The Evolutive prosthesis has been designed as the culmination of work conducted since 1997 by GUEPAR (1, 2) and biometric studies (3) in order to be a simple-to-install implant with a cemented radial stem and mobile cup.

This is an implant that is cemented inside the neck of the radius. The tail end is secured along the axis of the neck at an angle of 15° with respect to the anatomical axis of the radius, and recreates the resection height so as not to change the height of the humero-radial spacing and therefore the pressure balance between the humero-ulnar and humero-radial joints.

The particularity of this implant is that it offers a line consisting of an intramedullary stem of the same length, regardless of the stem model. Only the height of the base varies. This concept makes it possible to have a line meeting the needs of most anatomical situations.

The radial cup is mobile, with a constant height, and only its diameter (16 to 26 mm) varies. Recent work (4, 5) confirms GUEPAR’s results and the superiority of mobile cups compared to fixed cups.

Factors that improve survival of the implant have also been optimised, particularly by limiting contact between the head and neck to +/- 15° of travel.

In conclusion, with its real mechanical improvements and modular line, the Evolutive mobile radial head prosthesis makes it possible to adapt to patient anatomy and recreate the lateral console, an indispensable factor for stability in all serious elbow traumas with non-synthesizable fractures of the radial head or traumatic sequelae of the elbow.

The designers are: Prof. B. Augereau, Prof. C. Chantelot and Prof. E. Masmejean, GUEPAR members, Prof. F. Canovas, Prof. C. Fontaine, Dr R. Lille, Prof. P. Mansat and Prof. F. Van Glabbeek.

Bibliography:
5 A. Dotti, G. Cortesi, E. Magali, C. Traverso. A 10-mm or 12-mm throat/neck/head assembly resulting in:
- four heights from 8.5 to 17 mm between the centre of the head and the cut.
- harmonious and appropriate contact between the capitulum and radial cup.

**Introduction**

**Radial stem**

The radial stem is characterised by:
- a 30-mm long diaphyseal stem having a truncated cone shape measuring 6.5 mm in diameter, with anti-rotational longitudinal grooves.
- a fixed-diameter (13 mm) base with a variable height.
- a 10-mm or 12-mm throat/neck/head assembly resulting in:
  - four heights from 8.5 to 17 mm between the centre of the head and the cut.
  - harmonious and appropriate contact between the capitulum and radial cup.
PATIENT PLACEMENT AND SURGICAL APPROACH

Planning must be done using an X-ray of the healthy elbow; if not possible, then the elbow being operated on. If the implant line is not appropriate for the patient’s anatomy (which is unusual), postpone the operation and request a custom-made implant.

The patient is placed in the supine position. The upper limb, provided with a tourniquet at the shoulder and surrounded by a sterile shirt, is placed on an arm table. Prophylactic intravenous antibiotics are administered.

The approach is lateral between the long radial extensor of the carpus and the extensor digitorum communis, more frequently than Cadenat’s posterolateral. This leads to the annular ligament, which must be exposed before it is incised obliquely. Pronation is required and the supinator muscle must not be incised so as to remain away from the deep branch of the radial nerve.

The posterior route at the Kocher interval between the anconeus and extensor carpi of the carpus provides for good exposure; it must not harm the ulnar bundle of the lateral collateral ligament; it does not require exposure of the radial nerve; it makes it possible to repair the lateral collateral ligament.

CUTTING THE HEAD OF THE RADIUS

After removal of all fracture fragments, the radial head is cut with an oscillating saw or gouge forceps perpendicularly to the neck axis, with irregularities being removed. Ideally, this cut should be conservative, bearing in mind the four base height options, and must be based on the seat of the radial notch of the ulna.

