The MOTEC® wrist joint prosthesis is a modular prosthesis consisting of four parts, providing the surgeon with 144 combinations closely replicating the patient’s normal wrist joint range of motion.

The articulation is metal-to-metal with ball and socket articulation made of cobalt chrome molybdenum alloy treated with chromium nitride. Fixation is achieved by threaded implants made of titanium alloy, blasted and coated with Bonit®, which is a resorbable calcium phosphate combination with proven osteoconductive properties.

The MOTEC wrist joint prosthesis is designed with the objective to reduce the risk of subluxation and loosening by:

- Limit bone resection
- Preserve soft tissue and ligament structures
- Improve short term fixation
- Optimize long term fixation
- Reduce the risk of failure associated with long term use

The operative procedure is straight forward and easy to learn.

Indication for the MOTEC wrist joint prosthesis is pain and reduced motion of the wrist caused by rheumatoid arthritis, primary osteoarthrosis and secondary arthrosis due to Kienböck’s disease of the lunate, non-unions of fracture of the scaphoid, wrist instability, and fracture of the distal radius.
The ball and socket design have several advantages

- Increased range of motion (ROM) 136°–160°.
- Increased stability, especially in patients with poor soft tissue.
- The MOTEC wrist joint prosthesis is closely replicating the anatomical center of rotation during both flexion/extension and ulna/radial deviation (Ref. 1).
- The ball and socket articulation diverts rotational forces from the bone implant interface that can cause loosening.
- Can resist forces that cause subluxation (no subluxations have been reported in more than 250 patients).
Limited bone resection

- The ball and socket metal-to-metal articulation saves joint space compared to polyethylene-to-metal. The only bone that needs to be removed is the lunatum, half the scaphoid and the tip of the radial styloid. Wrist arthrodesis as a salvage procedure is possible to perform without difficulty due to the limited bone removal.

Preserves soft tissue and ligament structures

- Most of the soft tissue and ligament structures between the radius, ulna and the carpal bones are preserved, maintaining the natural stability of the wrist. The distal radio-ulnar joint may function unaffected of the prosthesis. The peripheral rim of the distal radius with its important ligamentous and soft tissue attachments are preserved.
Improved short term fixation

- Immediate primary fixation is achieved by threaded implants. The design of the threaded radius implant has been optimized for maximum bone purchase. The rounded tip reduces stress concentration.

The threads of the conical radius implant engages into the cortical bone, volarly and dorsally, preventing the implant from sinking.

- The cementless fixation of the components makes the operation easier to perform and eliminates potential cement related complications.

The threads of the conical metacarpal implant engage into the cancellous and cortical bone of the capitate and the third metacarpal, ensuring a stable fixation. Fusion of the midcarpal bones is only needed between the capitate and the third metacarpal.
Optimized long term fixation and osseointegration

- **Optimal blasting of titanium alloy implants improves long term fixation and osseointegration** (Ref. 2,3).

  The titanium surface is blasted with extra pure Al₂ O₃ using a specific technique and to a specific roughness value to maximize the bone ingrowth.

- **The titanium alloy threaded implants are coated with Bonit®, a resorbable calcium phosphate combination with proven osteoconductive properties, improving long term fixation.**

  Implant in black and bone in purple.

  The implants are coated with a Bonit® layer of 20-30 μm.

In vivo biomechanical comparison

Bonit® and hydroxyapatite (HA) coated titanium screws were inserted in the proximal tibia of a rabbit. The screw fixation increased with time (6 to 12 to 52 weeks) for the Bonit® coated screws whereas HA screws showed no increase in fixation with time after 6 weeks. (Ref. 4 and 5).

<table>
<thead>
<tr>
<th>Bonit®</th>
<th>Bonit®</th>
<th>Bonit®</th>
<th>HA coating</th>
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<tbody>
<tr>
<td>6 weeks</td>
<td>12 weeks</td>
<td>52 weeks</td>
<td>52 weeks</td>
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The Bonit layer is partly resorbed. The Bonit layer was fully resorbed and the osseointegration is acting between titanium oxide layer and bone. The HA-layer and particles are loosening from the titanium surface. Giantcell, macrophages are visible.

Problems with long term fixation using HA coating on implants have been shown in a thesis by Magne Røkkum (Ref. 6).
Reduced risk of failure associated with long term use

- The modular cup and head are made of cobalt-chrome-molybdenum (CoCrMo) alloy, minimizing the risk of osteolysis associated with polyethylene bearings.

