MRP-TITAN

THE MODULAR REVISION PROSTHESIS FOR ALL SITUATIONS IN EVERYDAY CLINICAL PRACTICE

SURGICAL TECHNIQUE

PETER BREHM
Die Präzision in Titan
für den Menschen

Table of contents

MRP-TITAN

PRODUCT DESCRIPTION

Preface

Successfully in clinical use since 1993, the original modular revision prosthesis MRP-TITAN was developed according to the rules of the "Circle of Competence".
Within this process, the range of indications has been developed consistently and include by now:

- MRP-TITAN 80
- KAM-TITAN (knee arthrodesis module)

This proven instrumentation has been improved by including:

- IGS (impaction grafting system)
- MRP-TITAN Aiming device (aiming device for curved anchoring stems with distal interlocks)
- Torsionfree Preloading Instrument (TOV)
- Taper Wiper
- Ex situ pretensioning block
- Cardan Screw Driver

System concept at a glance

The goal of MRP-TITAN development

- Optimal intraoperative adaptability to the specific situation

Characteristics

- Anchoring stems 80 mm, **Ø 13 - 25 mm in 1 mm increments**, 140 and 200 mm, **Ø 13-30 mm in 1 mm increments**
- Anchoring stems (with distal interlocking) 260 and 320 mm, **Ø 11-29 mm in 1 mm increments**
- Total prosthesis lengths from 130 to 420 mm **in 10 mm increments**
- **Curved anchorings stems** are available starting at 250 mm total length, with a curvature in the right place
  - Reduced risk of fissures
- **Three** neck versions
- **Lateralized neck segment** with 10 mm additional offset
- Design allows intraoperative and postoperative correction of implant length and angle of anteversion **in situ**
- Angle of anteversion is **continuously adjustable** over 360°
- **All-titanium components:** no cobalt-chrome taper ▸ no galvanic element
- Pretensioning to a defined torque and securing of the implant components
- Use of a high precision manufactured morse taper junction
- Specially treated taper (shot peened)

Surgical procedure

Select anchoring stem diameter
↓↑
Impact until correctly seated
↓↑
Assemble to precise length with modular neck segment
↓↑
Set angle of anteversion (continuously adjustable)
↓↑
Reduce the hip joint and evaluate function
↓↑
Surgeon is free to change implant length and anteversion intraoperatively as necessary

Design characteristics: 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.

MRP-TITAN 80
(Tapered, 7 mm slope)

MRP-TITAN Standard
(Tapered, 6 mm slope)

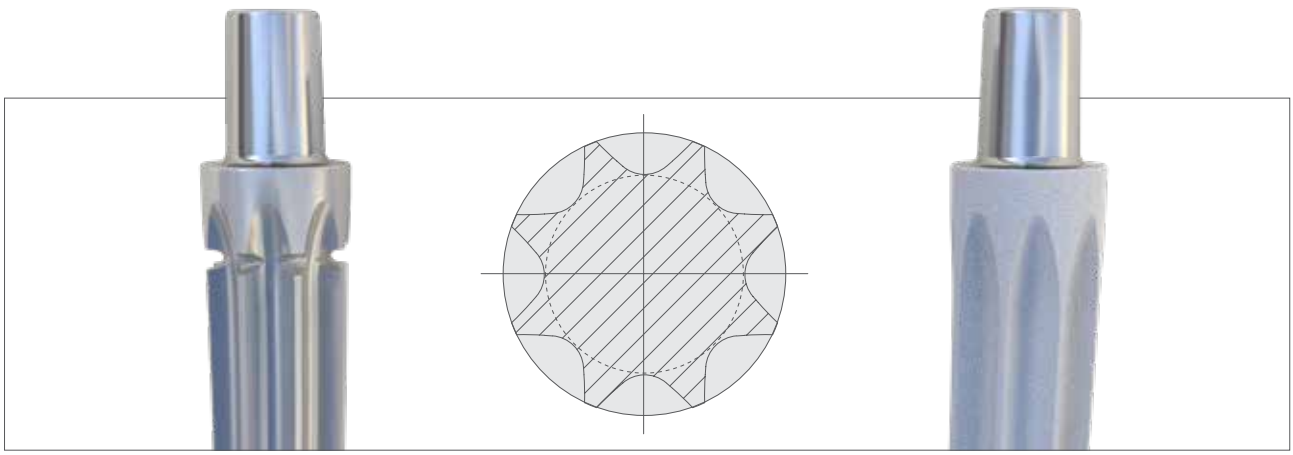
MRP-TITAN mdV (with distal interlocks)
(Tapered, 2 mm slope)

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 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 morse 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. Due to the identical stem geometry, the system is characterized by a reliable change from trial to original stem diameter.



Design characteristics: Neck Segment

Different versions of Neck Segments are available for the modular MRP-TITAN.

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

❶ With fin
Standard, CCD angle of 130°

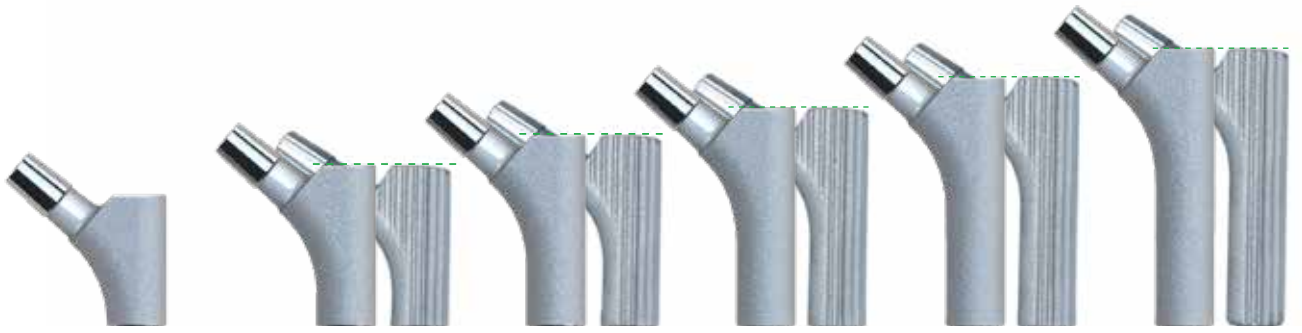
❷ Without fin
Standard, CCD angle of 130°

❸ Without fin
Lateralized, CCD angle of 123.5°

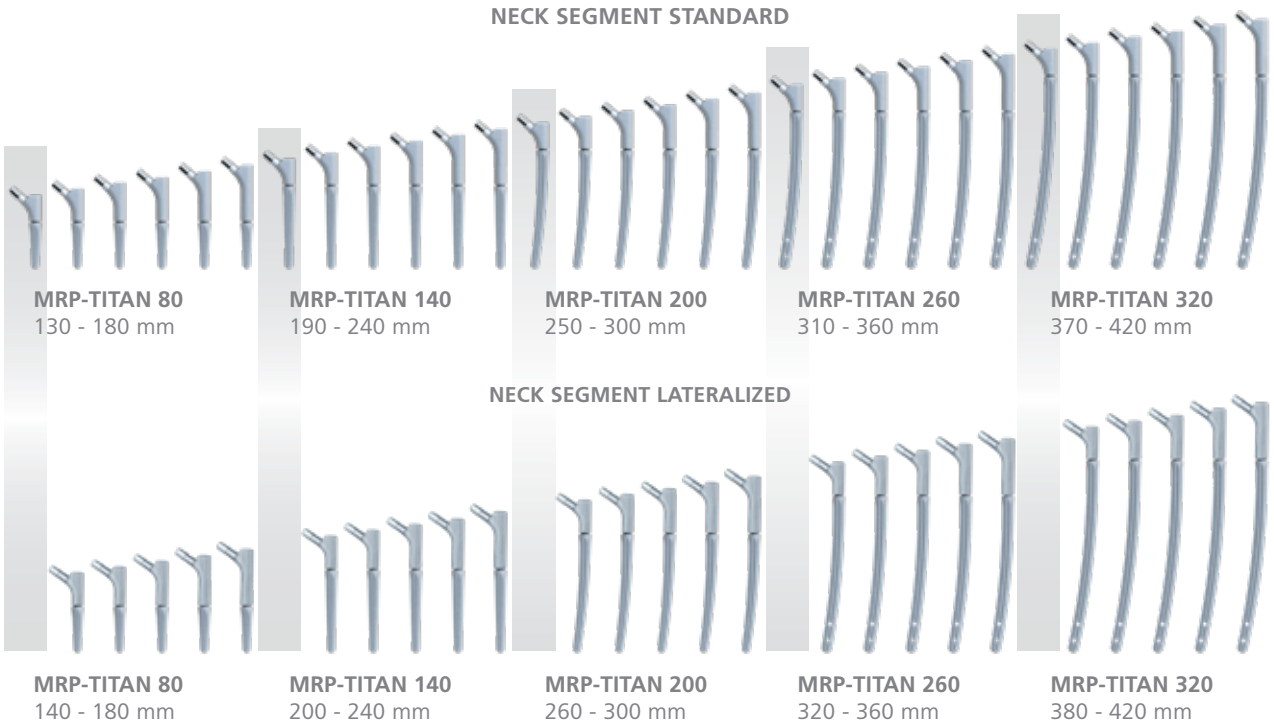
The lateralized neck segment allows 10 mm more lateralization of the leg than the standard neck segment.

Design characteristics: Implant system

A major goal of surgery is to precisely obtain the desired leg length. Therefore, different lenghts of neck segments (S = 50 mm, M = 60 mm, L = 70 mm, SH = 80 mm, MH = 90 mm, LH = 100 mm) are available for the modular MRP-TITAN system.



S = 50 mm **M = 60 mm** **L = 70 mm** **SH = 80 mm** **MH = 90 mm** **LH = 100 mm**



The various different components (anchoring stem, neck segment) 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.

Due to the patented morse taper junction, the system also offers the possibility of setting the anteversion angle independently over 360°.

This minimizes the risk of dislocation and guarantees a total arthroplasty solution with long-term mechanical stability.

Design characteristics: Morse taper junction

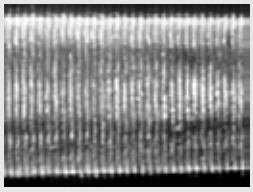
The safety of a morse taper junction depends essentially on the design, the material and the machining.
PETER BREHM GmbH consistently and successfully pursues the following points:

- **Use of a high precision manufactured morse taper junction**
  ➔ No crevice between neck segment and anchoring stem
    - reduced risk of crevice corrosion
    - reduced risk of fretting

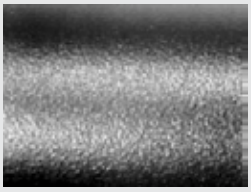
- **Complete manufacturing from one material (TiAl6V4): neck segment, anchoring stem and all screws.**
    - reduction of stress peaks, no different e-moduli
    - reduction of contact corrosion (and thus fretting)

- **Maximum joining of the morse taper junction**

- **Specially treated taper**
  ➔ Introduction of residual compressive stresses
    - increase of stability
    - no material throw-up during joining



MRP-TITAN
taper freshly turned



MRP-TITAN
taper shot peened
(steel balls)

