Surgical Technique

Radial Head Prosthesis

CRF II

TORNIER
SURGICAL IMPLANTS

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1. OVERVIEW

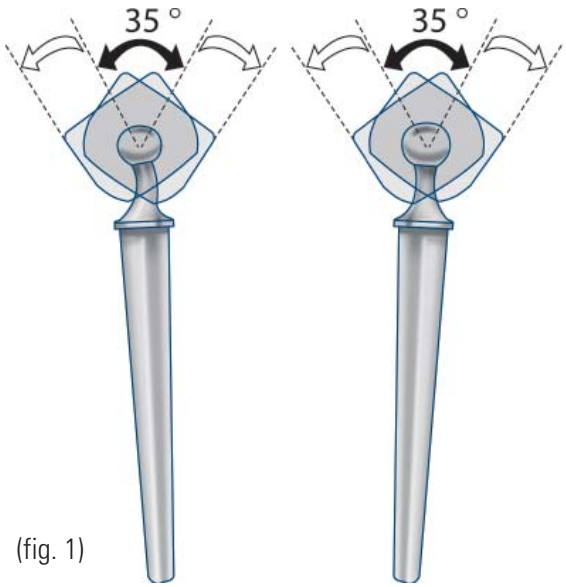
1. The long conical radial stem can be inserted using a modern cementing technique with pressurization of acrylic cement in the medullary canal.

2. The 15° neck-shaft angle restores anatomy of the proximal radius.

3. The 6 mm diameter ball creates a ball-and-socket joint with the bipolar radial head.

4. Metal-backed radial head (CoCr/PE).

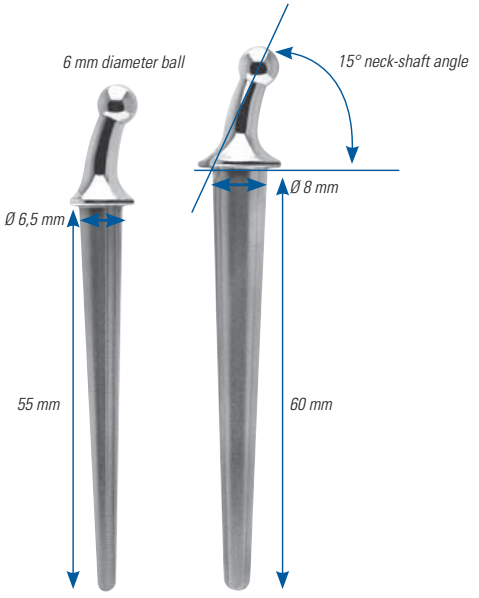
5. Maximum PROM : 35° (bipolar radial head/ball articulation) (Fig. 1)



(fig. 1)

Two stem sizes and two radial head sizes are offered to anatomically match each individual patient:

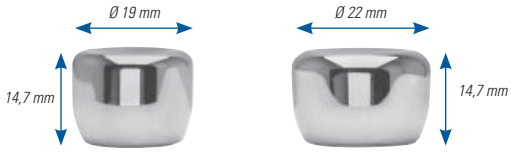
• Radial stems:
- **55 mm** stem: **6.5 mm** diameter under the collar
- **60 mm** stem: **8 mm** diameter under the collar.



• Radial heads:
- Ø **19 mm** x H **14.7 mm**
- Ø **22 mm** x H **14.7 mm.**

Distance between the base of the prosthetic neck and the top of the bipolar radial head is 22.5 mm.

As the prosthetic neck and ball have a fixed size, the small and large radial heads offer mix-and-match capabilities with the short and long radial stems.



