MRP - TITAN
THE MODULAR REVISION PROSTHESIS FOR ALL SITUATIONS IN EVERYDAY CLINICAL PRACTICE
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Preface

Proven effective in clinical practice since 1993, the original modular revision prosthesis MRP-TITAN was developed according to the rules of the “Circle of Competence”. The range of indications has been expanded to reflect enhanced design capabilities and now includes:

- MRP-TITAN pFE (proximal femur replacement)
- MRP-TITAN 80
- KAM-TITAN (knee arthrodesis module)

This proven instrumentation has been expanded to include:

- IGS (impaction grafting system)
- MRP-TITAN mdV (aiming device for curved and distally interlocked femoral anchoring stem)

System Concept at a Glance

The goal of MRP-TITAN Development

- Optimal intraoperative adaptability to the specific situation

Characteristics

- Anchoring stems measuring 80 Ø 13-25 mm in 1 mm increments, 140, and 200 mm, Ø 13-30 mm in 1 mm increments
- Distal interlocking anchoring stems measuring 260 and 320 mm, Ø 11-29 mm in 1 mm increments
- Total prosthesis lengths from 130 to 420 mm in 10 mm increments
- Anchoring stems with an anterior bow are available starting at 250 mm overall length, with a bow in the right place
  - no more hairline fractures
- Four neck versions, neck stem angle of 130°, 12/14 taper
- Lateralized neck segment with offset 10 mm larger
- Design allows intraoperative and postoperative correction of implant position and angle of anteversion in situ
  - Angle of anteversion is continuously adjustable over 360°
- All-titanium components: no cobalt-chrome taper  ➔ no galvanic element  ➔ no osteolysis
- Implant components pretensioned to a defined torque

Surgical Procedure

Select anchoring stem diameter

Impact until correctly seated

Assemble to precise length with modular neck segment and extension sleeve where indicated

Set angle of anteversion (continuously adjustable)

Reduce the hip and evaluate function

Surgeon is free to change implant length and anteversion intraoperatively as necessary
Design Characteristics: Implant Anchoring Stem

With 8 longitudinal ribs arranged in a stellate cross section, an integral gradient angle, and anchoring stem thicknesses available in 1 mm increments, the MRP-TITAN anchoring stem design ensures immediate stable cementless fixation.

The parabolic longitudinal ribs give the implant excellent initial stability and high fracture strength. The design also spares cancellous bone and thus preserves the arterial supply within the femur. This promotes solid bony ingrowth over a broad area for biologic fixation of the implant.

The titanium alloys TiAl6Nb7 and TiAl6V4 were selected as the material for the implant. Both exhibit high strength and excellent biocompatibility. The surfaces in contact with bone have also been shot peened with corundum (40-60 μm).

A uniform taper on the end of the anchoring stem makes it possible to use the anchoring stem in combination with neck segments of different lengths and designs. Anteversion is continuously adjustable through 360°, enabling the surgeon to achieve optimal stem placement. Anteversion can be adjusted as required without any limitation.

The TRIAL Anchoring Stems are distinguished from the definitive anchoring stems by their smooth surface and by a radiographically visible notch on the proximal end of the anchoring stem.
Design Characteristics: Implant Neck Segment

Different versions of neck segments are available for the modular MRP-TITAN anchoring stems.

The standardized inner and outer tapers of the neck segments allow them to be used in any combination. The precision fit of the taper connection is ensured by a special inspection and testing process.

- **With fin**
  - Standard, neck segment angle of 130°
  - Thick, neck segment angle of 130°

  The difference between these two versions of the neck segment is their volume. The larger volume of the thick neck segment makes it suitable for filling larger proximal femoral defects.

- **Without fin**
  - Standard, neck segment angle of 130°

- **Without fin**
  - Lateralized, neck segment angle of 123.5°

  The lateralized neck segment allows 10 mm more lateralization of the leg than the standard neck segment.

- **For trochanter segment**
  - Large, neck segment angle of 130°
  - Small, neck segment angle of 130°

  This version can completely reconstruct the proximal femur where extreme defects are present or following tumor surgery.
Design Characteristics: Implant System

A major goal of surgery is to precisely obtain the desired leg length. Therefore, different versions of neck segments (S = 50 mm, M = 60 mm, L = 70 mm) are available for the modular MRP-TITAN system. An extension sleeve (30 mm) available in various diameters can also be used.

The various different components (anchoring stem, neck segment, extension sleeve) can be combined intraoperatively. This makes it possible to determine the exact length required and then test and place the implant. The implant can be assembled in lengths from 130 to 420 mm in 10 mm increments.