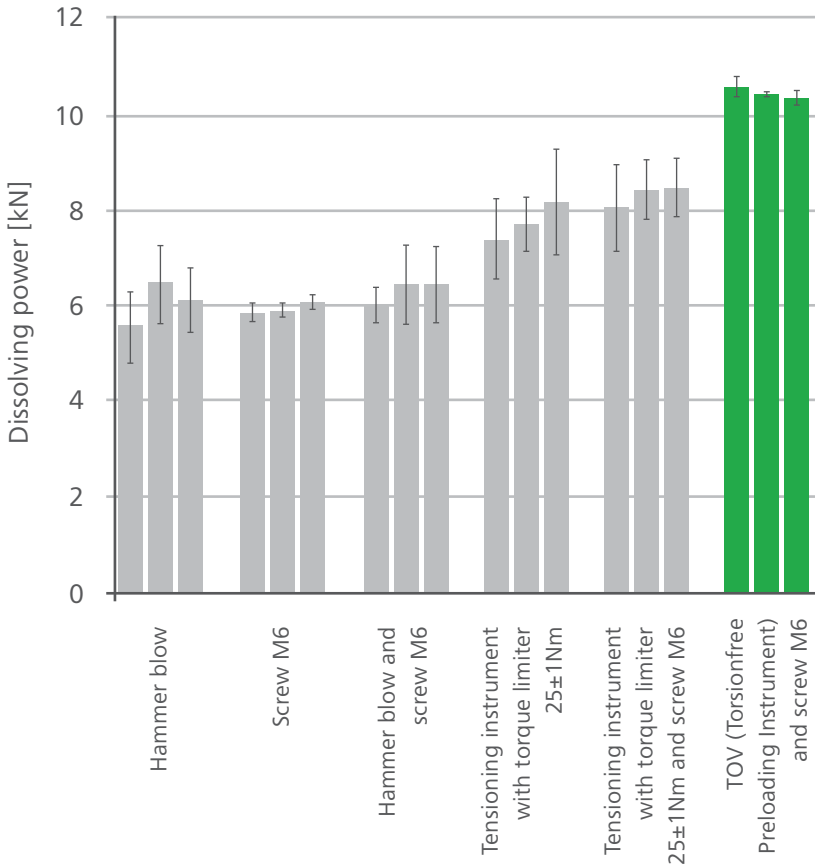
Taper Wiper to increase application safety

Reliable joining is only possible if the taper is cleaned and dried correctly [6-11].
Special taper cleaner **Taper Wiper** was developed for this reason.
The **Taper Wiper** is designed to enable the surgeon to clean the modular interface in a standardised manner. The instruments thus supports the implementation of the existing cleaning instructions in the instructions for use. The effectiveness of the **Taper Wiper** was examined in the study by Boettcher et al. (2024)[12] , which analysed the influence of contamination and the joining conditions of the tapered connections between the shaft and neck section of the MRP-TITAN system on the connection strength.

More stability through pretensioning and securing

The strictly axial pretensioning of the morse taper junction with subsequent securing by the M6 screw is currently the **safest pretensioning method**[1]. The diagram shows that this is clearly superior to the other tensioning methods.

- High joining force
- Strict axial joining of the morse taper junction
- Additional securing of the morse taper junction



! NOTE

- A safe and durable assembly is only guaranteed if the M6 screw is used.
- The M6 screw short is only approved for single use with torque, do not reuse!

Pretensioning the morse taper junction to a defined torque

Since a joint prosthesis is not only subjected to static, but in particular to dynamic loads, it is not sufficient with modular systems to simply place or plug their components together!

In order to achieve a permanent, torsion-resistant morse taper junction, the MRP-TITAN system is first preloaded in a defined manner with the *Torsionfree Preloading Instrument (TOV).* The defined preload of the morse taper junction is ensured by the strictly axial use of the *Torsionfree Preloading Instrument (TOV)* in combination with the stud bolt. This achieves the joining forces required for a durable and torsion-resistant morse taper junction. Reduced joining forces lead to a risk of higher relative movement and fretting within the morse taper junction. For this reason, it must be ensured that no transverse forces act on the instruments during pretensioning.[2]

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

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

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

- Connection strength is increased by about 30%
- Precise maintenance of the pretensioning force due to constantly high joining forces
- The required pretensioning of the morse taper junction is achieved with purely axial loading
- The morse 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

"This consistent further development is our contribution to the safety of modular prostheses."

Controlled release of the morse taper junction

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. This gives the surgeon the option of placing a longer neck segment or readjusting the anteversion. The great advantage of this is that the anchoring 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

- As soon as a morse taper shows signs of corrosion or damage, the Anchoring Stem must be replaced.
- Due to the level of activity or the body weight of the patient, an additional setting behaviour of the components may occur, which means that separation of the implants is no longer possible.

MRP-TITAN

SURGICAL TECHNIQUE

Preoperative planning

01

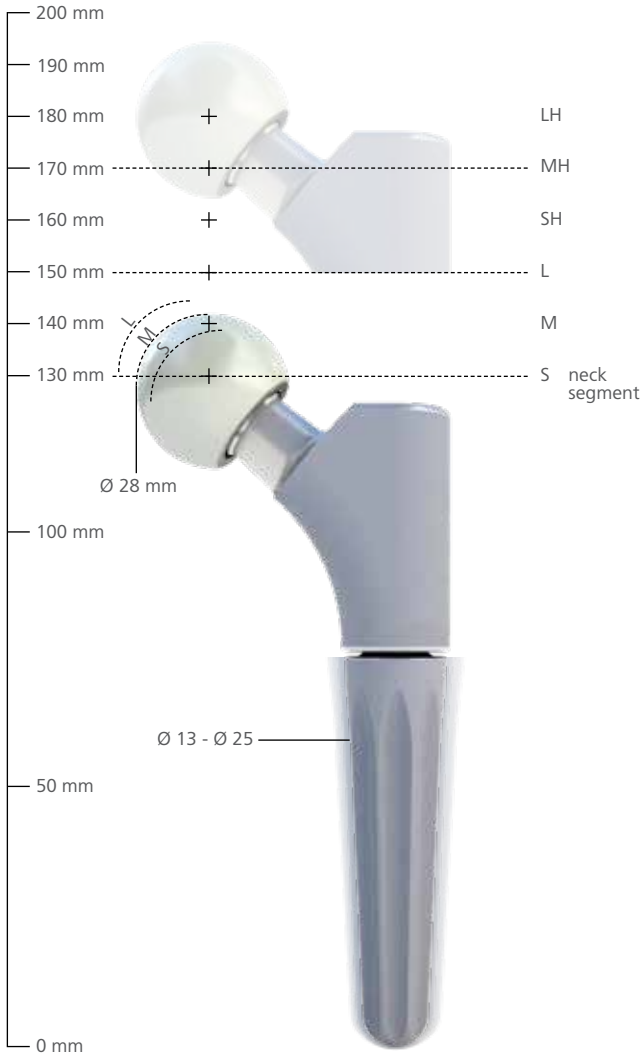
The goal of total arthroplasty is the optimum anatomic reconstruction of the affected joint.

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 ball head lies about level with the apex of the greater trochanter. Ideally, the center of the ball head 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

Digital X-ray templates are available.



! NOTE

- In order to keep the stress on the morse taper junction as low as possible, PETER BREHM GmbH recommends, as far as individually pathoanatomically possible, the use of Neck Segment lenghts L or SH without lateralization.
- The correct selection of the implant (size, shape, composition, etc.) can reduce risks such as loosening.
- To ensure safe instrumentation when pretensioning and securing the implant components, the following instruments must be checked by PETER BREHM GmbH Quality Assurance at specified intervals.
  After 15 operations:
  - Torque Limiter 25±1Nm
  - Guiding Rods
  After 45 operations:
  - Torsionfree Preloading instruments
  If necessary, please contact a representative authorized by PETER BREHM for this purpose.
- Instruments and trial implants must be checked for fatigue fretting and correct handling/function prior to surgery.

! NOTE

- For the articles:
  - Anchoring Stem Curved with Distal Interlocking Cementless, Ø 11 x 320 mm
  - Anchoring Stem Curved with Distal Interlocking Cementless, Ø 11 x 260 mm
  - Anchoring Stem Straight Cementless, Ø 13 x 200 mm
  - Anchoring Stem Curved Cementless, Ø 13 x 200 mm

  there is a restriction of the patient weight to 65 kg.

Patient positioning and approaches

02

This 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.

! NOTE

- In the interest of reliable instrumentation, avoid placing shear forces on instruments during the entire operation. Lateral forces can damage instruments or impair their function.
- No special positioning of the patient and no special access for the implant is prescribed. The surgeon is free to choose his preferred approach, but must follow the prescribed steps and modify them for his chosen approach. A prerequisite for implantation is the clear exposure.

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
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. 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 box osteotome which is impacted into the central metaphyseal bone.

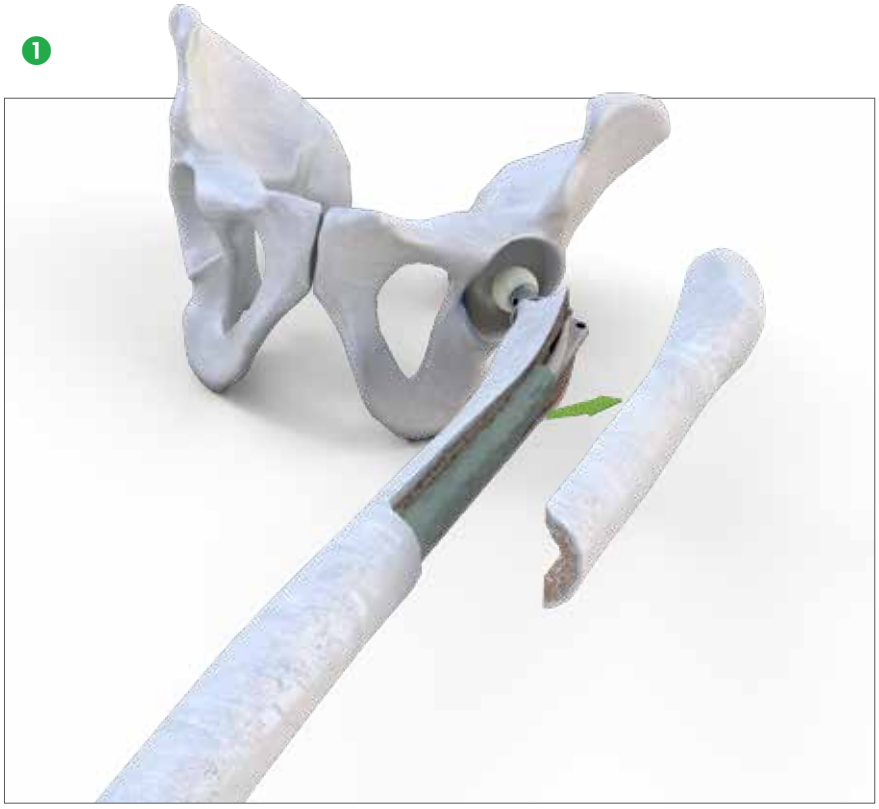
Where straight anchoring stem implants are used, it will be necessary to resect cortical bone at the apex of the greater trochanter. Otherwise it will not be possible to properly center the straight anchoring stem implant, especially in hard bone. The *Rasp MRP-TITAN 80 mm* may be used for this purpose.