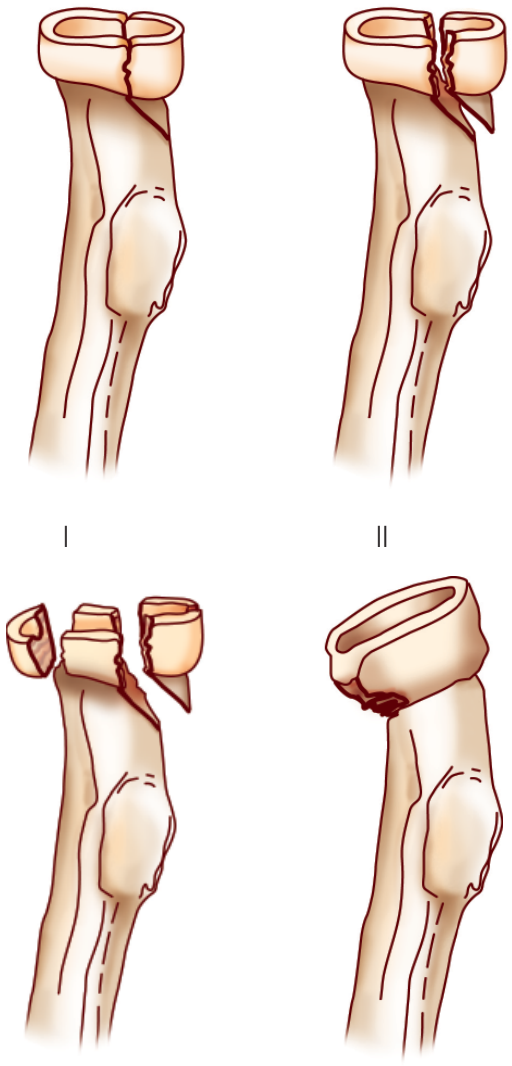
INDICATIONS

2. INDICATIONS

Restoration of a sound lateral bone platform is mandatory in specific indications:

1 Acute Trauma

Radial head fracture not suitable for internal fixation (Mason grade III with significant displacement) associated with another destabilizing injury (elbow dislocation, coronoid fracture or rupture of the internal ligament).

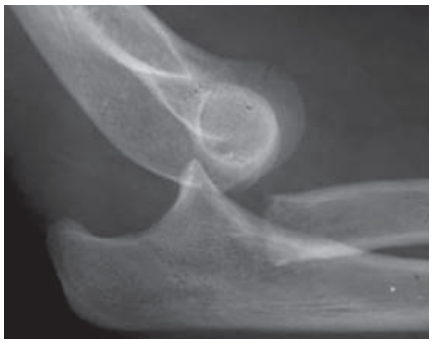


(fig. 2)

2 Trauma Sequalae

a/ Wrist pain syndrom following radial head resection after inferior radio-cubital dislocation or internal hyper-pressure of the carpus.

b/ Elbow instability after radial head resection



(fig. 3)

DESIGN RATIONALE

3. DESIGN RATIONALE

The head of the radius works together with the adjacent bony, ligamentous, and tendinous structures to stabilize the elbow joint.

The head of the radius acts as a stabilizer in three planes:

- **Coronal plane:** the synergistic action of the ulnar collateral ligament and the head of the radius resists valgus forces.
- **Sagittal plane:** the head of the radius works together with the medial and posterolateral ligamentous structures, and the coronoid process to prevent posterior dislocation.
- **Axial plane:** acting together with the interosseous membrane, it prevents upward migration of the radial shaft which has a detrimental effect on the inferior radioulnar joint.

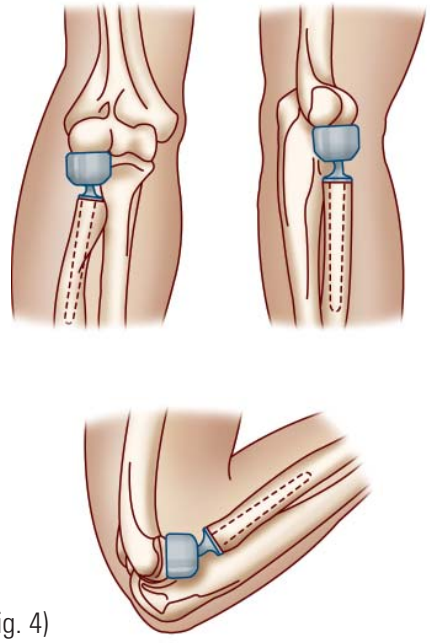
Therefore, the head of the radius can be considered as an "additional multifunctional stabilizer" of the elbow joint.
However, to perform all these functions, the prosthesis must be able to withstand the forces exerted on the humeroradial joint, which implies:

- **high mechanical strength** deformation and fatigue,
- **strong, reliable long-term fixation**.

Good wear characteristics are necessary to maintain high mechanical performance in the long run with no generation of pathogenic wear debris.

There must be a tight fit between the bipolar radial head and the humerus capitulum during flexion, extension, and pronation/supination (Fig. 4)

Point contacts should be avoided to eliminate the potential for hyperpressure and osteocartilaginous lesions of the capitulum.