**NOTE**

Always use only one extension sleeve. Every diameter of extension sleeve can be used with every diameter of anchoring stem.

The systems patented taper connection is also continuously adjustable through 360°, allowing the surgeon to select any desired angle of anteversion.

This minimizes the risk of dislocation and guarantees a total arthroplasty solution with long-term mechanical stability.
Pretensioning the Taper Connection to a Defined Torque

Because a prosthesis is subjected to dynamic loads as well as static loads it is not enough to simply place the components in apposition or insert them into each other.

In order to achieve a permanent taper connection that resists torsional stresses, the MRP-TITAN system is first pretensioned to a defined torque with the Torsionfree Preloading Instrument (TOV). Then the prosthesis is secured by screwing it together with a torque of 25 Nm.

Several requirements have driven the development of the Torsionfree Preloading Instrument (TOV):

- Minimizing transverse forces and their influence on the Guide Rod and pretensioning procedure
- Optimizing the connection strength and seating of the taper connection
- Simplifying intraoperative assembly of the taper connection
- Reproducible pretensioning
- Sturdy design to facilitate processing

The innovative Torsionfree Preloading Instrument (TOV) has several advantages over all other common pretensioning techniques:

- Connection strength is increased by about 30%
- The design ensures identical force application in every case to guarantee the desired prestress
- The required pretensioning of the taper connection is achieved with purely axial loading
- The taper components are optimally guided while making the connection

For the surgeon this means:

- About 40% less manual force is required to pretension the construct, thus simplifying the surgical technique
- No great effort is required to release the instruments after the pretensioning procedure
- The pretensioned taper components are easily released during the consolidation phase
- Components are easily retightened

"This rigorous further development is our contribution to your patients' safety."

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<th>NOTE</th>
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Reliable, permanent stability of the assembly is ensured only when the screw M6 is used.
Controlled Release of the Taper Connection

The MRP-TITAN system is designed to allow subsequent corrections to the implanted prosthesis should subsidence or a tendency to dislocate be detected intraoperatively or immediately postoperatively.

A separating instrument facilitates controlled release of the connections between the anchoring stem, extension sleeve, and neck segment. This gives the surgeon the option of placing a longer neck segment or readjusting the anteversion. The great advantage of this is that the implant stem can be left in situ. This avoids the risk of additional injuries to the femur from extracting the anchoring stem and impacting a new stem.

! NOTE

PETER BREHM can provide an additionally reinforced molding instrument for subsequent revision of the endoprosthesis.

The degree of activity or body weight of the patient may cause additional settling of the components, which makes the separation of the implant impossible.

INDICATIONS

- Congenital or acquired hip joint defects
- Degenerative, post-traumatic, rheumatic arthritis/arthrosis
- Joint replacement (revision) already carried out and worn or in case of failed surgery
- Defects or malfunctions of the hip joint
- Revisions with extensive bone resection
- Bone loss due to trauma
- Extensive loss of bone material
- Severe deformities (e.g. osteomyelitis)
- Coxa vara and Coxa valga
- Osteosarcoma and metastases

The additional module MRP-TITAN pFE is used for bone resection/bone loss.
MRP - TITAN
INSTRUMENTATION TECHNIQUE
Preoperative Planning

The goal of total arthroplasty is the optimum anatomic reconstruction of the affected joint.

The first step is to determine the center of rotation of the affected joint. Preoperative planning begins with the evaluation of the size and placement of the acetabular component based on the radiograph. The next step is to determine the stem size and position required to achieve identical leg length with optimum initial stability. The size should be selected to ensure that at least one-third of the ribbed structure is firmly seated in the bone. The center of the femoral ball lies about level with the apex of the greater trochanter. Ideally, the center of the femoral ball will correspond to the center of rotation of the acetabular component and leg length will be equal.

It is advisable to obtain radiographs of the hip in two planes (using a long imaging plate).

Radiographic magnification, scale 1.16:1

Patient Positioning and Approaches

This manual of surgical technique does not describe any particular approach for the MRP-TITAN. The surgeon can opt for any preferred approach with the patient in a lateral or supine position. If the patient is positioned supine, the hip must be able to move freely.
Preparing the Bone-Implant Interface (Primary Arthroplasty)

Initial stability is an essential requirement for the success of total arthroplasty. With cementless implants, this is achieved with press-fit fixation. The implant and the bone should have good contact over a broad area.