Metal-on-metal articulation (MOM) bearing couples have been shown to have much lower wear rates than polyethylene bearings in vitro simulator tests as well as in recent clinical studies (Ref 7, 8, 9 and 10).

- The modular cup and head have been coated with chromium nitride (CrN). When using chromium nitride, the wear rate is reduced by a factor of 40 compared to a standard cobalt-chrome-molybdenum articulation (Ref. 11).

No risk of severely worn or broken polyethylene bearings (Ref.12).
Case I


Post-op. 2 years post-op. ROM 118°. Jamar: 29 kg grip strength.

2 years post-op. ROM 118°. Jamar: 29 kg grip strength.

Case II

Pre-op. Male 66 years old. Previously operated with lunatum silicon prosthesis. AROM 98°. Jamar: 22 kg grip strength in the operated hand and 38 kg in the other hand.

Post-op. 2 years post-op. Jamar: 36 kg grip strength. AROM 124°.

2 years post-op. Jamar: 36 kg grip strength. AROM 124°.
Reference


6. Theses. Magne Røkkum, On Late Complications With Ha Coated Hip Arthroplasties, Department of Biomaterials/Handicap Research, Institute for Surgical Sciences, Faculty of Medicine, University of Göteborg, Göteborg, Sweden and Orthopaedie University Clinic, National Hospital, Oslo, Norway, Göteborg 2001.


Surgical technique

Indication

The MOTEC is indicated as a total joint replacement of the wrist joint in cases with pain or reduced motion caused by rheumatoid arthritis, primary osteoarthritis and secondary arthrosis due to Kienböck’s disease of the lunate, non-unions of fracture of the scaphoid, wrist instability, and fracture of the distal radius.

Contraindication

The physician’s education, training and professional judgement must be relied upon to choose the most appropriate device and treatment. Conditions presenting an increased risk of failure include:

- Previous open fracture or infection in the joint.
- Physical interference with another prosthesis during implantation or use.
- Inadequate skin, bone or neurovascular status.
- Irreparable tendon system.
- Inadequate bone stock or soft tissue coverage.
- Any mental or neuromuscular disorder which would create an unacceptable risk or complication during the postoperative care.
- Other medical or surgical conditions which would preclude the potential benefit of surgery.

Anaesthesia and antibiotics

Either axillary block or general anaesthesia is recommended. Preoperative antibiotics are recommended.

Pre-operative planning

It is recommended as an important part of the preoperative planning process that the surgeon should be familiar with the anatomy of the carpal area with special attention to the neuromuscular system.

NB. Do not touch the implants with your fingers! Use the screwdriver and the head and cup introducer.

Patient positioning

The patient is placed supine on the operating table with the arm abducted 90 degrees over an arm table. The C-arm is placed at the end of the operating table.

A tourniquet is applied and inflated. The patients arm is prepared and draped in the usual sterile manner.
The patient is 50 years of age and suffering from secondary arthrosis due to a fracture of the scaphoid. An arthrodesis was performed between the scaphoid and trapezium.

The carpus has luxated volarly and ulnarly. The patient has severe pain and can only move her wrist a few degrees. The intramedullary channel of the third metacarpal is very tight. There is a large ongrowth of bone at the volar ridge of the radius.
1. Surgical approach

Make a 60 mm dorsal incision.

The extensor retinaculum is exposed.

The extensor retinaculum is splitted at the listers tubercle.

The two radial wrist extensors and the long thumb extensor are held radially and the finger extensors ulnarly.
The capsule is freed dorsally and ready to be opened.

The capsule is opened.
2. Bone resection

In this case a substantial bone ongrowth of the volar ridge of the radius is resected.

The lunatum, 2/3 of the scaphoid and the tip of radial styloid are removed.

The border of the capitatum is marked with injection needles.

There is a 30 degree volar angle between the third metacarpal and the capitatum. The third CMC-joint is chiselled and cut open dorsally until all cartilage and subchondral sclerosis is gone.

There should be no angle between the capitatum and the third metacarpal when the above procedure is completed.
3. Preparation of the capitatum and third metacarpal

The wrist is angled volarly and a Hohmann-retractor is placed beneath the capitatum to lift it up (this will close the angle between the capitatum and the third metacarpal).

An awl is used to create a central hole through the capitatum and further into the intramedullary channel of the third metacarpal bone.

To ensure proper orientation of the awl, it is important to have a true A/P and lateral view.