(fig. 4)

4. SURGICAL TECHNIQUE

1 Preoperative assessment

Preoperative assessment requires the use of:
- AP and lateral views of the head of the radius.
- x-ray of the ipsilateral wrist, if painful.

2 Patient positioning

The patient is supine on the operating table, and a tourniquet is placed at the root of the limb. The elbow is flexed and allowed to rest on a short arm board that extends 25 cm away from the table and stops just past the olecranon. This way, the surgeon faces the affected joint, and a slight rotation of the patient's shoulder provides him easy access to the elbow through any approach.

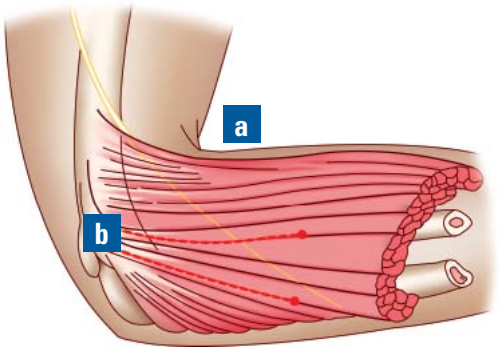
The forearm is placed and held in pronation, so that:
- **the radial nerve is medialized,**
- **the radial shaft is oriented in the axis of the operative field.**

3 Surgical approach and Incision of the annular ligament

With the elbow flexed, make one single angled incision centered over the tip of the epicondyle. It should extend proximally for a distance of 1 to 2 cm along the axis of the arm, and distally for a distance of 6 to 7 cm toward the ulnar crest.

The most popular approach is the lateral one, between the extensor carpi radialis brevis and the extensor digitorum communis. This interval is easier to identify at the distal end of the incision. Once the radial muscles have been retracted anteriorly and the head of the radius has been removed, it affords access to the radial notch, the humeroulnar joint line, and the coronoid process (Fig. 5a)

The other option is to use a posterolateral approach between the anconeus, posteriorly, and the remaining epicondylar muscles, anteriorly. This approach affords a more distal access to the radius (Fig. 5b)



(fig. 5)

4. SURGICAL TECHNIQUE

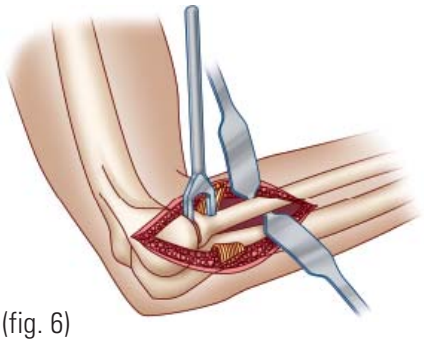
Incise the **annular ligament** (if intact).

Anyway, whether it was torn or incised, it should be repaired whenever possible.

An oblique incision will greatly facilitate the repair.

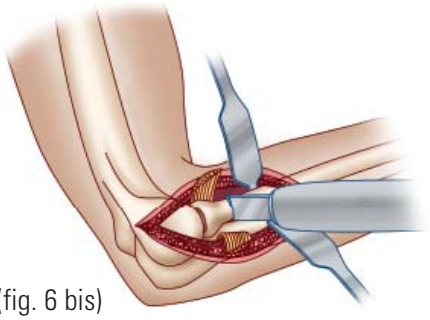
4 Radial head/neck osteotomy

Insertion of two double bent retractors provides adequate exposure. Not only the anterior retractor must be inserted with great caution, but throughout the radial preparation, the forearm must be held in full pronation to avoid the potential risk of elongation of the radial nerve.
The correct position for the osteotomy is 23 mm distal to the capitulum. This position is easy to determine, using the resection gauge included in the instrument set (Fig. 6)



(fig. 6)

The cut is performed with the oscillating saw.
Avoid using cutting pliers which tend to cause bone splinters and propagation of fracture lines (Fig. 6 bis)



(fig. 6 bis)

5 Associated fracture of the coronoid

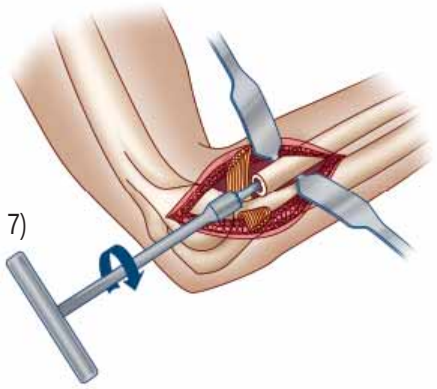
Fracture of the coronoid is often seen when the radial head fracture is associated with dislocation.
If present, the coronoid fracture should be managed at this stage of the procedure. Depending on the size of the bone fragment, simple resection or guided reduction is performed, followed by lag screw fixation (from the ulnar crest).