03
Femoral Neck Osteotomy
A lateral or posterior approach is used to expose the hip joint. Then the femoral neck is exposed with Hohman retractors with the hip dislocated. The osteotomy of the neck is then performed with an oscillating saw. The resection line on the femoral neck is determined according to preoperative planning.

04
Opening the Femoral Canal
The femoral canal is opened with a sharp rasp. The point of entry of the instrument usually lies in the middle of the cancellous osteotomy surface of the femoral neck. This rasp is then impacted axially, i.e. along the axis of the femoral shaft with a twisting motion. This creates a distal path for the subsequent reamers. In hard cancellous bone, the canal is first opened with a 10-mm box osteotome which is impacted into the central metaphyseal bone.

Where straight anchoring stem implants are used, it will be necessary to resect cortical bone at the apex of the greater trochanter. Otherwise it will not be possible to properly center the straight anchoring stem implant, especially in hard bone. The Rasp MRP-TITAN 80 mm may be used for this purpose.
Preparing the Bone-Implant Interface (Revision Arthroplasty)

1. Preparing the Femur

Implantation in revision cases requires not only removal of the initial implant but also a totally unobstructed femoral canal. Care must be taken to remove any residual bone cement from cemented implants and smooth any step-off from cementless implants. This is done to minimize the risk of deflecting the Rasps with AO Adapter and the TRIAL Ancho-ring Stem toward the opposite cortex, which could result in a perforation of the femur.

2. If it is not possible to remove all impediments within the femoral canal, then one can opt for a transfemoral approach (1) or open a distal cortical window (2).
Preparing the Bone-Implant Interface (Revision Arthroplasty)

Preparation of the implant bed will vary depending on whether a straight or curved MRP-TITAN anchoring stem is used.

**06 Curved anchoring stems**
The curvature of the femur and the anchoring stem requires the use of flexible reamers to prepare the medullary canal when using the 200, 260, and 320 mm curved anchoring stems. These reamers are introduced over an intramedullary guidewire. The femoral canal is machined with Drill Heads of successively larger diameters (in increments of 0,5 - 1 mm). This continues until the flexible reamer is in contact with the bone in a full circle over a distance of 70-100 mm. This will be indicated by the clear high-pitched sound of the cortex. Fluoroscopy must verify that the reamer remains centered in the medullary canal so that it will not perforate the cortex.

**07 Straight anchoring stems**
Where straight anchoring stems are used, it is recommended to prepare the medullary canal with the straight Rasp with AO Adapter. These rasps are suitable for use with the 80 mm, 140 mm, and 200 mm straight anchoring stems. The implant bed is reamed incrementally. The proper implant diameter is achieved when increased force is required to rotate the Rasp with AO Adapter. The implant length can be read from the scale on the instrument. The apex of the greater trochanter is used as the point of reference. It must align with the mark (center of hip rotation).
Trial Assembly

Selecting the Diameter of the TRIAL Anchoring Stem

The diameter of the last Rasp with AO Adapter used is selected as the initial diameter of the straight TRIAL Anchoring Stems. Then the diameters of the TRIAL Anchoring Stems are successively increased in 1 mm increments until the TRIAL Anchoring Stem is well seated at the desired location.

If the femur was prepared with flexible reamers, it is recommended to begin with the same TRIAL Anchoring Stem diameter as the reamer or the next smaller diameter. This is done because a narrower TRIAL Anchoring Stem can be used to palpate the physiologic curvature of the femur. Then the stem diameters are successively increased in 1 mm increments until a good interference fit is achieved.
Trial Assembly

Assembling the Impactor/Extractor
The seating instrument of the modular MRP-TITAN prosthesis consists of the Handle for Prosthesis Inserter / Remover, a Knurled Screw, and the Guide Rod. On the ends of the Guide Rod there are two threaded sections of different lengths. This defines where each threaded section can be used.

Short threading = anchoring stem and TRIAL Anchoring Stem

Long threading = Knurled Screw

! NOTE
Ensure that the Guide Rod is completely screwed into the TRIAL Anchoring Stem either manually or using a Socket Wrench SW 3.5.
Then the Handle for Prosthesis Inserter/Remover is slid over the Guide Rod and secured with the Knurled Screw S.

To secure the connection, proceed as follows: Screw in the Knurled Screw S by hand as far as it will go. Then insert the Socket Wrench SW 3,5 at a right angle and give it an additional half turn clockwise to secure the construct.

The TRIAL Anchoring Stem is then impacted into the prepared femur and securely seated with a hammer.
**Trial Assembly**

The curvature of the TRIAL Anchoring Stem lies in the plane of the handle.

