Motec Wrist Joint Prosthesis

The Motec® Wrist Joint Prosthesis has been designed with the objective to provide a strong, stable, mobile and pain free wrist while minimizing the risk of luxation, loosening and osteolysis.

The overall clinical results achieved with the Motec Wrist Joint Prosthesis are very promising. In the end of 2016, more than 1,000 surgeries have been performed. The longest follow-up time is +15 years.

Fixation is achieved by threaded implants made of titanium alloy, blasted and coated with Bonit®, which promotes osseointegration between the titanium oxide and the bone.

The articulation is modular and can be configured depending on surgeon and patient preference, either with CoCrMo articulation on CoCrMo or CoCrMo articulation on carbon fiber reinforced PEEK Motis™.

Each component is available in different sizes, to allow firm seating and close replication of the patient’s normal range of motion.

Features and benefits

The Motec Wrist Joint Prosthesis has the following features and benefits:

- Modular design
- State-of-the-art articulation
- Preserves soft tissue and ligament structures
- Improved short term fixation
- Optimized long term fixation through osseointegration
- Compatible wrist arthrodesis solution
- Fast and straightforward operative procedure
- Preserves the DRU joint
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.

Indications

The Motec Wrist Joint Prosthesis is indicated as replacement of the wrist joint in cases with pain, malalignment or instability due to rheumatoid arthritis, traumatic arthritis, osteoarthritis, Kienböck's disease or carpal collapse. The system may also be indicated after failed wrist surgery like four corner fusion, proximal row carpectomy, or arthrodesis. The patient must be at least 15 years of age.

Contraindications

Patients who are unwilling or incapable of following postoperative care instructions.

Preoperative antibiotic prophylaxis is recommended.

The following images are from a cadaver specimen.

Surgical technique

1. Position the patient

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, either axillary block or general anaesthesia is recommended. Preoperative antibiotics are recommended.

Note: The following images are from a cadaver specimen.

A tourniquet is applied and inflated. The patient's arm is prepared and draped according to common practice.
2. Make incision

A 60 mm dorsal incision is made and the extensor retinaculum is exposed.

The extensor retinaculum is split at the Lister’s tubercle.

The two radial wrist extensors and the long thumb extensor are held radially and the finger extensors ulnarly. The capsule is fully exposed.

The extensor retinaculum is split at the Lister’s tubercle.

The capsule is opened.

There is an alternative surgical approach, called the “Proximal Flap Procedure”, described by M.D. Greg Packer. A step-by-step description of this approach can be obtained from Swemac separately (P125-28-2-20130118).
3. Bone resection

A Proximal Row Carpectomy (PRC) is performed by removing the triquetrum, the lunate and the scaphoid. Preserve the resected bones on a sterile tissue to allow collection of bone chips if needed.

Note: When using the oscillating saw, it is important to keep the saw blade cold by spraying sterile water on it.

4. Preparation of the capitate and the third metacarpal

To facilitate fusion of the two bones, all subchondral sclerosis and cartilage must be removed, using either an oscillating saw or a Gouge forceps. The normal CMC3 joint has a volar angle of approximately 10 degrees. To allow the capitate to be aligned with the third metacarpal, a 10 degree wedge of bone should be resected. Make sure to avoid damaging the volar ligaments.

Use an oscillating saw to make a vertical cut and remove 1-2 mm of the Capitate pole. This will increase the space in the joint and make it easier to place the Guide Wire correctly (see surgical step 5).

The wrist is angled volarly and the Hohmann Retractor is placed beneath the capitate to lift it up. This will close the gap between the capitate and the third metacarpal. The capitate should be fully aligned with the third metacarpal when the above procedure is completed.
5. Guide Wire insertion

A sharp tip Guide Wire is used to create a central canal through the capitate and about 10-20 mm into the intramedullary canal of the third metacarpal bone. When inserting the Guide Wire, or the Awl, make sure to penetrate the capitate pole in the center or even better; slightly volar. If going too dorsal, there is a risk that the capitate will crack during drilling. If the canal through the capitate needs to be adjusted, this is best achieved using an Awl.