4. SURGICAL TECHNIQUE

6 Use of the end-cutting mill

Use the end-cutting mill to smooth off the cut surface.

Smooth off the cut surface to achieve a perfect fit between the prosthetic neck and the cut surface (fig. 7)



(fig. 7)

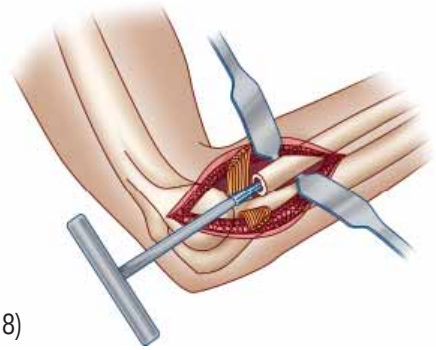
7 Use of the resection gauge

Make a final check of the resection level using the resection gauge. Perfect humeroulnar congruity must be achieved at the superior border of the radial notch.

8 Preparation of the radial canal

Ream the medullary canal using the reamers.

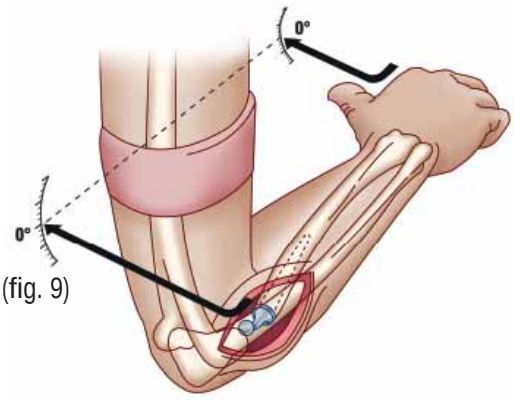
Work the small diameter reamer back and forth and, if necessary, use the large diameter reamer.
The reaming step allows determination of the appropriate size stem according to the radius size (fig. 8)



(fig. 8)

9 Selection and insertion of the trial stem

Insert the trial stem into the prepared cavity.
The neck of the trial stem must be flush against the resected surface.
Orientation of the prosthetic neck is determined relative to the bistyloid plane (fig. 9)

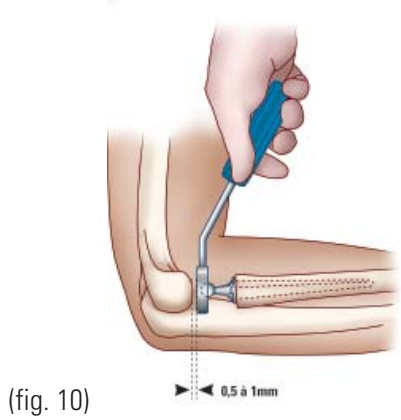


(fig. 9)

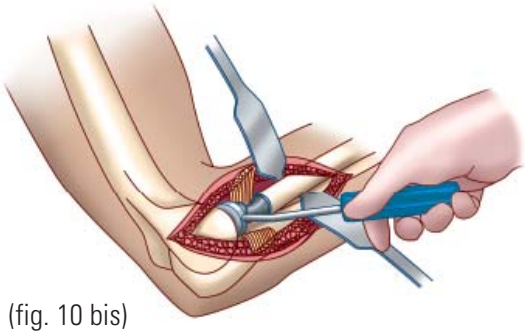
4. SURGICAL TECHNIQUE

10 Selection and insertion of the trial radial head

Once the trial stem has been properly seated, determine the size of the bipolar radial head. The trial radial head should allow for 0.5 to 1 mm clearance (figs 10 & 10 bis). The size of the bipolar radial head should correspond to the size of the removed head after it has been reassembled. In the few cases where the head of the radius is absent, use the trial radial head.