Preparing the bone-implant interface (Revision arthroplasty)

05

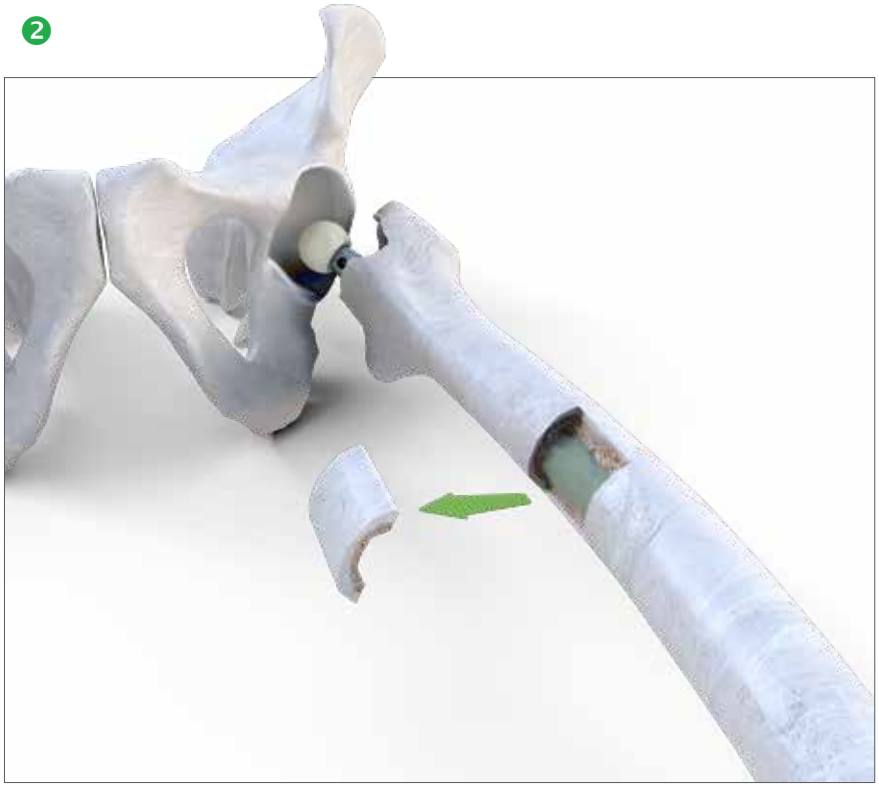
Preparing the femur
Implantation in revision cases requires not only removal of the initial implant but also a totally unobstructed femoral canal. Care must be taken to remove any residual bone cement from cemented implants and smooth any step-off from cementless implants. This is done to minimize the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

❶



If it is not possible to remove all impediments within the femoral canal, then one can opt for a transfemoral approach (❶) or open a distal cortical window (❷).

❷



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 over a distance of several centimeters. This will be indicated by the clear high-pitched sound of the cortex. The central run of the drill in the femur should be checked with the X-ray imaging to avoid perforations.

07

Straight anchoring stems
Where straight anchoring stems are used, it is recommended to prepare the medullary canal with the straight *Rasps with AO Adapter.* If these are not available, it is possible to use the flexible reamers as described above (06). The implant bed is reamed incrementally. 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

08

Selecting the diameter of the Trial Anchoring Stem
The last diameter of the last *Rasp with AO adapter* is used 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.

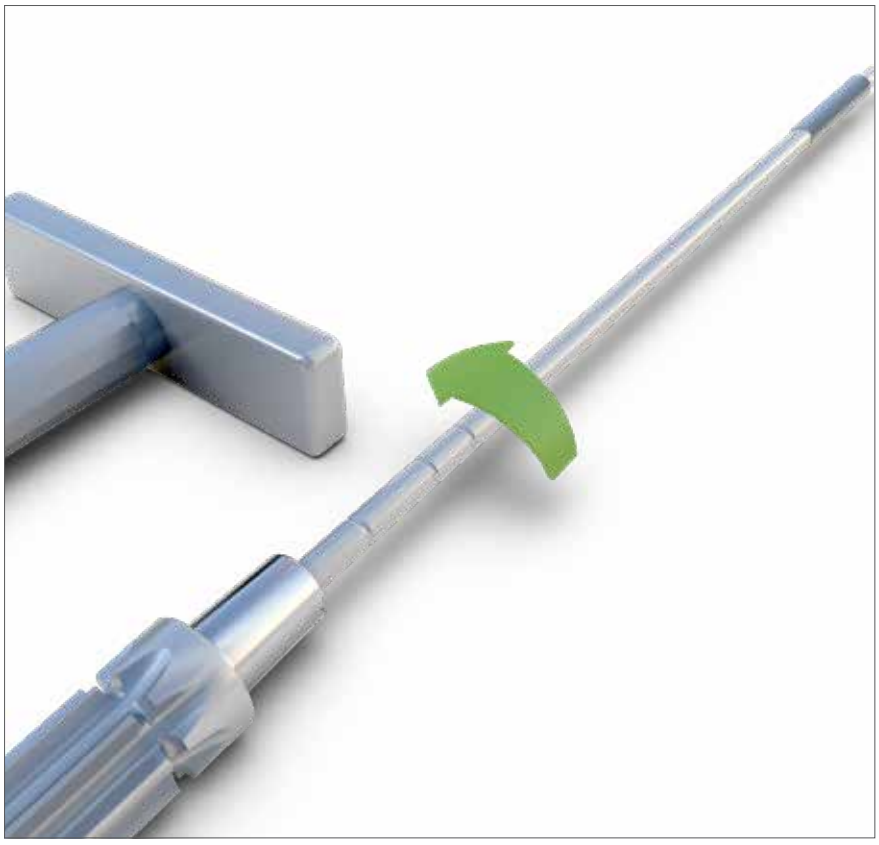
If the femur was prepared with flexible reamers, it is recommended to start with the one or two smaller diameter of the Trial Anchoring Stem as drilled. This is done because a narrower *Trial Anchoring Stem* can be used to palpate the physiologic curvature of the femur. Then the stem diameters are successively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

09

Assembling the impactor/extractor
The setting instrument of the modular MRP-TITAN prosthesis consists of the *Handle for Prosthesis Inserter/Remover*, a *Knurled Screw S*, and the *Guiding Rod.* On the ends of the *Guiding 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*



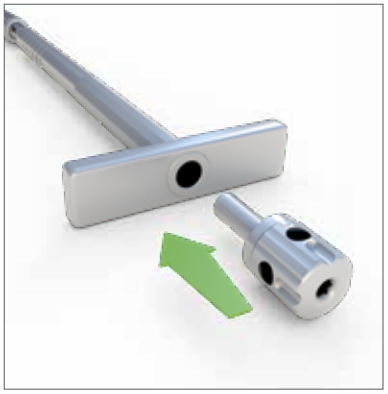
Ensure that the *Guiding Rod* is completely screwed into the *Trial Anchoring Stem* either manually or using a *Socket Wrench SW 3,5*.

! NOTE

- Before each screwing in of the Guiding Rod ensure it is free of contamination.
- It must be ensured that the Guiding Rod is completely screwed into the Trial Anchoring Stem stem manually or with the Socket Wrench SW3,5.

Trial assembly

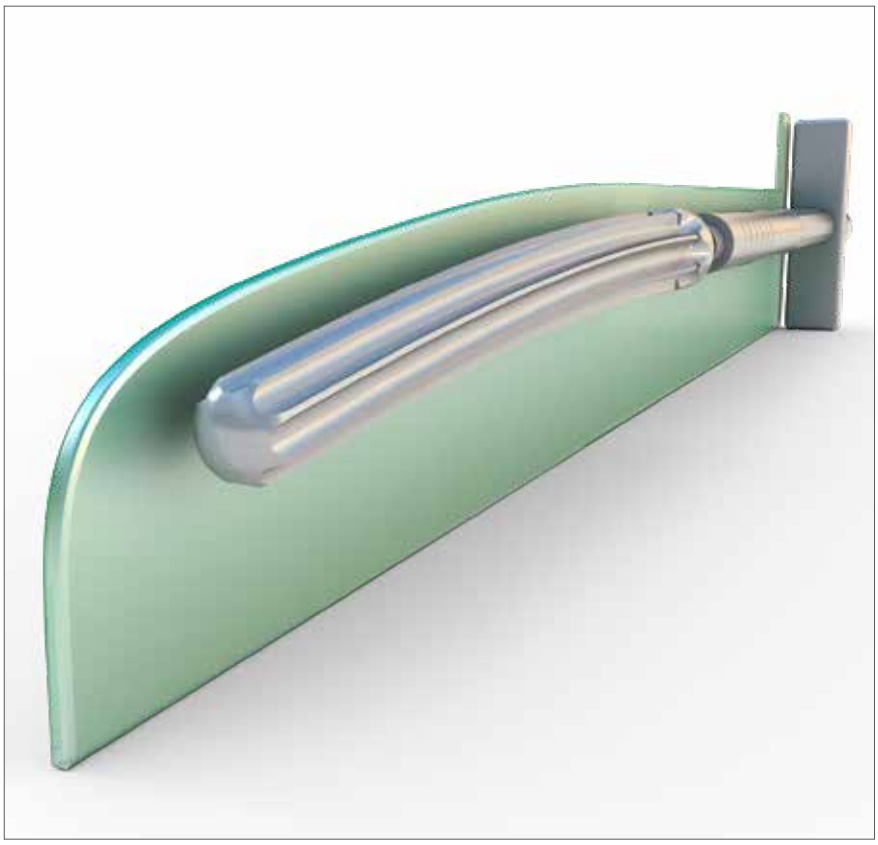
Then the *Handle for Prosthesis Inserter/Remover* is slid over the *Guiding Rod* and secured with the *Knurled Screw S*.



To secure the connection, proceed as follows: Screw in the *Knurled Screw S* by hand as far as it will go. With the transverse inserted *socket wrench SW3.5* an additional half turn clockwise is done to secure the connection.

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

After repeated hammer blows, it may be necessary to secure the connection of the mounted instrument again.

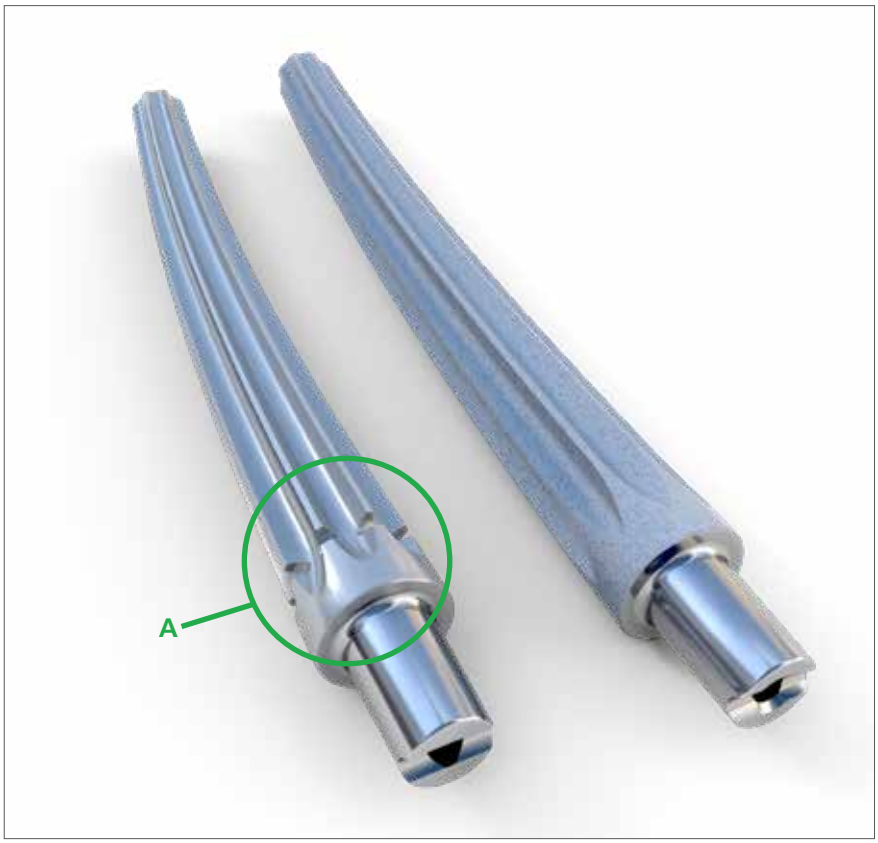


The curvature of the *Trial Anchoring Stem* lies in the plane of the handle.

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.*

! NOTE

Carry out implantation carefully (setting cerclages if necessary).