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

**Note:** The surgeon can use his thumb to put pressure on the CMC-3 joint. This will align the capitate and the third metacarpal.

The sharp tip Guide Wire is then removed and a blunt tip Guide Wire is mounted in the Guide Wire T-handle or inserted by power. It is introduced through the capitate and into the intramedullary canal of the third metacarpal. The Guide Wire should be advanced all the way to the distal subchondral bone. The advantage of using a blunt tip Guide Wire is that it will not penetrate the cortical wall of the third metacarpal.

The guide wire is introduced until the end of the intramedullary canal.
6. Drilling of the capitate and the third metacarpal

Start by drilling with the small diameter Cannulated Metacarpal Drill. The drill is introduced over the Guide Wire and advanced at reamer speed. Keep the drill cold by spraying sterile water on it. It is easy to drill through the capitate 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.

7. Measuring the drill depth

Drill depth can be taken directly from the cutting flutes of the Cannulated Metacarpal Drill. Make sure that the slot that indicates which length of the Metacarpal Threaded Implant to choose, is flush to the bone or inside the capitate bone. If no cortical resistance is felt during drilling of the third metacarpal, the drill should be exchanged to the large diameter drill. Push forward to eliminate any gap between the capitate and the third metacarpal when measuring.

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

It is important that the threads of the implant engage into the cancellous and cortical bone of the third metacarpal, ensuring stable fixation. Always try to pass the isthmus. The Cannulated Metacarpal Drill and the Guide Wire are then removed.
8. Introducing the Metacarpal Threaded Implant

The Metacarpal Threaded Implant should always be implanted at this stage. This will minimize any possible damage to the bone during preparation of the radius.

**Note:** Make sure all subchondral sclerosis and cartilage between the capitate and the third metacarpal is removed before introducing the Metacarpal Threaded Implant.

When introducing the Metacarpal Threaded Implant, it is important to push the implant forward, closing the gap between the capitate and the third metacarpal. Avoid touching the implant surface. Use a sterile cloth to avoid contact with the patient’s skin and avoid touching the implant with surgical gloves. Use the screwdriver to pick up the implant from the sterile packaging.

**Note:** Countersink the Metacarpal Threaded Implant to accomplish more joint space in order to insert a longer neck. The Implant shall be flush to the bone or inside the Capitate bone.

9. Preparation of the radius

The 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.

**Note:** If the radius is deformed or the bone channel is too narrow, it is possible to use the metacarpal drill with the corresponding Metacarpal Threaded Implant.
10. Guide Wire insertion

The Hohmann Retractor is placed beneath the edge of the volar ridge to lift the radius. This will facilitate the insertion of the Guide Wire and protect the capitate from the power drill. The Guide Wire is introduced through the hole made by the Awl 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.

11. Drilling of the radius

The Cannulated Radius Drill is introduced over the Guide Wire and drilling is carried out at reamer speed. Gather the bone chips that are collected in the cutting flutes of the drill on a sterile cloth.

If the radius is deformed or the intramedullary canal is very narrow, it is possible to use the Metacarpal Threaded Implant in the radius. In such a case, use one of the Cannulated Metacarpal Drills.

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.
12. Reaming of the radius

It is necessary to ream a cavity for the Radius Cup in the radius bone. Always start with the Radius Spherical Drill Ø15 mm.

The appropriate Radius Cup size (15 mm or 18 mm) is selected based on the height of the distal radius. The edge of the cup (15 mm or 18 mm) should not rise above the dorsal radius. The Driver Handle and the appropriate Radius Spherical Drill (15 or 18 mm) are used to ream a cavity for the cup. The Reamer has a mechanical stop that prevents over-reaming.

**Note!** The Radius CFR-PEEK Cup is only available in 15 mm.

13. Determining the correct Radius Threaded Implant size

After using the Spherical Drill, insert the Cannulated Drill for Radius once again. Advance drilling until the next slot is covered by the edge of the reamed spherical surface of the radius bone. The indicated length is the length of the Radius Threaded Implant to choose.