The rotational stability of the positive-locking connection between the Handle for Prosthesis Inserter / Remover and the TRIAL Anchoring Stem allows precise impaction of the TRIAL Anchoring Stem with minimal force. Placing a wire cerclage is recommended in the event of suspected injury to the femur from impaction of the TRIAL Anchoring Stem.

Differences between the TRIAL Anchoring Stem and the definitive anchoring stem:

- A notch in the TRIAL Anchoring Stem identifies it on radiographs.

- In contrast to the definitive anchoring stem the TRIAL Anchoring Stem has a smooth surface.
Determining Implant Length

The required neck segment length is measured on the scale on the Handle for Prosthesis Inserter/Remover in relation to the greater trochanter (S, M, L, SH, MH, LH).

If the greater trochanter lies below the shortest marking or above the longest one, then the diameter of the TRIAL Anchoring Stem must be corrected one millimeter up or down.

A 1-mm change in diameter corresponds to about a 20-mm change in length.

NOTE

The weakest position in the femur must be bridged by min. 50 mm using the TRIAL Anchoring Stem and the original anchoring stem.
Trial Assembly

Placing the neck segment
After the TRIAL Anchoring Stem has been impacted, the Knurled Screw is unscrewed and the Handle for Prosthesis Inserter/Remover is removed.

Using the Cutter for Neck Prosthesis inserted over the Guide Rod which remains in place in the TRIAL Anchoring Stem, the surgeon manually creates space for the TRIAL Prosthesis Neck.
Connecting the TRIAL Prosthesis Neck to the Setting Instrument for the Prosthesis.

After the taper surface on the end of the stem has been cleaned, the Setting Instrument for the Prosthesis for the selected TRIAL Prosthesis Neck is definitively inserted over the Guide Rod. The TRIAL Prosthesis Neck can be fixed in the desired anteversion by tapping it lightly with a hammer. If an extension sleeve is also required, then the TRIAL Prosthesis Neck and the TRIAL Extension Sleeve are first assembled by pressing them tightly together before they are seated.
Trial Assembly

Remove the Setting Instrument for the Prosthesis and the Guide Rod. Then a trial reduction is performed using the TRIAL Ball. Correct leg length, soft-tissue tension, and function are verified.

Disconnecting the Trial Assembly
The impression instrument facilitates controlled release of the individual components TRIAL Anchoring Stem, TRIAL Extension Sleeve, and TRIAL Prosthesis Neck.

Three situations are distinguished:

1. TRIAL Prosthesis Neck and TRIAL Extension Sleeve
2. TRIAL Extension Sleeve and TRIAL Anchoring Stem
3. TRIAL Prosthesis Neck and TRIAL Anchoring Stem
If the TRIAL Prosthesis Neck is to be separated from the TRIAL Extension Sleeve (1), then you must use the Impression Threaded Rod for Impression Instrument (separating rod with threading).

The Impression Rod for Impression Instrument is screwed into the TRIAL Prosthesis Neck with the Socket Wrench SW 3.5. The assembled impression instrument is slid over the rod and screwed into the TRIAL Prosthesis Neck.

Bone fracture due to failure to use the Counter Holder:
- Danger of injury caused by implant loosening!

⚠️ Always use the Counter Holder when removing the screw, working with the impression instrument, the Torque Limiter and the Torsionfree Preloading Instrument (TOV) to prevent rotation forces from being transferred to the bone.

Then the components are separated from each other by turning the Spindle for the impression instrument.
If the TRIAL Extension Sleeve is to be separated from the TRIAL Anchoring Stem (3), then you must use the Impression Threaded Rod for Impression Instrument (separating rod without threading).

The Impression Threaded Rod for Impression Instrument is inserted into the TRIAL Extension Sleeve. The assembled impression instrument is slid over it and screwed into the TRIAL Extension Sleeve.

Then the components are separated from each other by turning the Spindle for the impression instrument.
If the TRIAL Prosthesis Neck is to be separated from the TRIAL Anchoring Stem (1), then you must use the Impression Threaded Rod for Impression Instrument (separating rod without threading).

After the Impression Threaded Rod for Impression Instrument has been inserted into the TRIAL Prosthesis Neck, the assembled impression instrument is inserted over the Impression Threaded Rod for Impression Instrument and screwed into the TRIAL Prosthesis Neck.

Then the components are separated from each other by turning the Spindle for the impression instrument.
Trial Assembly

Removing the TRIAL Anchoring Stem
In order to place the definitive implant, the entire TRIAL Anchoring Stem must be removed. One can either extract the entire system or disassemble the prosthesis and remove each of the components separately.

