MOTEC®
Basal thumb joint prosthesis

Swemac
Pain, instability, and reduced motion of the basal thumb joint (CMC I) may be caused by rheumatoid arthritis, primary osteoarthrosis and secondary arthrosis due to fracture of the first metacarpal or trapezium.

Traditionally, these problems have been treated operatively by CMC I fusion or different kinds of resection arthroplasty. The strength of the thumb is less after resection arthroplasty, and reduced stability in the basal joint may be a problem (Ref. 1).

Different types of total CMC I-prostheses have therefore been developed. When successful, total replacement of the basal thumb joint affords the best solution in that it provides the patient with a strong, stable, mobile and pain free thumb.

A high frequency of loosening of both uncemented and cemented prostheses has been reported (Ref. 2, 3 and 4).

The MOTEC® basal thumb joint prosthesis has been designed to overcome the problems of loosening and subluxation by improving short term fixation, optimizing long term fixation and osseointegration, reducing the risk of osteolysis and minimizing the risk of procedure related complications.

However, we promote caution and emphasize the importance of patient selection based on functional demand.
The MOTEC is a modular prosthesis consisting of four parts, providing the surgeon with 168 combinations replicating the patient’s normal CMC-1 joint range of motion.

- Trapezium threaded implant (3 sizes + 3 XL sizes).
- Trapezium Cup implant.
- Metacarpal head implant (4 sizes).
- Metacarpal threaded implant (5 sizes + 2 XL sizes).

The implant has a collar. The articulation is metal against 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.

Range of motion (ROM) 120°
Improved short term fixation

- Immediate primary fixation is achieved by threaded implants.
- A collar prevents the trapezium implant from pivoting sideways or sinking.
- The design of the threaded trapezium implants has been optimized for maximum bone purchase (Ref. 5).
- The threads of the conical metacarpal implant engage into the cortical bone of the intramedullary canal, preventing the implant from sinking.

The trapezium implants are available in 7 mm, 8.5 mm and 10 mm lengths.

The metacarpal implants are available in 20 mm, 24 mm, 28 mm, 32 mm and 36 mm lengths.

The metacarpal drill core diameter matches the diameter of all metacarpal implants.
Optimized long term fixation and osseointegration

- **Optimal blasting of titanium alloy implants improves long term fixation and osseointegration** (Ref. 6).

  The titanium surface is blasted with extra pure Al₂O₃ 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.**

- **Cementless – eliminating potential cement related complications.**

  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. 7 and 8).

  ![Implant in black and bone in purple.](image)

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

  ![Implant in black and bone in purple.](image)

  Implant in black and bone in purple.

  Bonit®
  6 weeks
  The Bonit layer is partly resorbed.

  Bonit®
  12 weeks

  Bonit®
  52 weeks
  The Bonit layer was fully resorbed and the osseointegration is acting between titanium oxid layer and bone.

  HA coating
  52 weeks
  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. 9).
The modular cup and head are made of cobalt-chrome-molybdenum (CoCrMo) alloy. 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 10, 11, 12, 13).

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. 14).

Total wear loss of CrN-CrN, CrCN-CrCN and MOM prosthesis
Minimized risk of procedure related complications

- No risk of drilling to deep. The trapezium drills have a collar, making it impossible to drill further than the chosen drill depth.
- The drill for trapezium is very sharp and only slightly conical, reducing the risk of cracking the bone during drilling.

- XL trapezium implants with deeper threads are available for patients with severely osteoporotic bone or in the event the bone is stripped using a standard implant.
- The collar of the trapezium implant ensures a good fixation in the subchondral bone by preventing the implant from being inserted too deep.

Standard trapezium implant. XL trapezium implant.

The XL trapezium implant has the same core diameter as the standard implant.

If fixation with the standard or XL trapezium implants is unsuccessful a polyethylene cemented salvage cup is available.

Do not use the polyethylene cup as a standard solution.
Case – 62 year old woman

CMC-1 OA. Severe pain, VAS 10. Pre-operative A/P-view.

Direct post-operative lateral view.

6 weeks post-operative lateral view. No pain.

10 months post-operative lateral view. No pain, full ROM and good grip.

Reference


9. 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 basal thumb joint in cases with pain or instability due to rheumatoid arthritis, primary osteoarthritis and secondary arthrosis due to fracture of the first metacarpal or trapezium.

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.

Patient positioning
The patient is placed supine on the operating table with the arm abducted 90 degrees over an arm table. A tourniquet is applied and inflated. The patient’s arm is prepared and draped in the usual sterile manner.

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.

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Patient positioning diagram:
- Extensor pollicis longus
- Extensor pollicis brevis
- Dorsal branch of radial artery
- Branches of superficial radial nerve
- Abductor pollicis longus

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

The trapezium threaded implant is in the centre of the trapezium bone.

The threads of the conical metacarpal threaded implant engage into the cortical bone of the intramedullary canal.