After reconstituting the radial head on the table to avoid forgetting a fragment in the joint, measure its diameter using the gauge (2). Fig.1
The tests conducted with the rods and cups make it possible to estimate the prosthetic size as a function of the stem base height. A gripper (5) is used to insert the trial stem (12) into the previously prepared shaft. It can also be impacted with the impactor/disimpactor (4). Fig. 3

Using the impact gripper (16), install the trial cup (6) to (11) on the trial stem. In this way, the arm can be moved to test prono-supination, rotation, flexion, and extension:

• with extension, there must be a gap of at least 2 mm between the capitulum and the cup. Fig. 4

• with flexion, the cup must come close to the capitulum. It is better to implant a prosthesis that is too short than too long to avoid the risk of a conflict with the capitulum. Fig. 5

Take an X-ray or a fluoroscopy with an image intensifier while the trial implants are in place to check the orientation of the implants, stability, and mobility.

Remove the cup from the stem with the disimpaction gripper (17). Remove the trial stem with the gripper (5) or with the impactor/disimpactor (4).

Prepare the bone cement. Block the medullary canal with a fracture fragment. Insert the cement then the final stem into the canal with the stem gripper. Impact the stem with the impactor/disimpactor (4). Install the mobile cup on the stem using the impaction gripper (16). This assembly can also be done on a table before putting the stem in the canal.

The annular ligament is sutured without tension with an offset, if necessary, with non-absorbable suture. The lateral collateral ligament plane is reinserted into the lateral epicondyle if it had been injured or if disinsertion was necessary to approach the radial head.

The tendon plane is then sutured and the incision is closed plane by plane over a Redon drain.

Frontal and profile X-rays are taken.

The elbow is secured in a posterior plaster splint with the elbow at 90° flexion and the forearm pronated for 15 days. On the 15th day, after removal of the sutures, frontal and profile X-rays of the elbow confirm proper positioning of the mobile cup. The elbow is then released and mobilisation begins. In the event of disinsertion of the lateral ligament complex and its repair, this mobilisation is protected in a jointed orthosis limiting the last few degrees of extension, with the forearm remaining pronated until the 45th post-operative day. Next, after another X-ray inspection, the elbow is permanently freed.

• the foam-tip rasp has a handle with a lateral convex shape to work around the lateral condyle.
• the gripper applied to the prosthetic throat is used to insert the trial or final stem.
• two clamps are provided for impaction of the cup onto the radial stem and its disimpaction.
INDICATIONS
Intermediate elbow prosthesis for non-synthesisable radial head fractures, compound fracture of the radial head associated with elbow dislocation or an Essex-Lopresti syndrome, traumatic sequelae of the radial head.

PRINCIPLES
• Maintenance of the anatomical axis of the radial neck.
• Restoration of the radial head shape and function.
• Restored contact with the capitulum by the concave surface of the radial cup.

FEATURES
• The cemented radial stem, which comes in four models, includes:
  - an intramedullary part having a constant length and volume, regardless of the model, and provided with longitudinal grooves,
  - an extramedullary part of increasing length depending on the stem model, characterised by:
    • a fixed-diameter base with a variable height,
    • a gripping throat,
    • a neck and head of constant length and diameter (3 mm and 6 mm).

The design of the neck limits the travel of the radial cup to 30° (+/- 15°) to avoid contact between the neck and the metal shielding of the cup, or between the metal shielding of the cup and the bone cut.

• The mobile radial cup consists of:
  - a concave outer metal part in contact with the capitulum,
  - an inner polyethylene part articulated with the stem head.

It is available in six different diameters (of which one upon request) and a constant height of 12 mm, regardless of the diameter.

• The prosthetic space (from the cut to the top of the cup) varies from 14.75 mm to 23.75 mm, depending on the stem model, and therefore meets the needs of a broad range of anatomies.

MATERIALS
• Radial stem: cobalt-chromium alloy (ISO 5832-12).
• Radial cup: stainless steel (ISO 5832-1) and polyethylene (ISO 5834-1 and 2).

IMPLANT PART NUMBERS

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* upon request

PART NUMBERS OF THE INSTRUMENTATION
Evolutive A44000 Instrumentation.