Different Knurled Screws will be required depending on the specific implant configuration.

Removal of the TRIAL Anchoring Stem

Knurled Screw S

Removal of the TRIAL Anchoring Stem and TRIAL Prosthesis Neck

Or:

TRIAL Anchoring Stem and TRIAL Extension Sleeve

Knurled Screw M and Sliding Disk

Removal of the TRIAL Anchoring Stem and TRIAL Prosthesis Neck and TRIAL Extension Sleeve

Knurled Screw L and Sliding Disk

To secure the connection, proceed as follows: Screw in the Knurled Screw (S, M, L) as far as it will go. Then insert the Socket Wrench SW 3.5 at a right angle and give it an additional half turn clockwise to secure the construct.

If the trial assembly is to be removed from the site in pieces, then the individual components must be separated (see item 12).
Placing the Definitive Implant

Placing the anchoring stem
The definitive anchoring stem is placed in the same manner as the TRIAL Anchoring Stem. The first step is to screw the Guide Rod all the way into the anchoring stem. The Handle for Prosthesis Inserter / Remover is slid over it and the Knurled Screw S is screwed tight. Then insert the Socket Wrench SW 3,5 at a right angle and give the Knurled Screw S an additional half turn clockwise to secure the construct.

Then the anchoring stem is impacted. The goal is to place the anchoring stem in exactly the same position as the TRIAL Anchoring Stem. If this is not the case, you have the option of performing another trial reduction with the TRIAL Prosthesis Neck to determine the optimum neck segment length. If the definitive anchoring stem has been placed deeper, then space must again be created for the new neck segment using the Cutter for Prosthesis Neck inserted over the Guide Rod, which remains in place in the anchoring stem.

Then the Knurled Screw S and the Handle for Prosthesis Inserter / Remover are removed.
Placing the Definitive Implant

After the taper surface has been cleaned, the neck segment can be inserted over the Guide Rod with the aid of the Setting Instrument for the Prosthesis.

The neck segment can be fixed in the desired anteversion by tapping it lightly with a hammer. If required, an extension sleeve can be placed separately or in combination with the implant neck.

Foreign matter (e.g. cement remains, tissue, bone) between the implant components:
- Danger of injury caused by implant failure!
- Clean the implant components thoroughly.

Once the Setting Instrument for the Prosthesis and the Guide Rod have been removed, a trial reduction can again be performed with the TRIAL Balls S, M, or L. Correct leg length, soft-tissue tension, and function of the prosthesis are then verified before the prosthesis is pretensioned to a defined torque.

Damage to the cone connection:
- Risk of implant failure!
- Ensure careful implantation.
- Do not use damaged implants.
Pretensioning the Definitive Implant

The Torsionfree Preloading Instrument (TOV) is used to achieve defined pretensioning of the definitive implants assembled in situ.
Placing the Definitive Implant

The following rule should be observed when using the *Knurled Screw* for pretensioning:

Anchoring stem and neck segment
Or:
Anchoring stem and extension sleeve

![Knurled Screw M]

Anchoring stem, neck segment, and extension sleeve

![Knurled Screw L]

For definitive pretensioning, the *Handle for Prosthesis Inserter/Remover* is slid over the Guide Rod (which is screwed in as far as it will go) and secured with the appropriate *Knurled Screw* for torsion-free preloading.

<table>
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<th>! NOTE</th>
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<tr>
<td>The <em>Knurled Screw</em> is supposed to be only hand-tightened.</td>
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</tbody>
</table>
Once the Handle for Prosthesis Inserter/Remover has been slid over the Guide Rod and the appropriate Knurled Screw has been screwed in as far as it will go, the Stud Bolt is then screwed into the Knurled Screw as far as it will go.

The markings on the Torsionfree Preloading Instrument (TOV) are then aligned. Make sure the bolt receiver is extended.
Placing the Definitive Implant

Place the Torsionfree Preloading Instrument (TOV) on the Handle for Prosthesis Inserter/Remover and push it sideways over the Knurled Screw and Stud Bolt.

**NOTE**

Make sure that the instrument and Stud Bolt engage properly.

Pull the Torsionfree Preloading Instrument (TOV) slightly until it is firmly in place on the Handle for Prosthesis Inserter/Remover.

**WARNING**

Aborted pre-tensioning procedure of the implant components using the TOV:
- Risk of implant failure due to insufficiently tensioned components!
- Always use new Stud Bolt even if it had not been destroyed during the first aborted attempt.
- In case of a prematurely aborted tensioning attempt, dispose of the Stud Bolt.
Although the use of the Torsion-free Preloading Instrument (TOV) minimizes torsion forces, the Counter Holder must always be attached to the Handle for Prosthesis Inserter/Remover or the prosthesis.