The tip of the metacarpal threaded implant is in the centre of the bone and does not penetrate the MCP joint.

The volar lip and the ulnar prominence have been removed. They can act as a lever and cause dislocations.

A 2-4 mm resection of the metacarpal base.

The distance from the tip of the proximal end of the trapezium implant and the joint surface should not be shorter than 1.5 mm.

The metacarpal threaded implant is flush with the cut surface of the metacarpal bone.
1. Surgical approach

A dorsoradial approach centred on the trapezio-metacarpal articulation is used. Branches of the superficial radial nerve lie in the subcutaneous fat layer and should be carefully protected. The interval between the abductor pollicis longus and extensor pollicis brevis is used to gain access to the dorsal capsule. The carpometacarpal joint is identified.

Sharply divide the capsule longitudinally and elevate the adherent soft tissue envelope from the base of the first metacarpal, exposing the trapeziometacarpal joint. The APL which inserts on the base of the metacarpal should be freed from its insertion and tagged for later repair.

A 360 degree subperiosteal circumferential dissection of the proximal part of the metacarpal is performed in order to facilitate access to the trapezium and to release any adduction contractures.

2. Metacarpal base resection

A 2-4 mm resection of the metacarpal base is performed using an oscillating saw. The bone cut is performed perpendicular to the metacarpal axis.

The volar lip and the ulnar prominence are then removed. They can act as levers and cause dislocation after the metacarpal has been realigned with the implant.

Metacarpal bone after final resection.
3. Drilling and measuring of the metacarpal

The solid conical drill is inserted down the centre of the medullary canal. Its conical shape will automatically align with the axis of the canal.

Drilling is carried out by hand under image intensification. When resistance from the cortical bone is felt, the proper insertion depth has been reached. If no cortical resistance is felt, a wider XL metacarpal implant should be used. The wider XL metacarpal implants are only available in 32 and 36 mm length.

Be sure not to penetrate the MCP-joint and do not drill further than 36 mm as that is the longest metacarpal implant available. Drill depth is taken directly from the measurements on the drill’s cutting flutes.

The metacarpal bone is prepared and ready for insertion of the metacarpal implant.

4. Insertion of the metacarpal implant

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

The metacarpal implant is flush with the cut surface of the metacarpal bone.

The metacarpal implant should always be implanted at this stage, this will minimise any possible damage to the bone during the preparation of the trapezium.
5. Preparation of the trapezium

A small Hohman retractor is used to pull the metacarpal volarly and ulnarly allowing access to the trapezium. To evaluate the true trapezial joint surface, all osteophytes must be removed.

Place the centering guide on the trapezium to define the radial, ulnar and palmar limits to properly align the guide wire down the centre axis.

6. Orientation of the guide wire in the trapezium

The positioning of the guide wire in the trapezium is the most critical step in the whole procedure. To ensure proper orientation of the guide wire, it is important to have a true A/P and lateral view. Using the second metacarpal as a reference, the guide wire is inserted in approximately 25-35° of palmar abduction and 15-20° of radial abduction.
7. Insertion of the guide wire

Laser lines indicate drilling depth.

The guide wire is advanced under power up to the first laser mark, at this point check the insertion angle, if incorrect remove the wire and re-introduce at the correct angle. Using image intensification the guide wire is now driven to within 1.5 mm of the subchondral bone. If the wire depth corresponds exactly to one of the 3 laser marks – 7 mm, 8.5 mm or 10 mm – then that is the size of stop drill selected (depth can be double-checked by using the measuring sleeve as described in the following section).

Once the depth is determined advance the guide wire into subchondral bone, this will help prevent the wire from spinning during drilling.

8. Measuring with the measuring sleeve

If the depth cannot be determined exactly from the guide wire then the measuring sleeve is used. Slide the sleeve over the wire until it rests against the trapezium. The depth is read off the scale at the end of the wire.

The trapezium implant is available in 3 sizes: 7 mm, 8.5 mm and 10 mm. If the wire has been advanced all the way into subchondral bone then downsize by 1.5 mm. If between sizes chose the shorter size.
9. Drilling the trapezium

Introduce the appropriate cannulated stop drill over the guide wire and drill under power **in one single motion** until the stop drill is seated flush to the trapezium.

Remove both the guide wire and stop drill. Because of the shape of the trapezium the implant collar will not be in full contact with bone - this is normal.

Do not attempt to re-drill with a longer stop drill as this might destroy too much of the bone trabeculae and jeopardize the fixation of the trapezium implant.

10. Insertion of the trapezium implant

Irrigate the joint prior to the insertion of the trapezium implant. The appropriate implant is inserted with the screw driver until resistance is met. Check the position of the collar.

The trapezium implant is fully seated when the collar contacts the prepared trapezial bone. Forcing the trapezium implant further into the bone may compromise fixation and strip the bone. Should the bone strip a wider XL trapezium implant can be used to regain fixation. The wider trapezium implants with deeper threads can also be used in patients with severely osteoporotic bone.
11. Insertion of the trapezial cup

Ensure the internal Morse cone of the trapezium implant is washed out before inserting the cup. Use the cup introducer to insert the cup into the trapezium implant.