Differences between the *Trial Anchoring Stem* and the definitive anchoring stem:

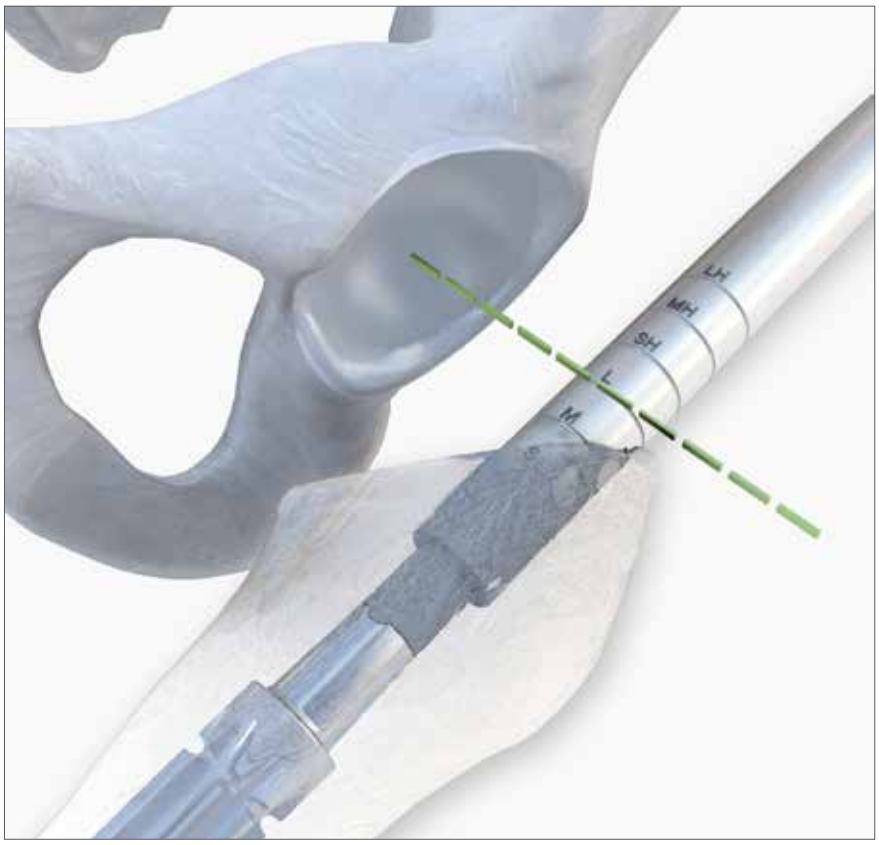
A notch *(A)* in the *Trial Anchoring Stem* identifies it on radiographs.

In contrast to the definitive anchoring stem the *Trial Anchoring Stem* has a smooth surface.

Trial assembly

10

Determining implant length
The required neck segment length is measured on the scale of the *Handle for Prosthesis Inserter/ Remover* in relation to the greater trochanter tip (S, M, L, SH, MH, LH). The target is to aim for the middle range of the length scale (L or SH).



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.
- In order to keep the stress on the morse taper junction as low as possible, PETER BREHM GmbH recommends, as far as individually pathoanatomically possible, the use of Neck Segment lenghts L or SH without lateralization.

11

Placing the neck segment
After placing the *Trial anchoring stem*, unscrew the *Knurled Screw S* and remove the *Handle for Prosthesis Inserter/Remover*.

Using the *Guiding Rod* remaining in the *Trial Anchoring Stem*, the space for the *Trial Neck Segment* is created manually with the miller for neck segment. Make sure that the miller is screwed in as far as it will go to ensure that the neck segment fits exactly.

! NOTE

Always use the *Guiding Rod* when preparing to mill the bone for the Trial Prosthesis Neck / original Neck Segment and when placing the Neck Segment. If the bone is hard, the milling cutter may be displaced, which is why the procedure must then be repeated several times.

Trial assembly

Connecting the *Trial Neck Segment* to the *Seating instrument prothesis Neck*.

After the taper surface on the end of the stem has been cleaned, the *Seating instrument prothesis Neck* for the selected *Trial Neck Segment* is inserted over the *Guiding Rod* in a defined manner. The *Trial Neck Segment* can be fixed in the desired anteversion by tapping it lightly with a hammer.

In order to simulate the Trial Neck Segment lengths SH, MH and LH, the Trial Neck Segment and the Trial Extension Sleeve are pre-assembled by pressing them together firmly before placement.

Trial components Trial Prosthesis Neck standard / lateralized	Original components Prosthesis Neck standard	Original components Prosthesis Neck lateralized
Trial Prosthesis Neck S	Prosthesis Neck S	-
Trial Prosthesis Neck M	Prosthesis Neck M	Prosthesis Neck M
Trial Prosthesis Neck L	Prosthesis Neck L	Prosthesis Neck L
Trial Prosthesis Neck S + Trial Extension Sleeve	Prosthesis Neck SH	Prosthesis Neck SH
Trial Prosthesis Neck M + Trial Extension Sleeve	Prosthesis Neck MH	Prosthesis Neck MH
Trial Prosthesis Neck L + Trial Extension Sleeve	Prosthesis Neck LH	Prosthesis Neck LH

Remove the *Seating instrument prothesis Neck* and the *Guiding Rod*. Then a trial reduction is performed using the *Trial Ball*. Correct leg length, soft-tissue tension, and function are verified.

Continue with item 13, provided that checking the correct leg length, soft tissue tension and function was positive.

! NOTE

- PETER BREHM GmbH recommends the obligatory use of intraoperative x-rays to assess the correct positioning of the implant and to detect any bone fractures.
- Use trial implants exclusively for the selection of corresponding permanent implants.
- Ensure that trial implants are not implanted permanently.

12

Disconnecting the trial assembly
The impression instrument facilitates controlled release of the individual components *Trial Anchoring Stem*, *Trial Extension Sleeve*, and *Trial Neck Segment*.

It is always important to work with the counterholder to prevent the transmission of rotational forces to the bone.

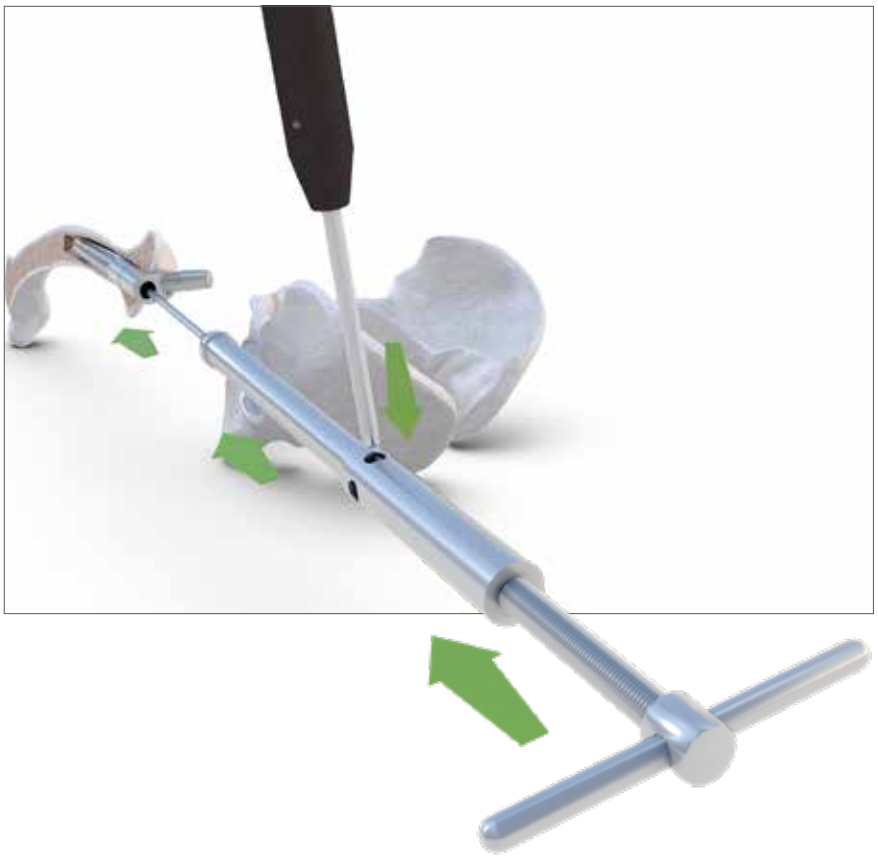
Three situations are distinguished:
1. *Trial Neck Segment* and *Trial Extension Sleeve*
2. *Trial Extension Sleeve* and *Trial Anchoring Stem*
3. *Trial Neck Segment* and *Trial Anchoring Stem*

Trial assembly

If the *Trial Neck Segment* is to be separated from the *Trial Extension Sleeve* (❶), then the *Impression Threaded Rod for Impression Instrument* (separating rod with threading) must be used.

The *Impression Rod for Impression Instrument* is screwed into the *Trial Extension Sleeve* with the *Socket Wrench SW 3.5*. The assembled impression instrument is slid over the rod and screwed into the *Trial Neck Segment*.

Then the components are separated from each other by turning the *Spindle*.

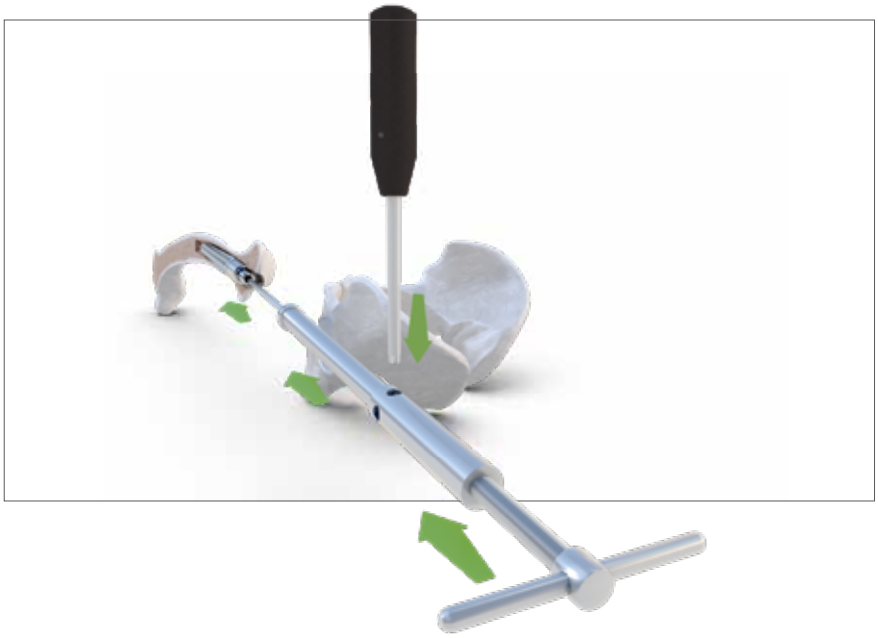


! NOTE

Always use *counterholder* also when removing screws, working with the impression instrument, *Torque Limiter 25±1Nm* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.

If the *Trial Extension Sleeve* is to be separated from the *Trial Anchoring Stem* (❷), then you must use the *Impression Rod for Impression Instrument* (separating rod without threading).

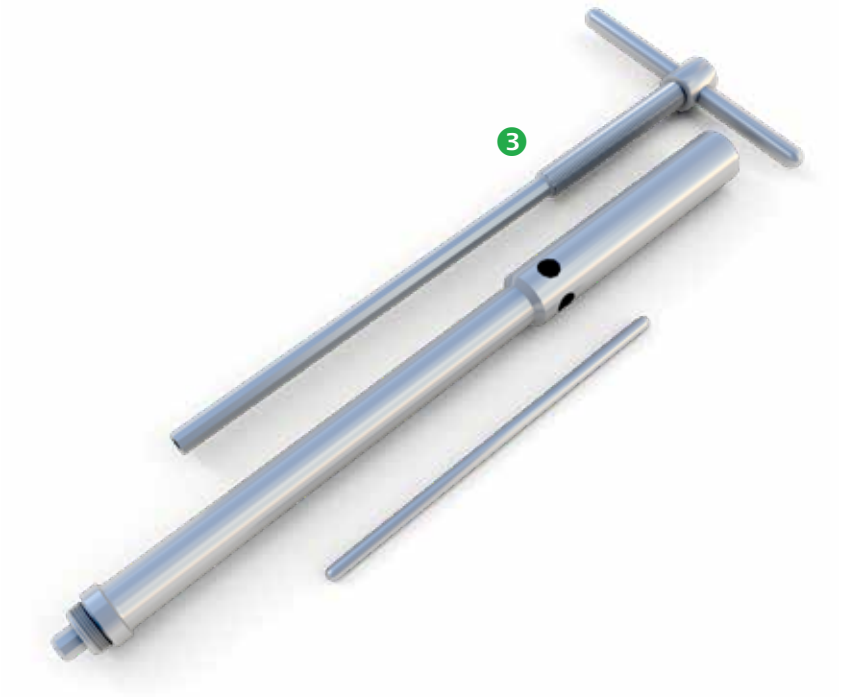
The *Impression Rod for Impression Instrument* is inserted into the *Trial Extension Sleeve*. The assembled impression instrument is slid over it and screwed into the *Trial Extension Sleeve*.