The Counter Holder can be used in three different ways depending on how the patient is positioned (see illustrations).
Placing the Definitive Implant

Turn the handle of the Torsionfree Preloading Instrument (TOV) clockwise until the Stud Bolt is cut apart. Then the components are locked together and pretensioned.

**NOTE**

As long as the Stud Bolt has not been divided, the handle of the TOV instrument springs back.
Then the Torsionfree Preloading Instrument (TOV) is removed from the Knurled Screw or the Handle for Prosthesis Inserter/Remover, respectively.

**NOTE**

The rest of the Stud Bolt remains in the instrument until it has been turned counterclockwise to the original position.
After the instruments have been removed, the screw M6 is screwed into the neck segment with the Allen Key SW 5 Ball Head 300 mm to lock it.

<table>
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<tr>
<th>Component Description</th>
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<tr>
<td>Tommy Bar for Socket Head Wrench SW 6</td>
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<tr>
<td>Torque Limiter 25±1 Nm</td>
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<tr>
<td>Allen Key SW 5 Ball Head 300 mm</td>
</tr>
<tr>
<td>Allen Key SW 5</td>
</tr>
<tr>
<td>Screw M6 (short)</td>
</tr>
<tr>
<td>Screw M6 (long)</td>
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</tbody>
</table>

NOTE

In order to set the screw M6 use the Allen Key SW 5 Ball Head 300 mm, since it tolerates slight angle deviations during insertion. The screw M6 centers itself in the thread.

After the instruments have been removed, the screw M6 is screwed into the neck segment with the Allen Key SW 5 Ball Head 300 mm to lock it.

Anchoring stem and neck segment = screw M6 (short)
Anchoring stem, neck segment, and extension sleeve = screw M6 (long)
To tighten the screw M6 to a defined torque, use the Allen Key SW 5 with the Torque Limiter 25±1 Nm and the Tommy Bar for Socket Head Wrench.

The Counter Holder can be used in two different ways depending on how the patient is positioned.

**Insufficiently pre-tensioned and secured components:**
- Risk of implant failure!
- Observe the correct handling of the implant components and instruments.
- Pre-tension the cone connections using the Torsionfree Preloading Instrument (TOV).
- Secure the screw M6 using the torque limiter.
- Ensure that the limit mechanism of the Torque Limiter 25±1 Nm is released.

**WARNING**
Sealing the neck segment
After the screw M6 has been placed, the final step is to insert the sealing screw into the neck segment and hand tighten it. The screw has no mechanical function. It only prevents ingrowth of soft tissue and bone into the neck segment.

Securing the Prosthetic Trochanter
If the neck segment for trochanter has been used, then the last step is to place the prosthetic greater trochanter in the desired position.

To permanently secure the desired alignment, the sealing screw must be placed with the Torque Limiter 25±1 Nm.
Placing the Definitive Femoral Ball

The taper is carefully cleaned and the selected femoral ball is attached and rotated to fix it in place. The connection is then locked by lightly tapping the construct with a plastic mallet.

- Ensure that the inner cone of the ball head corresponds to the outer cone of the anchoring stem.
- Ensure that the outer diameter of the ball head corresponds to the inner diameter of the inlay for acetabular treatment.

Ball neck lengths approved by PETER BREHM GmbH for Steckkugeln manufactured by PETER BREHM GmbH made of the materials BIOLOX forte, BIOLOX delta, BIOLOX Option, Titan and CoCr are: S (-4), M (0), L (+4)

In the case of combination with other components of PETER BREHM GmbH, observe the instructions in the respective instructions for use, instrumentation instructions and, if necessary, the surgery videos. In case of any questions or uncertainties, contact PETER BREHM GmbH.

PETER BREHM GmbH does not guarantee component reliability for the combination of ball head sizes L1-L4 with hip implants because the leverage forces are increased thereby.

**Combination of implant components of differing sizes:**
- Damage to implant components!
- Only use components of the same size.

**Use of damaged or defective implants/instruments:**
- Danger of injury caused by premature implant breakage!
- Do not use instruments/implants with recognizable damage.

**Damage to the cone connection:**
- Risk of implant failure!
- Ensure careful implantation.
- Do not use damaged implants.

