2x1.50 mm guide wire, trocar tip</td>
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<tr>
<td>SF1050</td>
<td>Drill brace</td>
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<td>EBA-0050</td>
<td>6 mm Allen wrench</td>
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<td>SF1070</td>
<td>ø4 mm chuck for bone screw</td>
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<td>SF1080</td>
<td>ø5 mm chuck for bone screw</td>
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<td>F4-0220</td>
<td>T handle for chucks</td>
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<tr>
<td>F4-0215</td>
<td>Bone screws guide</td>
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<tr>
<td>F4-0205</td>
<td>Torque wrench</td>
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