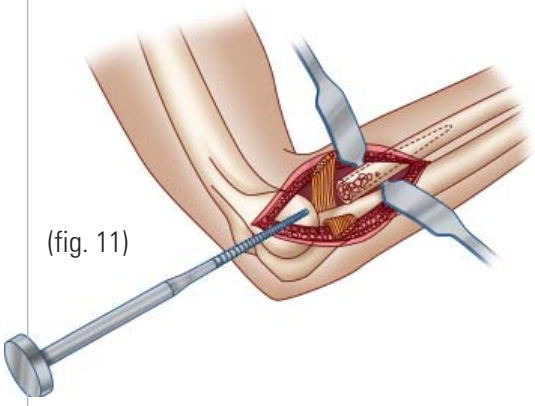
(fig. 10)



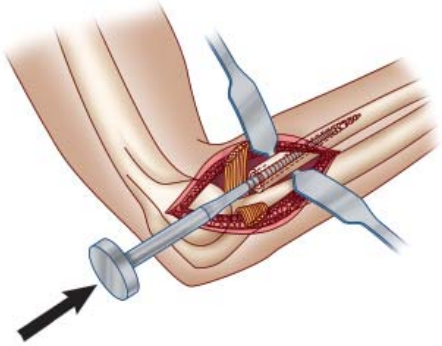
(fig. 10 bis)

11 Distal bone plug

Make a bone plug using bone fragments from the resected head or use a distal canal occluder, and insert it into the medullary canal with the help of the cylindrical rasp. Place the bone plug/occluder 10 mm distal to the stem end (figs 11 & 11 bis)



(fig. 11)



(fig. 11 bis)

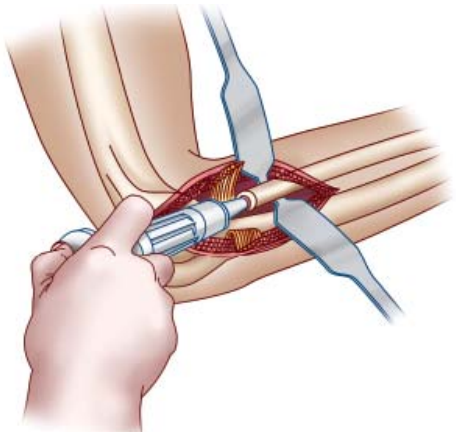
4. SURGICAL TECHNIQUE

12 Use of a modern cementing technique for the final components

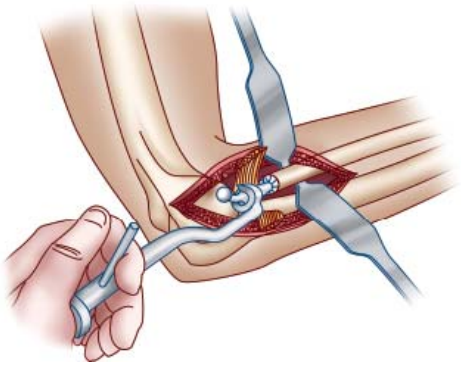
Thoroughly dry the prepared cavity using a small diameter drain. Then, inject low viscosity cement while in the liquid phase with a large-nozzle syringe, using a retrograde cement filling technique (fig. 12). Pressurize the cement until formation of the doughy phase. Then, insert the radial stem using the positioner/impactor and firmly hold it in place until the cement is hard.

The stem can now be impacted with the positioner/impactor. Carefully remove any excess cement. The orientation mark on the convex side of the prosthetic neck assists in correct orientation of the concave side of the neck, laterally.

Confirm proper position of the stem by palpation (fig. 12 bis)



(fig. 12)

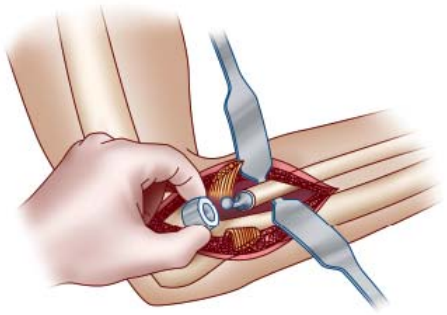


(fig. 12 bis)

13 Bipolar radial head assembly

Assemble the bipolar head.