**When combining ball heads made of CoCr or TiAl6V4 (TiN coating) with sliding surfaces made of ceramic or metal:**
- Danger of injury caused by implant failure!
- Do not combine implant components with sliding surfaces made of ceramic or metal.
- Combine ball heads made of CoCr and Ti6Al4V only with PE inlays.

**Combination with oversized ball heads:**
- Danger of injury caused by implant breakage!
- Impairment of the component reliability due to increased leverage forces!
Postoperative Disassembly

Releasing the Pretensioned Components and Disassembling the Implant

The sealing screw and the screw M6 are unscrewed and removed with the Allen Key SW 5 and the Tommy Bar for Socket Head Wrench SW 6. Then the implant can be disassembled with the aid of the impression instrument.

! NOTE

First remove the sealing screw M14x1 and the screw M6. To do so, use the Counter Holder and the Allen Key SW 5.
Components of the revision separating instrumentation:

1. Impression Rod
2. Threaded Impression Rod Revision
3. Impression Rod with Nip
4. Spindle
5. Adapter Revision
6. Impression Instrument (Revision)
7. Tommy Bar for Socket Head Wrench SW 6

**NOTE**

PETER BREHM can provide an additionally reinforced molding instrument for subsequent revision of the endoprosthesis.

The degree of activity or body weight of the patient may cause additional settling of the components, which makes the separation of the implant impossible.
Postoperative Disassembly

Three situations are distinguished when disassembling the prosthesis:

1. Separation of neck segment and anchoring stem

Screw in the Impression Rod and insert the assembled impression instrument (Impression Instrument (Revision), Spindle, and Tommy Bar for Socket Head Wrench SW 6) over the rod and screw the separating instrument into the neck segment.

Bone fracture due to failure to use the Counter Holder:

- Danger of injury caused by implant loosening!
- Always use the Counter Holder when removing the screw, working with the impression instrument, the Torque Limiter and the Torsionfree Preloading Instrument (TOV) to prevent rotation forces from being transferred to the bone.

2. Separation of neck segment and extension sleeve

Screw the Threaded Impression Rod Revision into the extension sleeve and insert the assembled impression instrument (Impression Instrument (Revision), Spindle, and Tommy Bar for Socket Head Wrench SW 6) over the rod and screw the separating instrument into the neck segment.
Surgical Technique

Separation of extension sleeve and anchoring stem

Screw the Impression Rod with Nip into the anchoring stem and insert the assembled impression instrument (Impression Instrument (Revision), Spindle, Adapter Revision, Tommy Bar for Socket Head Wrench SW 6) over the rod and screw the impression instrument into the neck segment.

Then the components are separated from each other by turning the Spindle with the Tommy Bar for Socket Head Wrench SW 6.

**NOTE**

First remove the sealing screw M14x1 and the screw M6. To do so, use the Counter Holder and the Allen Key SW 5 (see p. 40).

If the cone connections are extremely fixed, using a metal hammer to impact the Spindle repeatedly is advisable. These impulses cause loosening.
Removing the Definitive Implant

Removal
Three situations are distinguished when removing the prosthesis: For all three situations you will need the Guide Rod, the Handle for Prosthesis Inserter / Remover and a Knurled Screw to secure the construct. Note that the Guide Rod must be screwed all the way into the prosthesis. Then the Handle for Prosthesis Inserter / Remover is slid over the Guide Rod and secured with a Knurled Screw. To secure the connection, proceed as follows: Screw in the Knurled Screw as far as it will go. Then insert the Socket Wrench SW 3.5 at a right angle and give it an additional half turn clockwise to secure the construct.

The length of the Knurled Screw depends on the number of components to be removed.

Components for removing the definitive implant:

1. Handle for Prosthesis Inserter / Remover
2. Guide Rod
3. Knurled Screw S
4. Knurled Screw M and Sliding Disk
5. Knurled Screw L and Sliding Disk
The length of the Knurled Screw depends on the number of components to be removed.

Anchoring stem

Knurled Screw S

Anchoring stem and neck segment
Or:
Anchoring stem and extension sleeve

Knurled Screw M and Sliding Disk

Anchoring stem, extension sleeve, and neck segment

Knurled Screw L and Sliding Disk
Removing the Definitive Implant

Then the components can be extracted by tapping them with a hammer.

Removing the Entire System with the Slap Hammer

Alternatively, the implant can be removed with the Slap Hammer. One can either extract the entire implant system or remove each of the components separately.

The Slap Hammer must be ordered separately as it is not included in the standard instrumentation set.