Then the components are separated from each other by turning the *Spindle*.

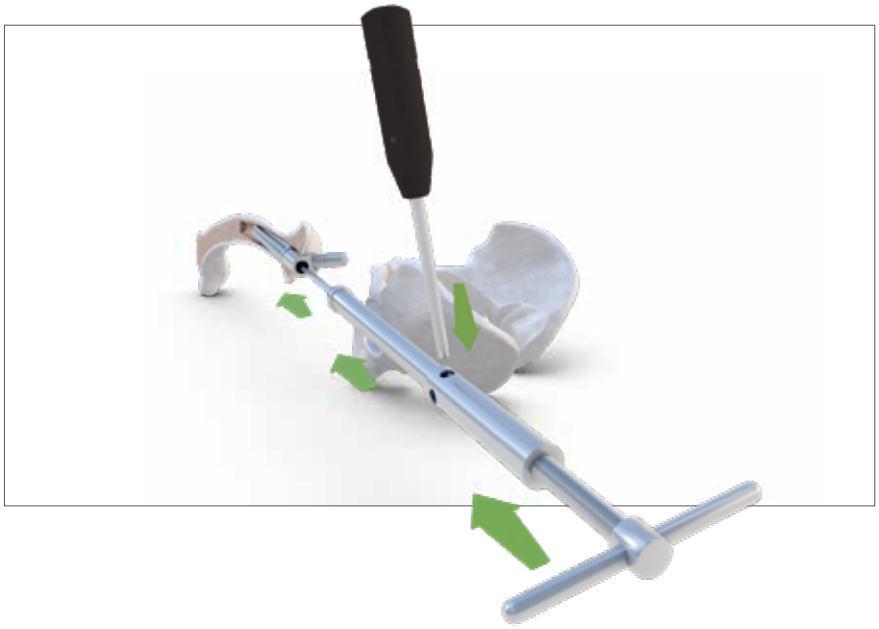
Trial assembly

If the *Trial Neck Segment* is to be separated from the *Trial Anchoring Stem* (❸), 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 Neck Segment,* the assembled impression instrument is inserted over the *Impression Threaded Rod for Impression Instrument* and screwed into the *Trial Neck Segment.*

Then the components are separated from each other by turning the *Spindle.*



13

Removing the Trial Anchoring Stem

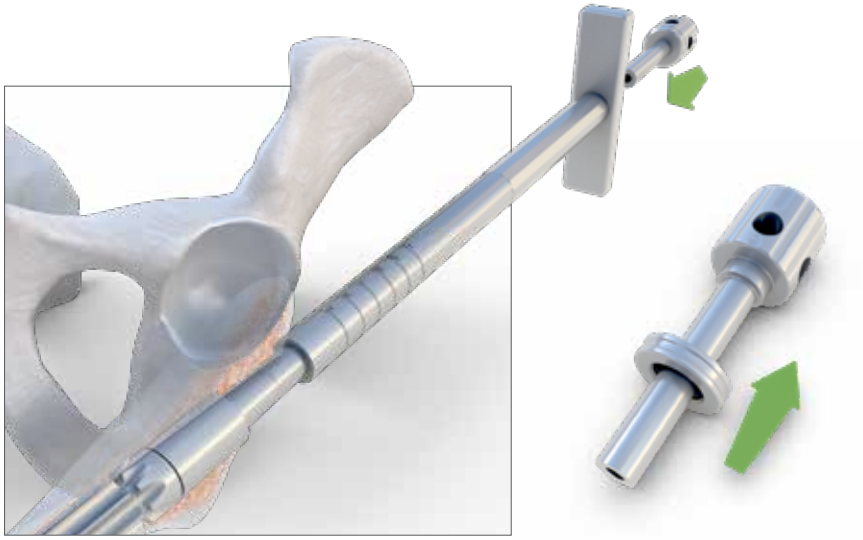
In order to place the definitive implant, the entire *Trial Implant* must be removed. One can either extract the entire system or disassemble the prosthesis and remove each of the components separately.

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 Neck Segment*
Or:
Trial Anchoring Stem and
Trial Extension Sleeve

↓

Knurled Screw M
and Sliding Disk

Trial assembly

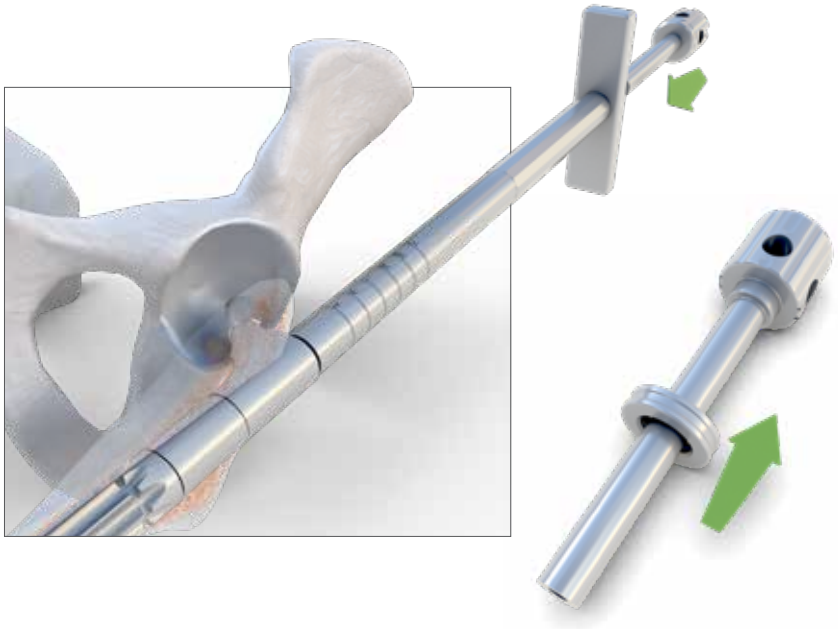
Removal of the *Trial Anchoring Stem* and *Trial Neck Segment* and *Trial Extension Sleeve*

↓

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.

After repeated hammer blows, it may be necessary to secure the connection again.



! NOTE

Tighten knurled screw again with Socket Wrench SW3,5.

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

! NOTE

Always hold the prosthesis extractor axially in the direction of force.

Optionally, an additional sliding hammer can be ordered from Peter Brehm to facilitate the removal of fixed trial implants.

Placing the definitive implant

14

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 *Guiding 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 all the way in. 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.

! NOTE

- Before each screwing in of the *Guiding Rod* ensure it is free of contamination.
- It must be ensured that the Guiding Rod is completely screwed into the Trial Anchoring Stem stem manually or with the Socket Wrench SW3,5.
- Do not use implants whose packaging is damaged.
- Do not resterilize and/or repack implants delivered sterile.
- Do not use implants whose use-by date has expired.
- Return products with expired use-by date to PETER BREHM GmbH.
- Check the use-by date and the integrity of the sterile packaging.
- Thoroughly clean Implant components.
- Do not touch rough surfaces with cloths or any materials that produce lint.

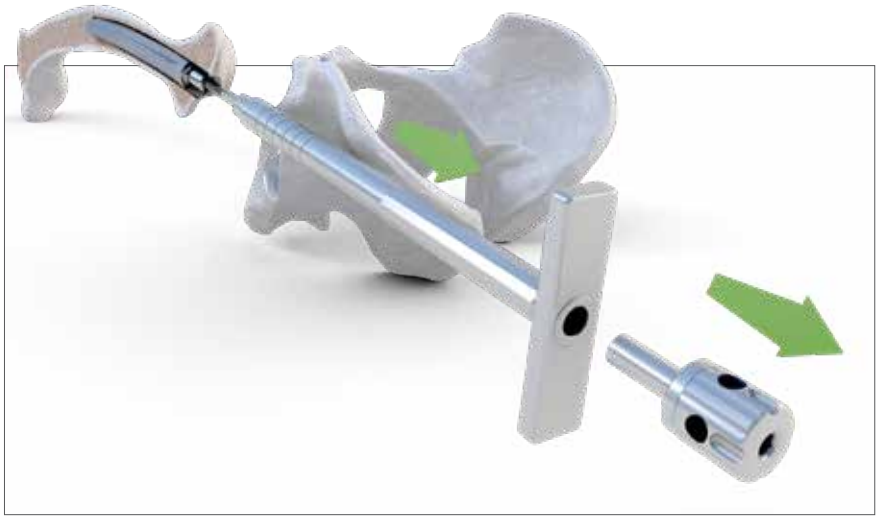
Placing the definitive implant

After repeated hammer blows, the connection must be secured again.

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 Neck Segment* 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 *Guiding Rod,* which remains in place in the anchoring stem.

! NOTE

Repeated milling for the Neck Segment is necessary if the prosthesis stem is located deeper than the Trial Anchoring Stem. If the bone is hard, the milling cutter may be displaced, which is why the process must then be repeated several times.



Then the *Knurled Screw S* and the *Handle for Prosthesis Inserter/Remover* are removed.

Clean the Taper connection with the help of the taper cleaner Taper Wiper.

A secure joining is only possible if the Taper is properly cleaned and dried [6-11]. For this reason, the taper is cleaned with the Taper Wiper before the original neck segment is placed for joining.

Placing the definitive implant

15

Cleaning the morse taper connection

1. Mounting stand
2. Sleeve slotted
3. Thorn
4. Tissue protection sleeve
5. Handle
6. Gauze swab

! HINWEIS

- *Gauze swab:*
  10 x 10 cm
  16 ply (12 ply)
  dry

Placing the definitive implant

Mounting Taper Wiper

- Gauze swab:
  10 x 10 cm
  16 ply (12 ply)
  dry
- Fold out twice

! NOTE

- *The unfolded gauze swab cosists of 4 layers.*

Placing the definitive implant

- Put down the mounting stand
- Slide on the t issue protection sleeve

Slide on sleeve slotted with plate facing downwards.

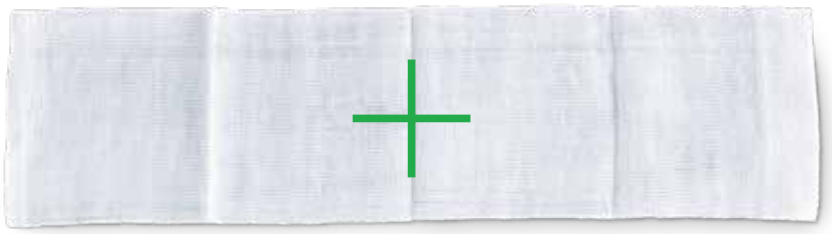
Placing the definitive implant

Insert thorn into sleeve slotted.
Tip upwards.