**Note!** A step-by-step description of the surgical technique regarding the optional large Radius Threaded Implants can be obtained from Swemac separately (P125-28-2-optional-20190205).
14. Insertion of the Radius Threaded Implant

The Radius Threaded Implant is introduced as far as it will go. Avoid touching the implant surface. Use a sterile cloth to avoid contact with the patient’s skin and avoid touching the implant with surgical gloves. Use the screwdriver to pick up the implant from the sterile packaging. Clean the joint cavity with saline to remove small bone chips.

15. Insertion of the trials

The Radius Cup Trial is inserted in the Radius Threaded Implant. Do not use the Impactor on the trial.

To determine the correct size of the Metacarpal Head component, start by inserting the Metacarpal Head Trial with long neck. Increase or decrease the Trial size until the right tension has been achieved. When pulling the fingers, the Metacarpal Head Trial should only 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 slightly adjust the Metacarpal Threaded Implant further into the bone. Keep in mind that tension will increase when closing the capsule.

Note! The Metacarpal Head with short neck should be reserved for previously failed PRC:s or other similar conditions, where the presented space in the wrist is tight and there is no other realistic alternative. The best tips to increase the space in the joint is, as mentioned above, to adjust the Metacarpal Threaded Implant further into the bone.
16. Warning!

If the choice of Metacarpal Head Ø15 mm stands between Short neck and Medium neck, choose Medium neck. If size Short neck is implanted, an impingement between the Radius Cup component (PEEK or CoCrMo) and the Metacarpal Threaded Implant might occur. This might result in excessive wear, which shall be avoided.

The Metacarpal Head with short neck is especially recommended for previously failed PRC:s or other similar conditions, where the presented space in the wrist is tight and there is no other realistic alternative. If the Short Neck is still the chosen size it is very important that the tension of the patient’s soft tissue is sufficient, to ensure that the patient does not have excessive ROM and therefore an increased risk of impingement.

Note! The best tips to increase the space in the joint is to adjust the Metacarpal Threaded Implant further into the bone.

17. Insertion of the Radius Cup

Before introducing the Radius Cup, make sure that the internal taper of the Radius Threaded Implant is clean. The Radius Cup is then inserted into the Radius Threaded Implant.

Tap the Impactor to ensure firm seating of the Radius Cup. Tap the Impactor once for the best attachment between the rough surfaces of the Radius Cup and the Radius Threaded Implant.

Note! Make sure that the taper of the Radius Cup is firmly seated in the Radius Threaded Implant. There should be a 1-2 mm gap between the cup and the bone.
18. Insertion of the Metacarpal Head

Before introducing the chosen Metacarpal Head, make sure that the internal Morse taper of the Metacarpal Threaded Implant is clean. The Metacarpal Head is then inserted into the Metacarpal Threaded Implant. Tap the Impactor once to ensure firm seating. **Note:** Do not use excessive force when impacting the Metacarpal Head, that might strip the threads of the Metacarpal Threaded Implant.

Reduce the joint and evaluate stability and range of motion under image intensification.

**Note!** It is mechanically possible to reverse the prosthesis, placing the Metacarpal Head in the Radius Implant. This has however not been investigated and can not be recommended.

19. Packing the gap between capitate and third metacarpal

Successful fusion of the capitate and the third metacarpal is absolutely crucial for the long term fixation of the Metacarpal Threaded Implant. To ensure successful fusion, pack the gap using the bone chips that were gathered during drilling of the radius. If necessary, collect additional bone chips from the resected bones from the PRC.

**If the capitate cracked**

If a crack occurred in the capitate during the procedure, pack the crack with bone chips and increase the cast period with about two weeks.
20. Final reduction

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

In this case there were no signs of impingement during final reduction.

21. In case of impingement

If needed to avoid impingement, the tip of the radial styloid is also removed.

When resecting the radial styloid, use a periost elevator to gently loosen the soft tissue. This will help preserve the stability of the wrist.