Components for removing the definitive implant with the Slap Hammer:

1. Slap Hammer
2. Adapter M14x1
3. Bolts
4. Threaded Rod (M6)

! NOTE

First remove the sealing screw M14x1 and the screw M6. To do so, use the Counter Holder and the Allen Key SW 5 (see p. 40).
Before the Slap Hammer can be connected, the Adapter M14x1 must be screwed into the neck segment.

Then the Adapter M14x1 and Slap Hammer are connected with the Bolt.
Removing the Definitive Implant

The implant is extracted by sliding the head of the *Slap Hammer*.

**NOTE**

Always hold the *Slap Hammer* in the direction of force.

Removing the anchoring stem with the *Slap Hammer*

To remove the anchoring stem, the *Threaded Rod (M6)* is screwed into the anchoring stem.
The Threaded Rod (M6) is mounted on the Adapter M14x1.

Then the Slap Hammer is connected to the Adapter M14x1 and the anchoring stem is extracted.
MRP - TITAN
SUPPLEMENTARY PRODUCTS
Impaction Grafting System (IGS)

**Indications**
- All proximal femoral defects where the cortex is intact, regardless of the stem diameter

**Objectives and Tasks**
- Biologic reconstruction of bony defects
- Achieving a positive-locking interference fit by filling the entire bone-implant interface
- Creating an initial situation sufficient for sustainable bone remodeling and proximal stress transfer

**Advantages of the System**
- The guided mallet system eliminates the risk of damaging the implant
Supplementary Products

**MRP-TITAN mdV Aiming Device**

**Indications**
- Can be used with all interlocking anchoring stems of the MRP-TITAN system

**Objectives and Tasks**
- Quick interlocking
- Reliable interlocking

**Advantages of the System**
- This instrument can shorten the surgical procedure. It also minimizes the patient’s exposure to ionizing radiation as the locking bolt can be placed without fluoroscopic control.
MRP-TITAN pFE Proximal Femur Replacement

**Indications**
- Osteosarcomas and metastases
- Revision with extensive bone resection
- Bone loss due to trauma
- Extensive loss of bone material
- Severe deformities as in osteomyelitis

**Objectives and Tasks**
- Modular anatomic design for functional reconstruction
- Allows unrestricted resection
- Optimal kinematics
- Precise implantation with MRP-TITAN instrumentation
- Allows fixation of soft tissue

**Advantages of the System**
- Cementless MRP-TITAN anchoring stems available in all lengths and diameters
- All the advantages of the MRP-TITAN system still apply
- Adapters and sleeves are extendable in 10 mm increments
- Completely modular system
- Instrumentation identical to MRP-TITAN
- Optional MRP-TITAN pFE lateral plate for additional stabilization
KAM-TITAN

Indications
- Posttraumatic findings that contraindicate implantation of a total knee
- Findings after removal of infected total knee arthroplasty that are not conducive to revision total arthroplasty
- Degenerative joint disease that requires immediate full weight bearing
- Loss of or damage to the knee extensors
- Neuromuscular indication

Advantages of the System
- Anatomic design with left and right variants (6° valgus, 7° flexion)
- Cementless implantation (optional: cemented anchoring stems)
- Freely selectable leg length and continuously adjustable external rotation in situ
- Intraoperative flexibility in any situation
- Assembly with trial implants in situ
- Modules coupled in flexion (from 35°)
- Escape route at every step of the procedure
- Best results in long-term studies with a high degree of patient satisfaction
- Can be used without restriction where bony ingrowth is absent or unlikely
MRS-TITAN and MRS-TITAN Comfort

Indications
- Congenital or acquired hip joint defects
- Arthrosis (degenerative, rheumatic)
- Joint replacement (revision) already carried out and worn or in case of failed surgery
- Defect of the geometric rotation center
- Defects or malfunctions of the hip joint
- Post-traumatic arthritis
- Severe deformities (e.g. osteomyelitis)

Advantages of the System
- Immediate stable fixation in healthy bone
- The mechanical stability of the implant minimizes motion, ensuring a situation conducive to remodeling of the bone graft
- Restoration of the physiologic geometric center of rotation improves the biomechanics of the hip
- The reduction in inventory and the elimination of costly preoperative imaging studies reduce costs
- Maximum flexibility for adjusting inclination and anteversion
This brochure is intended for physicians only and is not suitable as a source of information for lay persons. The information about the products and/or procedures described in this brochure is of a general nature and does not represent the advice or recommendation of a physician. The information provided here does not in any way represent an opinion on the diagnosis or treatment of any specific medical case. The respective patient must be examined individually and advised accordingly. This brochure can neither completely nor partially substitute these measures.

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