Overall construction assembly:

- Thorn
- Sleeve slotted
- Tissue protection sleeve
- Mounting stand

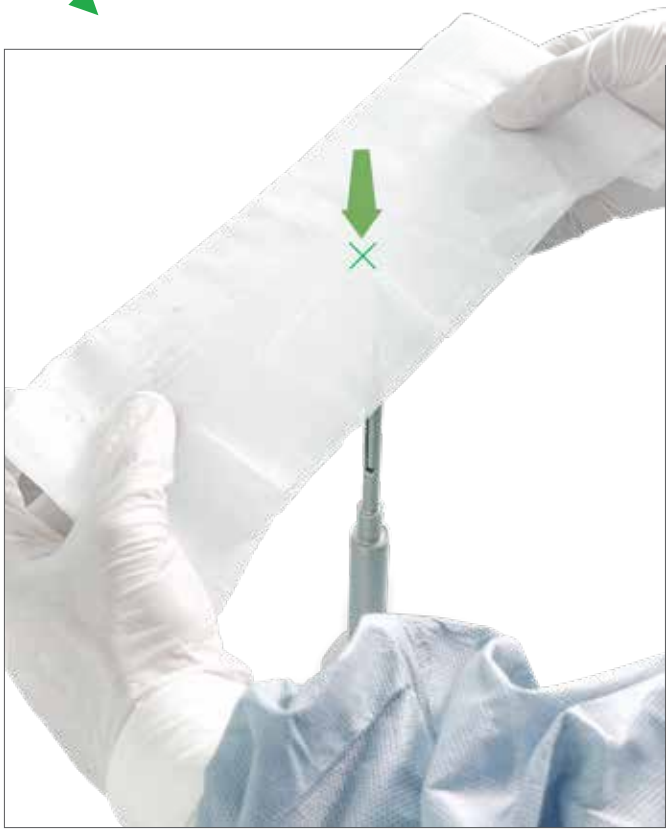
Placing the definitive implant

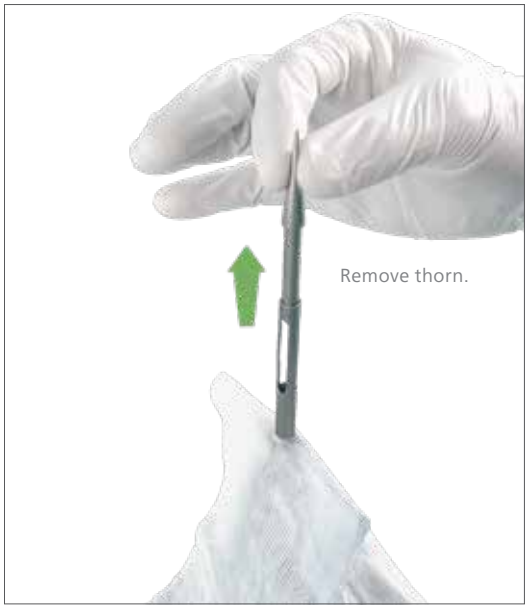


Central threading point gauze swab.

Thread the dry gauze swab onto the thorn at the centre point (see above) until it stops

Slightly pulling back and forth facilitates the expansion of the stitches.





! HINWEIS

- Pick up dry gauze swab in the middle and make sure that no threads are pulled or torn.

Placing the definitive implant

Put on the handle piece and push it onto the sleeve slotted against resistance as far as it will go.

Placing the definitive implant

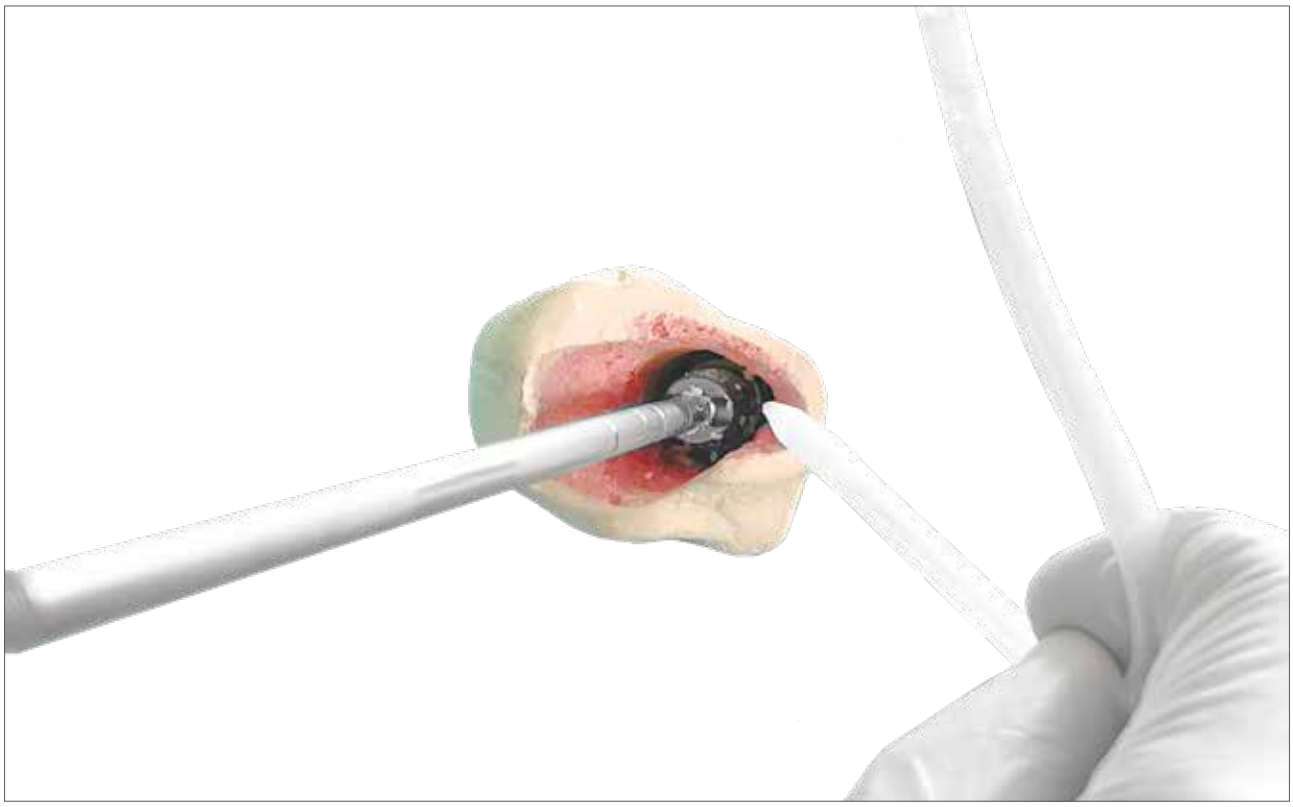
Hold the handle in position and push the tissue protection sleeve upwards to the stop with the other hand.

Gauze swab becomes visible.

Remove the mounted Taper Wiper from the mounting stand.

Placing the definitive implant

Cleaning with Taper Wiper

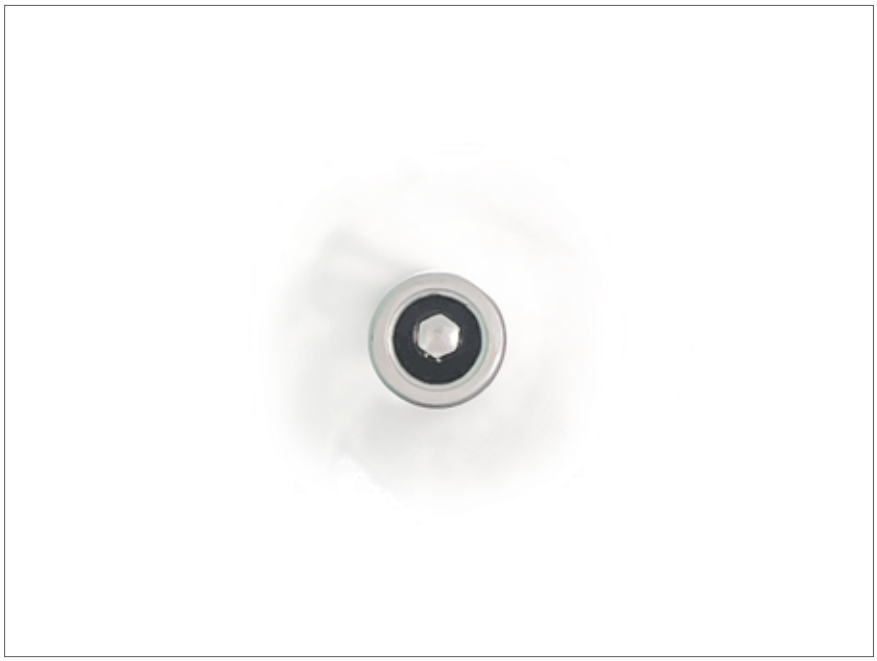


! HINWEIS

- Before mounting the morse taper junction, clean it carefully using the Taper Wiper (rinse with NaCl 0.9%) and dry it
- When using the Taper Wiper, always use the guiding rod.
- Before each screwing in of the Guiding Rod ensure it is free of contamination.
- It must be ensured that the Guiding Rod is completely screwed into the Trial / Anchoring Stem manually or with the Socket Wrench SW3,5.

Placing the definitive implant

Push the Taper Wiper via the guiding rod onto the taper as far as it will go.



End position: Flush finish between handle end Taper Wiper and guiding rod.

Placing the definitive implant

Rotate the Taper Wiper to remove blood residues from the taper.

Carefully remove Taper Wiper from cone and guiding rod.

! HINWEIS

- Clean the taper at least **twice** with a fresh gauze swab!

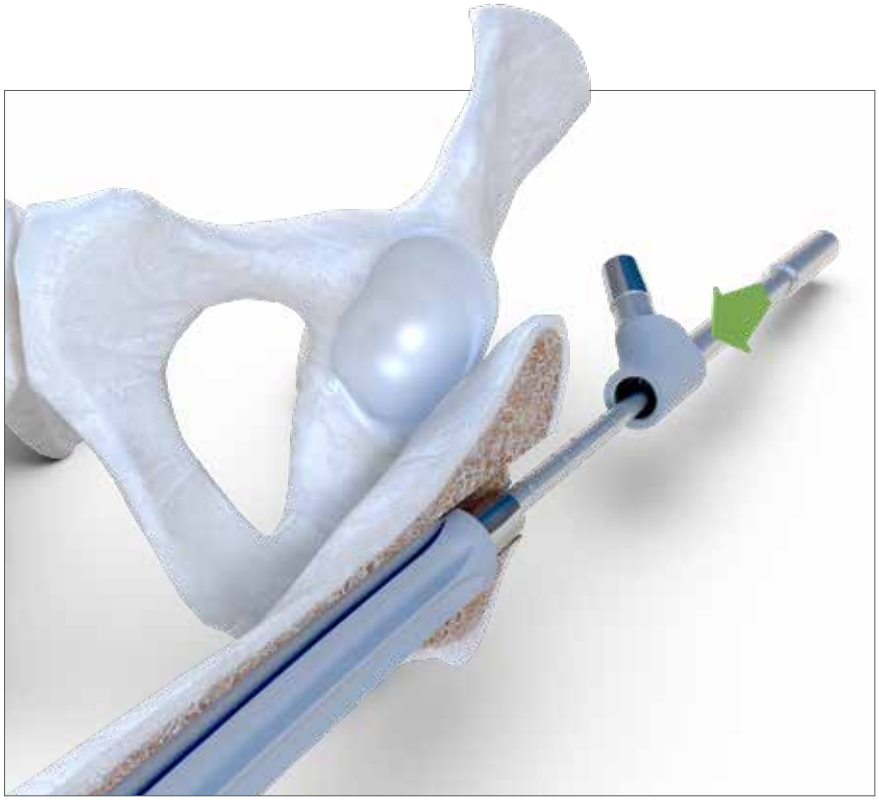
Placing the definitive implant

Disassembly Taper Wiper

Pull off the tissue protection sleeve while securing the gauze swab with the second hand.

Pull out the sleeve slotted with the help of the gauze swab.

Unthread the sleeve slotted from the gauze swab.
Repeat all procedures → at least two cleaning cycles.



! NOTE

- Before mounting the morse taper junction, clean it carefully using the Taper Wiper (rinse with NaCl 0.9%) and dry it.
- Pick up dry gauze swab in the middle and make sure that no threads are pulled or tear
- When using the taper cleaner, always use the guiding rod.
- Clean the taper at least **twice** with fresh gauze swab!
- Pay attention to careful, axis-appropriate implantation.
- Do not use damaged implants.
- In order to keep the stress on the morse taper junction as low as possible, PETER BREHM GmbH recommends, as far as individually pathoanatomically possible, the use of Neck Segment lenghts L or SH without lateralization.