12. Trial of the metacarpal head neck length

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

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

When the correct neck length is determined the trial head is removed.

When the cup is in position, tap the impactor gently.
13. Insertion of the metacarpal head

Before introducing the chosen head, make sure that the internal Morse cone of the metacarpal implant is clean. Use the head introducer to introduce the metacarpal head into the metacarpal implant.

When the head is in position, tap the impacter gently.

14. Final reduction

The joint is reduced and stability and range of motion are evaluated under image intensification. Haemostasis is obtained after releasing the tourniquet.
15. Closure

The APL is reattached to the metacarpal with a transosseous suture.

Carefully close the capsule with absorbable sutures.

Close the skin in the normal fashion.

Postoperative care

A postoperative plaster is applied to immobilize 1st CMC, 1st MCP and STT.
It is important that the plaster is applied with the 1st metacarpal in palmar and radial abduction and the MCP joint in slight flexion. Motion is allowed in the radiocarpal joint, the finger joints and the thumb IP-joints.

The basal thumb joint should be splinted in this fashion for ten days. Active motion without load is started at 14-30 days with a removable protective resting splint used for 6 weeks. No load is recommended during a period of 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**
--- | --- | --- | ---
45-2000S | Trapezium Cup | CoCrMo | Ø 6 mm
45-2240S | Trapezium Threaded Implant | Ti6Al4V | Length 7 mm
45-2250S | Trapezium Threaded Implant | Ti6Al4V | Length 8.5 mm
45-2260S | Trapezium Threaded Implant | Ti6Al4V | Length 10 mm
45-2241S | Trapezium Threaded Implant XL | Ti6Al4V | Length 7 mm, XL
45-2251S | Trapezium Threaded Implant XL | Ti6Al4V | Length 8.5 mm, XL
45-2261S | Trapezium Threaded Implant XL | Ti6Al4V | Length 10 mm, XL
45-2240S | Metacarpal Head - Extra Short | CoCrMo | Ø 6 mm extra short neck
45-2210S | Metacarpal Head - Short | CoCrMo | Ø 6 mm short neck
45-2210S | Metacarpal Head - Medium | CoCrMo | Ø 6 mm medium neck
45-2220S | Metacarpal Head - Long | CoCrMo | Ø 6 mm long neck
45-2420S | Metacarpal I Threaded Implant | Ti6Al4V | Length 20 mm
45-2424S | Metacarpal I Threaded Implant | Ti6Al4V | Length 24 mm
45-2428S | Metacarpal I Threaded Implant | Ti6Al4V | Length 28 mm
45-2432S | Metacarpal I Threaded Implant | Ti6Al4V | Length 32 mm
45-2436S | Metacarpal I Threaded Implant | Ti6Al4V | Length 36 mm
45-2332S | Metacarpal I Threaded Implant XL | Ti6Al4V | Length 36 mm XL
45-2242S | Trapezium Salvage Cup | UHMWPE | Length 7 mm
45-2252S | Trapezium Salvage Cup | UHMWPE | Length 8.5 mm
45-2262S | Trapezium Salvage Cup | UHMWPE | Length 10 mm

**CAT. NR.** | **INSTRUMENTS** | **MATERIAL** | **DIMENSION**
--- | --- | --- | ---
45-2510 | Guide Wire | Stainless Steel | Ø2 mm
45-2515 | Impactor | Radel | Ø6 mm
45-2518 | Head & Cup Introducer | Radel | Ø6 mm
45-2520 | Measuring Sleeve | Stainless Steel | Ø2 mm
45-2530 | Metacarpal Head Trial | Ti6Al4V | Ø6 mm extra short neck
45-2531 | Metacarpal Head Trial | Ti6Al4V | Ø6 mm short neck
45-2532 | Metacarpal Head Trial | Ti6Al4V | Ø6 mm medium neck
45-2533 | Metacarpal Head Trial | Ti6Al4V | Ø6 mm long neck
45-2525 | Centering Guide | Stainless Steel | Ø2 mm
45-2582 | Hex Driver Tip (Quick-Lock) | Stainless Steel | 3 mm
45-2560 | Metacarpal Drill | Stainless Steel | Length 20-36 mm
45-2570 | Cannulated Trapezium Stop Drill | Stainless Steel | Length 7 mm
45-2571 | Cannulated Trapezium Stop Drill | Stainless Steel | Length 8.5 mm
45-2572 | Cannulated Trapezium Stop Drill | Stainless Steel | Length 10 mm
45-2585 | Driver Handle (Quick-Lock) | Elastosil | n/a
45-2500 | Tray & Lid | Stainless Steel | 236 mm x 236mm x 47 mm

All implants are delivered sterile for immediate use and better inventory control.
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.