4. Guide wire insertion

The positioning of the guide wire through the capitatum and the third metacarpal is the most critical step in the whole procedure.

A guide wire with a blunt end is introduced by hand through the capitatum and into the intramedullary channel of the third metacarpal.

The guide wire is introduced until the end of the intramedullary channel.
5. Drilling of the capitatum and the third metacarpal

Start by drilling with the small diameter cannulated drill. The drill is introduced over the guide wire and advanced using reamer speed.

Keep the drill cold by spraying sterile water on it. It is easy to drill through the capitatum but the hard bone in the third metacarpal is difficult to open up. The drill must be cleaned several times. It is recommended to drill further than the isthmus.

To ensure proper orientation of the drill, it is important to have a true A/P ...

Drill depth is taken directly from the measurement from the drill cutting flutes. If no cortical resistance is felt during drilling of the third metacarpal, the drill should be exchanged to the large diameter drill.

It is better to have a long and small diameter metacarpal implant, than a short and large diameter metacarpal implant.
6. Introduce the metacarpal implant

The metacarpal implant should always be implanted at this stage. This will minimise any possible damage to the bone during the preparation of the radius.

The guide wire is removed and the chosen metacarpal implant is inserted without touching the skin.

The metacarpal implant is inserted until its edge is flush with the surface of the capitatum. Insertion is carried out by hand only.

Sometimes, the metacarpal implant will not be completely covered by bone on the dorsal side of the proximal capitatum.
7. Preparation of the radius

A Hohmann-retractor is placed beneath the edge of the volar ridge to lift the radius. An awl is introduced under image intensification through the joint surface of the radius. It should be placed central in the A/P view ...

... and slightly volar in the lateral view.

8. Guide wire insertion

The guide wire is introduced through the hole in the joint surface of the radius.

The orientation of the guide wire is checked under image intensification in both A/P view ...

... and lateral view.
9. Drilling of the radius

The cannulated drill for the radius is introduced over the guide wire and drilling is carried out at reamer speed.

To ensure proper orientation of the drill it is important to check the position under image intensification during drilling. Continue drilling until cortical resistance is felt.

10. Reaming of the radius

A decision is made regarding which size of the cup (15 or 18) that should be used.

The corresponding radius spherical drill is used to ream a cavity for the cup.

The drill is reinserted and the drill depth is taken directly of the measurement of the drill cutting flutes. It is important to measure at a inner cutting edge created by the radius spherical drill.
10. Insertion of the radius implant

The chosen radius implant is introduced as far as it will go.

The radius implant is almost inserted all the way. The picture taken by the image intensifier shows that there is still some space between the tip of the radius implant and the cancellous bone.

11. Insertion of the trials

The radius cup trial is placed in the radius implant.

To determine the correct metacarpal head trial, you must start by inserting the shortest head trial. Increase the trial size until the right tension has been achieved. The impactor should not be used with the trials.

When pulling the radius, the metacarpal head trial should just lift from the bottom of the cup. If one size up feels too tight, or if one size down feels too loose, it is possible to adjust the metacarpal implant slightly by introducing it further into the bone. Tension will increase when later closing the capsule.

When the correct metacarpal head trial is determined the metacarpal head trial is removed.
12. Insertion of the radius cup

Before introducing the chosen radius cup, make sure that the internal Morse cone of the radius threaded implant is clean. The radius cup is inserted into the radius threaded implant.

Tap the impactor gently.

13. Insertion of the metacarpal head

Before introducing the chosen metacarpal head, make sure that the internal Morse cone of the metacarpal threaded implant is clean. The metacarpal head is inserted into the metacarpal threaded implant. When the head is in position tap the impactor gently.

The joint is reduced and stability and range of motion are evaluated under image intensification.

The position of the implant is good but there is still bone that needs to be removed between the radius and the triquetrum.
14. Final reduction

Extension.

Radial deviation.

Flexion.

Ulnar deviation.
15. Closure

The dorsal capsule is closed as good as possible.

The extensor retinaculum is sutured back and a subcutaneous drainage is introduced before the incision is closed.

Post operative care

A post operative plaster is applied to immobilize the wrist. The lower arm should be splinted in this fashion for 3 weeks. Active motion without load is then started with a removable protective resting splint used for 6 weeks. Thereafter, the patient should gradually increase active motion with load. There are no restrictions after 12 weeks.