After the taper surface has been cleaned, the neck segment can be inserted over the *Guiding Rod* with the aid of the *Seating instrument prothesis Neck*.

The neck segment can be fixed in the desired anteversion by tapping it lightly with a hammer.

Once the *Seating instrument prothesis Neck* and the *Guiding Rod* have been removed, a trial reduction can again be performed with the *Trial Ball 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.

Placing the definitive implant

16

Pretensioning the definitive implant
The *Torsionfree Preloading Instrument (TOV)* must be used for definitive pretensioning of the definitive implant assembled in situ.

Definitive pretensioning of the morse taper junctions is ensured by strictly axial application of the *Torsionfree Preloading Instrument (TOV)* in combination with the *Stud Bolt*.

! NOTE

- Pre-tension morse taper junction with the Torsionfree Preloading Instrument (TOV).
- Despite strictly axial access, care must be taken to ensure that no soft tissue act on the instruments during pretensioning and securing.[2]

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

Anchoring stem and neck segment (S, M, L)

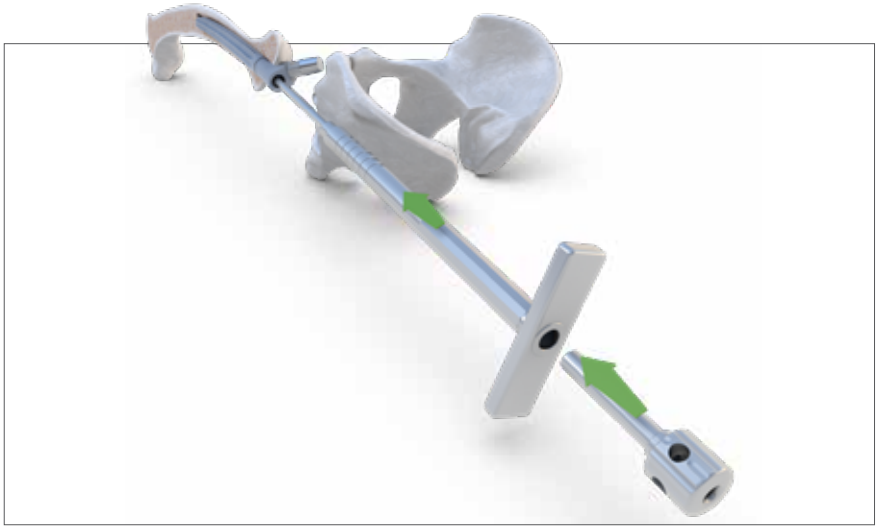
↓

Knurled Screw M

Anchoring stem, neck segment (SH, MH, LH)

↓

Knurled Screw L



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

! NOTE

The *Knurled Screw* is supposed to be only hand-tightened.

Placing the definitive implant

Screw the *Stud Bolt* as far as it will go into the *Knurled Screw*.

Align the markings on the *Torsion-free Preloading Instrument (TOV)*. Make sure the bolt receiver is extended.

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.*

Placing the definitive implant

The torsion forces are reduced using the *Torsionfree Preloading Instrument (TOV).*

The *Counter Holder 12/14* can be used in three different ways depending on how the patient is positioned (see illustrations).

! NOTE

Always use *counterholder* also when removing screws, working with the impression instrument, *Torque Limiter 25±1Nm* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.

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 teared off, the handle of the TOV instrument springs back.
- Always use a new *Stud Bolt*, even if it was not destroyed during the first aborted attempt.
- Dispose of *Stud Bolt* in case of premature termination of preload test.

Placing the definitive implant

Then the *Torsionfree Preloading Instrument (TOV)* is removed sideways from the *Handle for Prosthesis Inserter/Remover,* respectively.

! NOTE

The rest of the *Stud Bolt* remains in the instrument until it is again turned counterclockwise into its initial position.

17

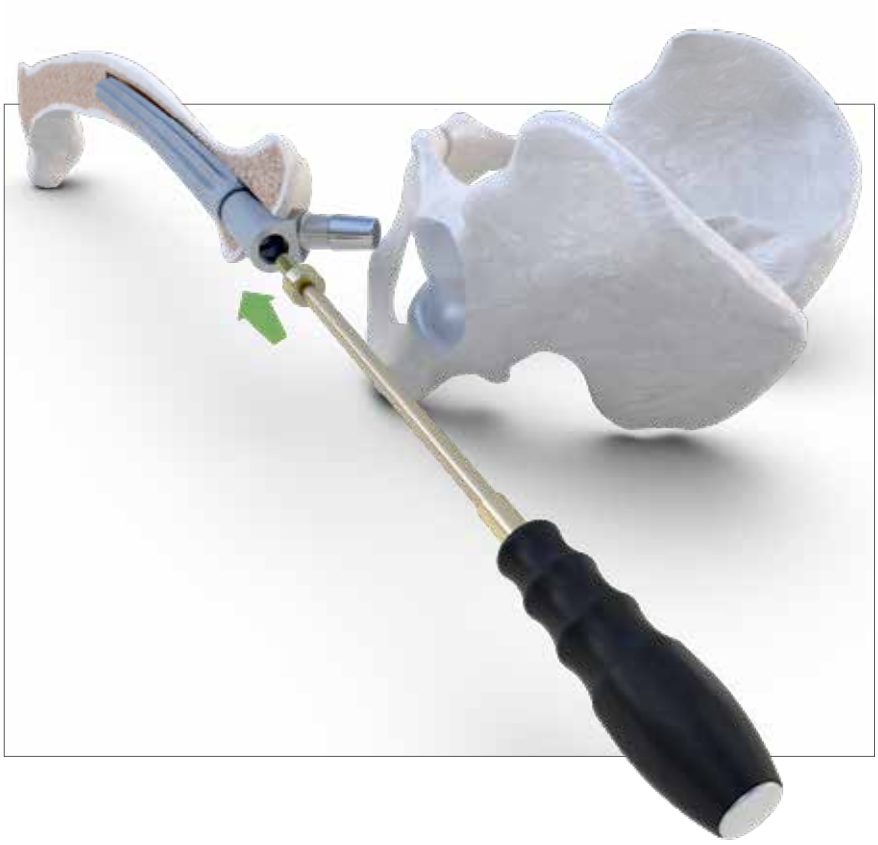
Securing the definitive implant
Components for inserting and tightening the *Screw M6 (Safety screw)*:

1. *Tommy Bar f. Socket Head Wrench AF 6*
2. *Torque Limiter 25±1 Nm*
3. *Allen Key SW5 Ball Head*
4. *Cardan Screw Driver AF 5*
5. Screw M6 (short)

Anchoring stem
+ neck segment
(S, M, L, SH, MH, LH)
= screw M6 (short)

! NOTE

Before screwing in the screw M6, ensure the internal thread of the anchoring stem is free of contamination. Therefore, the internal thread must be thoroughly rinsed with at least 100 ml saline solution (NaCl 0.9%) by using a syringe. Care must be taken that the thread is not damaged.



The screw M6 should always be screwed in with the *Allen key SW5 ball head* as far as it will go without applying much force. Only then the screw M6 is tightened with a defined torque.

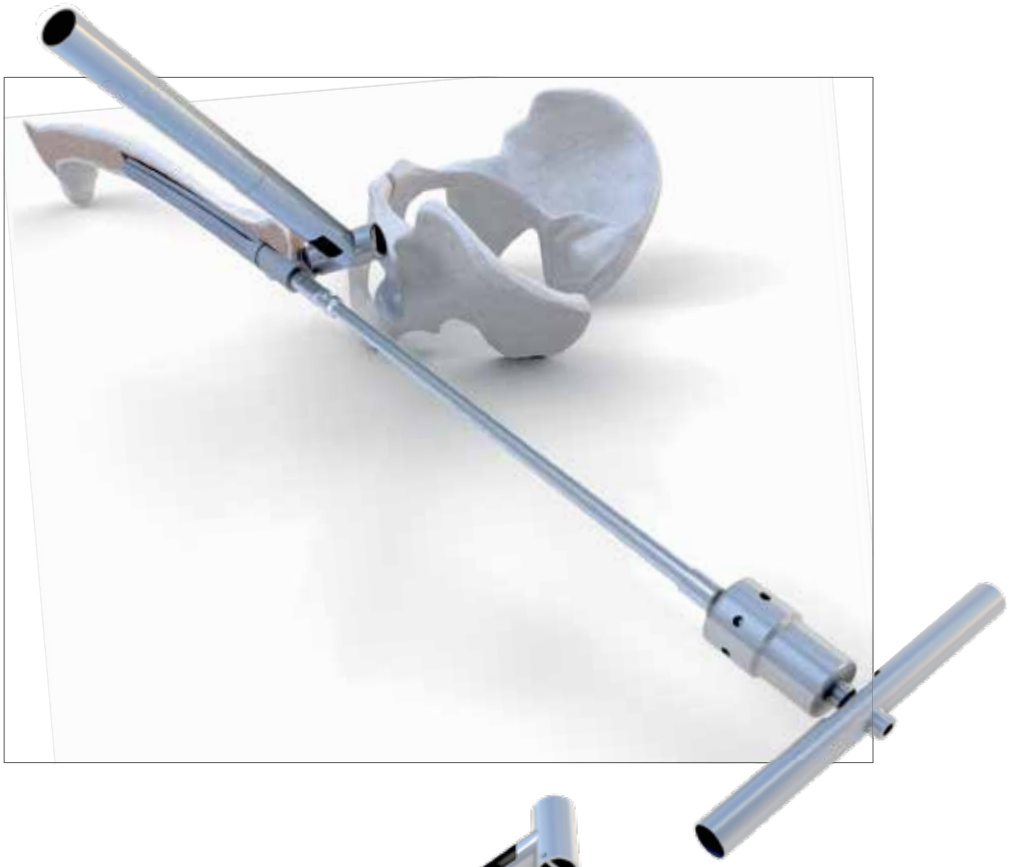
! NOTE

- Always use the *Allen Key SW5 Ball Head* to screw in the M6 screw. The screw M6 must be able to be screwed in hand-tight with little force until the screw head is in contact. Make sure that the thread is free of bone residuals, tissue, blood, fat and other fluids.
- The screw M6 itself must be free of contamination before being screwed in.

Placing the definitive implant

To tighten the screw M6 to a defined torque, use the *Cardan Screw Driver AF 5* with the *Torque Limiter 25±1 Nm* and the *Tommy Bar f. Socket Head Wrench AF 6*.

The *Counter Holder 12/14* can be used in two different ways depending on how the patient is positioned (s. illustrations).



! NOTE

To avoid transverse forces acting on instruments, the Cardan Screw Driver AF 5 (max. permitted deflection 10°) must be used.

! NOTE

- Tighten the screw M6 with the torque limiter 25±1Nm defined.
- Ensure that the limiting mechanism of the torque limiter is triggered.
- Always use *counterholder* also when removing screws, working with the impression instrument, *Torque Limiter 25±1Nm* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.
- The M6 screw short is only approved for single use with torque, do not reuse!

18

Sealing the neck segment
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.

19

Securing the prosthetic trochanter
If the neck segment for trochanter has been used, 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.*

! NOTE

To avoid transverse forces acting on instruments, the Cardan Screw Driver AF 5 (max. permitted deflection 10°) must be used.

! NOTE

- Ensure that the limiting mechanism of the torque limiter is triggered.
- Always use *counterholder* also when removing screws, working with the impression instrument, *Torque Limiter 25±1Nm* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.