Place the bipolar head on the ball ; positive capture of the bipolar head is confirmed by a clean audible click (fig. 13)



(fig. 13)

4. SURGICAL TECHNIQUE

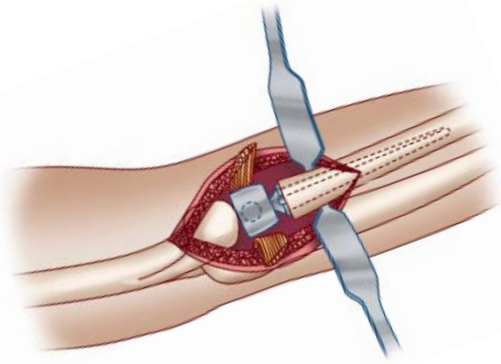
14 Assessment of stability and range of motion - Soft tissue repair

After reduction, assess range of motion in flexion/extension and in various pronation/supination positions, before and after suture repair of the annular ligament (if present). Assess stability of the bipolar radial head relative to the capitulum, good fit, and stability in the coronal plane (figs 14 & 14 bis).

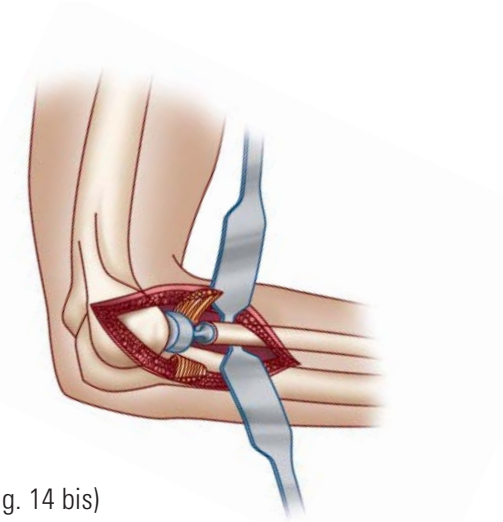
In fresh fractures, severe lesions of the soft tissues (i.e. rupture of the annular ligament, detachment of its posterolateral fibers and part of the muscle insertions) are often seen.
This causes anterior-posterior instability of the bipolar radial head and requires anatomical repair of the injured soft tissues.

Implantation of the CRF II Radial Head Prosthesis is seldom associated with a residual valgus instability that requires repair of the medial collateral ligaments.

However, should this be the case, the posterolateral capsule and ligaments should be repaired using transverse sutures.
Place a Redon drain and close the wound.



(fig. 14)



(fig. 14 bis)

15 Wound closure

Repair the annular ligament (whenever possible), place a suction drain, and close the wound in a routine fashion.

POSTOPERATIVE MANAGEMENT

5. POSTOPERATIVE MANAGEMENT

1 Radiographic evaluation

Take x-rays to check the position of the prosthesis and proper restoration of the humeroulnar joint line.

In case of incongruity that indicates the presence of a foreign body within the joint or high positioning of the prosthesis, immediate revision should be considered.

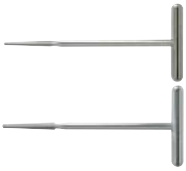
2 Rehabilitation program

Early rehabilitation is essential to prevent joint stiffening which frequently occurs after management of a radial head fracture.
The rehabilitation program (i.e. all motions or a specific range of motion that was initially restricted) and the use of a splint depend on whether soft tissue injuries were associated with the radial head fracture.
In any case, gentle active exercises are always recommended.
The use of an elbow CPM machine may be considered.
Application of an ice bag and use of anti-inflammatories are recommended.

INSTRUMENTS

Reamers

Ø 6,5 mm	Ref. MTJ 026
Ø 8 mm	Ref. MTJ 028



End-cutting mill

Ref. MTJ 010

Trial stems

Ø 6,5 mm	Ref. MTJ 036
Ø 8 mm	Ref. MTJ 038

Instrument set

Ref. YKAD 048

Rasps

Ø 6,5 mm	Ref. MTJ 016
Ø 8 mm	Ref. MTJ 018

Trial radial heads

Ø 19 mm	Ref. MTJ 020
Ø 22 mm	Ref. MTJ 021

Positioner/impactor

Ref. MTJ 013

Resection gauge

Ref. MTJ 023

NOTES

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IMPLANTS

IMPLANTS

Radial Head Prosthesis

Stems

Ø 6,5 mm	Ref. DTJ 006
Ø 8 mm	Ref. DTJ 008

Bipolar radial heads

Ø 19 mm	Ref. DTJ 019
Ø 22 mm	Ref. DTJ 022

TORNIER
SURGICAL IMPLANTS

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