In this case there were no signs of impingement during final reduction.
Postoperative care

0-6 weeks: Casting for 6 weeks is recommended (first 2 weeks a plaster slab is used) with the wrist in slight extension excluding the elbow, and allowing free forearm rotation, thumb and finger motion. Start early hand therapy during the hospital stay, with finger, forearm, elbow and shoulder motion. At approximately 2 weeks the slab and sutures are removed and a circular cast applied for additional 4 weeks. If there is any problem with upper extremity motion the patient receive hand therapy.

6 weeks: The cast is removed (and radiographs taken), and active and passive wrist motion in all directions is instructed and encouraged. Free weight-bearing is allowed if possible.

6 months: Radiographs are taken and ROM/grip strength/VAS pain is recorded. If the patient have a slow progression, the hand therapist is involved. The patient is further followed at 1 year and yearly thereafter with radiographs and recording of ROM/grip strength/VAS pain. The improvement halts between the 2 and 3 year. Further follow up according to the doctors preference, but should include a 5 and 10 year appointment.

Note: The postoperative regime has been recommended by Dr. O. Reigstad, Rikshospitalet, Hand and Microsurgery Section, Orthopaedic Department N-0027 Oslo, Norway.
## Implants

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Code</th>
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<tbody>
<tr>
<td>Radius Cup</td>
<td>CoCrMo</td>
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<tr>
<td>Radius Cup</td>
<td>CoCrMo</td>
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<td>Radius Cup</td>
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<td>Metacarpal Head</td>
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<td>Long Neck</td>
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<td>Ø18 mm</td>
<td>Long Neck (optional)</td>
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<td>Metacarpal Head</td>
<td>Ø15 mm</td>
<td>Extra Long Neck</td>
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<td>Radius Threaded Implant</td>
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<td>Metacarpal Threaded Implant</td>
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<td>Metacarpal Threaded Implant</td>
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</table>
Metacarpal Threaded Implant | length 65 mm | Large (optional) 40-1465S

Metacarpal Threaded Implant | length 70 mm | Large (optional) 40-1470S

Metacarpal Threaded Implant | length 45 mm | Small 40-1475S

Metacarpal Threaded Implant | length 50 mm | Small 40-1480S

Metacarpal Threaded Implant | length 55 mm | Small 40-1485S

Metacarpal Threaded Implant | length 60 mm | Small 40-1490S

Metacarpal Threaded Implant | length 65 mm | Small (optional) 40-1495S

Metacarpal Threaded Implant | length 70 mm | Small (optional) 40-1400S

Trials

Trial – Radius Cup | Ø15 mm 40-1522

Trial – Radius Cup | Ø18 mm (optional) 40-1521

Trial – Radius Cup | Ø15 mm | For CFR-PEEK Cup 40-1541

Trial – Metacarpal Head | Ø15 mm | Short Neck (optional) 40-1529

Trial – Metacarpal Head | Ø18 mm | Short Neck (optional) 40-1527

Trial – Metacarpal Head | Ø15 mm | Medium Neck 40-1524

Trial – Metacarpal Head | Ø18 mm | Medium Neck (optional) 40-1523

Trial – Metacarpal Head | Ø15 mm | Long Neck 40-1528

Trial – Metacarpal Head | Ø18 mm | Long Neck (optional) 40-1526

Trial – Metacarpal Head | Ø15 mm | Extra Long Neck 40-1602
<table>
<thead>
<tr>
<th>Instruments</th>
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</tr>
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<tbody>
<tr>
<td>Hohmann Retractor</td>
<td>40-1503</td>
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<tr>
<td>Bits 3,5 mm HEX with Quick-Lock</td>
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<td>Impactor</td>
<td>40-1516</td>
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<td>Guide Wire T-handle</td>
<td>40-1518</td>
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<tr>
<td>Cup Remover</td>
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<tr>
<td>Cannulated Drill for Radius</td>
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<td>Cannulated Drill for Metacarpal III</td>
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<td>Awl</td>
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<td>Tray and lid</td>
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IFU

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