X-rays should be obtained intraoperatively, at 6 weeks, 3 months and 12 months postoperatively.
### Product information

#### CAT. NR. | IMPLANTS | MATERIAL | DIMENSION
--- | --- | --- | ---
40-1015 | Radius Cup Ø15 | CoCrMo | Ø15 mm
40-1018 | Radius Cup Ø18 | CoCrMo | Ø18 mm
40-1332 | Radius Threaded Implant | Ti6Al4V | Length 32 mm
40-1338 | Radius Threaded Implant | Ti6Al4V | Length 38 mm
40-1344 | Radius Threaded Implant | Ti6Al4V | Length 44 mm
40-1118 | Metacarpal Head – Short | CoCrMo | Ø18, Short Neck
40-1718 | Metacarpal Head – Medium | CoCrMo | Ø18, Medium Neck
40-1218 | Metacarpal Head – Long | CoCrMo | Ø18, Long Neck
40-1115 | Metacarpal Head – Short | CoCrMo | Ø15, Short Neck
40-1715 | Metacarpal Head – Medium | CoCrMo | Ø15, Medium Neck
40-1215 | Metacarpal Head – Long | CoCrMo | Ø15, Long Neck
40-1445 | Metacarpal III Threaded Implant – Large | Ti6Al4V | Length 45 mm
40-1450 | Metacarpal III Threaded Implant – Large | Ti6Al4V | Length 50 mm
40-1455 | Metacarpal III Threaded Implant – Large | Ti6Al4V | Length 55 mm
40-1460 | Metacarpal III Threaded Implant – Large | Ti6Al4V | Length 60 mm
40-1475 | Metacarpal III Threaded Implant – Small | Ti6Al4V | Length 45 mm
40-1480 | Metacarpal III Threaded Implant – Small | Ti6Al4V | Length 50 mm
40-1485 | Metacarpal III Threaded Implant – Small | Ti6Al4V | Length 55 mm
40-1490 | Metacarpal III Threaded Implant – Small | Ti6Al4V | Length 60 mm

#### CAT. NR. | INSTRUMENTS | MATERIAL | DIMENSION
--- | --- | --- | ---
40-1562 | Measuring Sleeve | Stainless Steel | Ø2 mm
40-1561 | Guide Wire | Stainless Steel | Ø2 mm Sharp Tip
40-1563 | Guide Wire | Stainless Steel | Ø2 mm Round Tip
40-1516 | Impactor Head & Cup | Plastic | Ø15 – Ø18
40-1531 | Radius Cup Trial | Plastic | Ø18 mm
40-1532 | Radius Cup Trial | Plastic | Ø15 mm
40-1536 | Metacarpal Head Trial | Plastic | Ø18, Long Neck
40-1537 | Metacarpal Head Trial | Plastic | Ø15, Long Neck
40-1538 | Metacarpal Head Trial | Plastic | Ø18, Short Neck
40-1539 | Metacarpal Head Trial | Plastic | Ø15, Short Neck
40-1533 | Metacarpal Head Trial | Plastic | Ø18, Medium Neck
40-1534 | Metacarpal Head Trial | Plastic | Ø15, Medium Neck
40-1513 | Hex Driver Tip (Quick-Lock) | Stainless Steel | 3.5 mm HEX
40-1551 | Cannulated Metacarpal III Drill – Large | Stainless Steel | 45 – 60 mm
40-1552 | Cannulated Metacarpal III Drill – Small | Stainless Steel | 45 – 60 mm
40-1546 | Cannulated Radius Drill | Stainless Steel | 32 – 44 mm
40-1566 | Radius Spherical Drill | Stainless Steel | Ø18
40-1567 | Radius Spherical Drill | Stainless Steel | Ø15
40-1517 | Awl | Stainless Steel | Elastosil
40-1518 | Holder for Guide Wire | Stainless Steel
45-2585 | Driver Handle (Quick Lock) | Stainless Steel
40-1500 | Tray & Lid | Stainless Steel

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![Radius threaded implant (3 sizes)](image1)

Radius threaded implant (3 sizes)

![Radius Cup (2 sizes)](image2)

Radius Cup (2 sizes)

![Metacarpal head implant (6 sizes)](image3)

Metacarpal head implant (6 sizes)

![Metacarpal threaded implant (8 sizes)](image4)

Metacarpal threaded implant (8 sizes)
Swemac develops and promotes innovative solutions for fracture treatment and joint replacement. We create outstanding value for our clients and their patients by being a very competent and reliable partner.