Placing the definitive implant

20

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

! CAUTION

- Have to be combined with products released by PETER BREHM GmbH.
- Observe the size specifications on the labels.
- Observe correct handling of implant components and instruments.
- In order to keep the stress on the morse taper junction as low as possible, PETER BREHM GmbH recommends, as far as individually pathoanatomically possible, the use of Neck Segment lenghts L or SH without lateralization.
- Approved ball head lengths made of ceramic and CoCr are: S, M and L in the range from -4 to +4.
- Do not combine CoCr ball heads with bearing surfaces made of ceramic or metal.
- CoCr ball heads can only be combined with PE inlays.
- Ceramic ball heads can only be combined with PE or ceramic inlays.
- Ceramic ball heads made of BIOLOX®*delta* / BIOLOX®*forte** may only be combined with PE inserts or with ceramic inserts made of BIOLOX®*delta* / BIOLOX®*forte*.
- Ensure that strictly axial access to the medullary canal is guaranteed during the entire operation to avoid transverse forces on instruments.
- Ensure that there is no contact between products for osteosynthesis for example plates, screws, cerclages and the MRP-TITAN implants except on the intended locations (neck segment with fin, neck segment trochanter replacement, distal locking).
- Avoid surface damage of the implant such as scratches and impact points which could be caused by chisels, hammers, lustres, clamps, etc. as well as contact or sparks caused by electrosurgical instruments.
- Do not use implants/instruments with visible damage and/or contamination.
- The weight limitation of the implants must be observed.
- The criterion should also be checked and observed during the follow-up examination.
- For combination with other PETER BREHM GmbH components, please refer to the respective instructions for use. Follow the surgical techniques. In case of ambiguity, contact PETER BREHM GmbH.

*BIOLOX® *delta* and BIOLOX® *forte* are registered trademarks of CeramTec GmbH.

Disassembly

! NOTE

To avoid transverse forces acting on instruments, the Cardan Screw Driver AF 5 (max. permitted deflection 10°) must be used.

21

Releasing the pretensioned components and disassembling the implant

With the introduction of the new monoblock neck segments in 2024, only the implantation of MRP-TITAN monoblock neck segments is described in the instrumentation guide. In the chapters on „Disassembly“ and „Removing the definitive implant“, the two situations of monoblock neck segments (new from 2024) and extension sleeve (old before 2024) are described.

The sealing screw and the screw M6 are unscrewed and removed with the *Cardan Screw Driver AF 5* and the *Tommy Bar for Socket Head Wrench AF 6*. Then the implant can be disassembled with the aid of the impression instrument (see page 26, item 12). Please note that the neck segments in the lengths S, M, L, SH, MH and LH are to be instrumented identically. The Impression Rod for Impression Instrument is with threaded part is only to be used if neck sections of the lengths S, M and L have been combined with an extension sleeve.

! NOTE

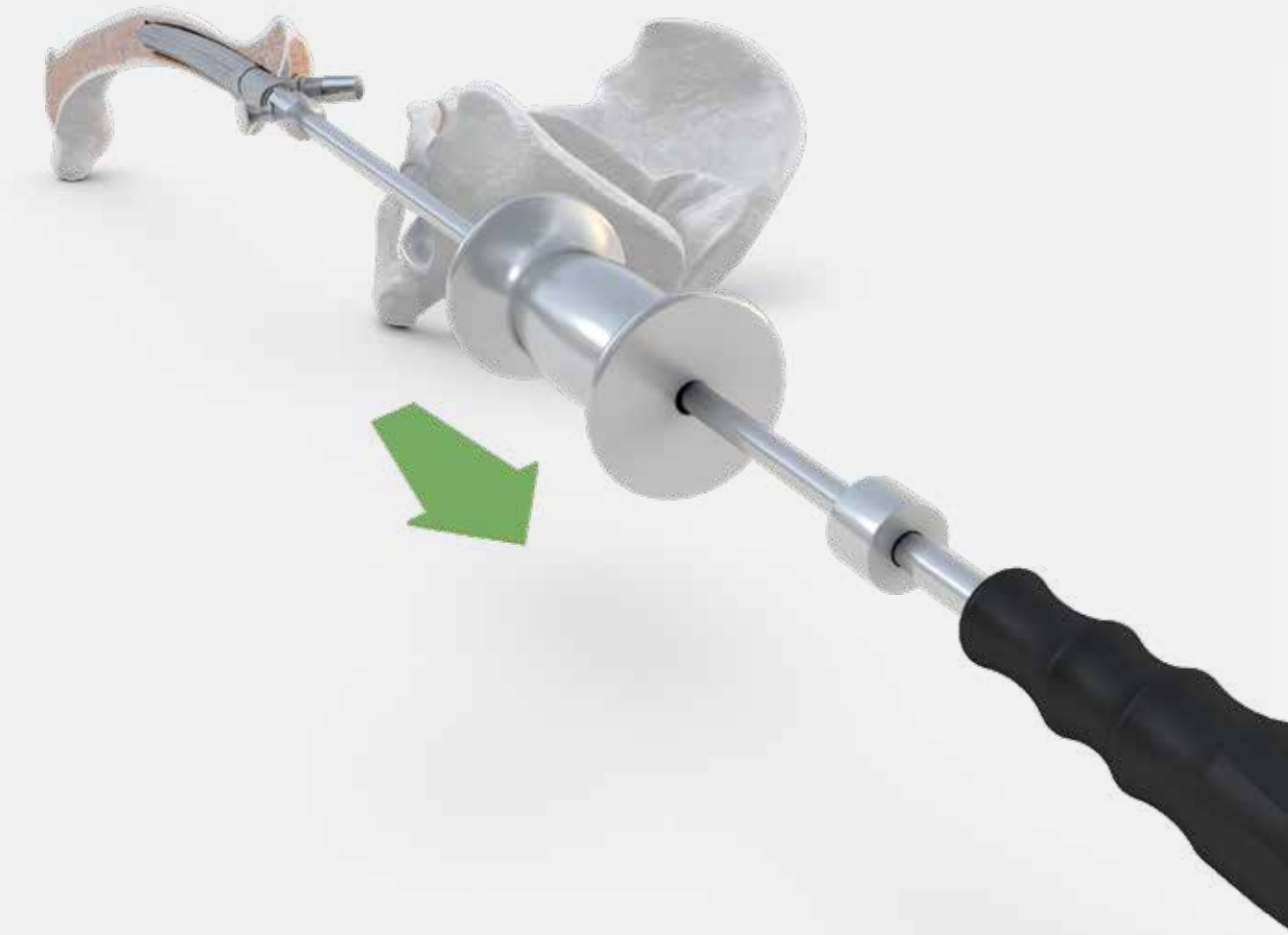
- As soon as a morse taper shows signs of corrosion or damage, the Anchoring Stem must be replaced.
- Due to the level of activity or the body weight of the patient, an additional setting behaviour of the components may occur, which means that separation of the implants is no longer possible.
- Do not use T*orque Limiter 25±1Nm* to loosen screw connections.

! NOTE

- When loosening screw connections, always use the counterholder to prevent the transfer of rotational forces with risk of fracture to the bone.
- To loosen the tight morse taper junction of the Neck Segment, it is recommended to hit the Spindle of the Handle f. Impression Instrument with a metal hammer with repeated blows in the axial direction. The impulses of the metal hammer blows can cause loosening.
- The M6 screw short/long is only approved for single use with torque, do not reuse!

MRP-TITAN

SUPPLEMENTARY SURGICAL TECHNIQUE



Removing the definitive implant

22

Removing with the *Handle for Prosthesis Inserter/Remover*
With the introduction of the new monoblock neck segments in 2024, only the implantation of MRP-TITAN monoblock neck segments is described in the instrumentation guide. In the chapters on „Disassembly“ and „Removing the definitive implant“, the two situations of monoblock neck segments (new from 2024) and extension sleeve (old before 2024) are described.

Three situations are distinguished when removing the prosthesis: For all three situations you will need the *Guiding Rod*, the *Handle for Prosthesis Inserter/Remover* and a *Knurled Screw + Sliding Disk* to secure the construct. Note that the *Guiding Rod* must be screwed all the way into the prosthesis. Then the *Handle for Prosthesis Inserter/Remover* is slid over the *Guiding Rod* and secured with a *Knurled Screw + Sliding Disk*. To secure the connection, proceed as follows: Screw in the *Knurled Screw* as far as it will go. Then insert the *Socket Wrench SW3,5* at a right angle and give it an additional half turn clockwise to secure the construct.

Components for removing the definitive implant:

1. *Handle for Prosthesis Inserter/Remover*
2. *Guiding Rod*
3. *Knurled Screw S*
4. *Knurled Screw M and Sliding Disk*
5. *Knurled Screw L and Sliding Disk*

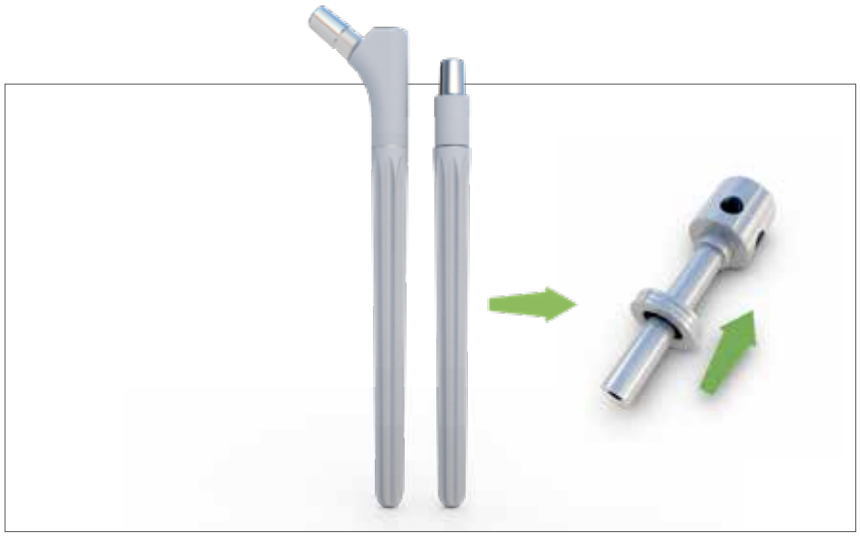
! NOTE

- Do not use implants/trial implants/instruments with visible damage.
- Use only implants/trial implants/instruments without visible contamination.
- Handle implants/trial implants/instruments exclusively with sterile surgical gloves.
- The implants are approved for single use only, do not reuse!
- Always hold the prosthesis extractor axially in the direction of force.
- It must be ensured that the Guiding Rod is completely screwed into the Trial Anchoring Stem stem manually or with the Socket Wrench SW3,5.

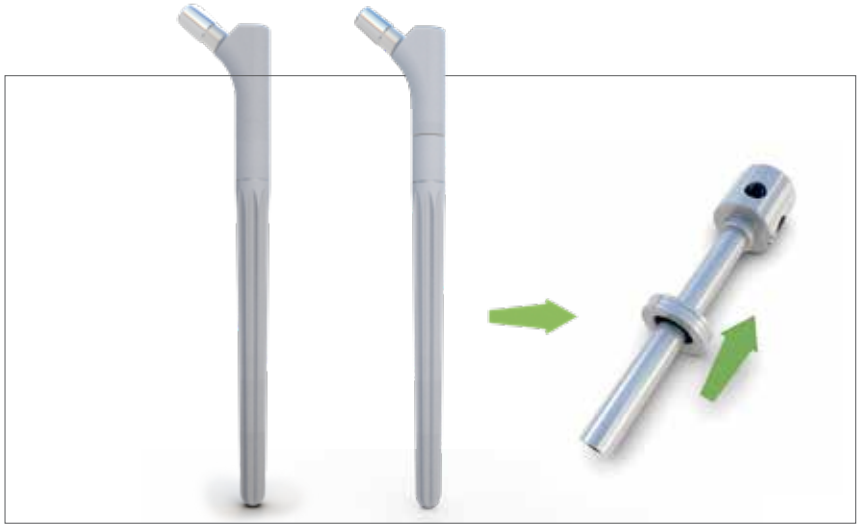
The length of the *Knurled Screw* depends on the number of components to be removed.

Anchoring stem
↓
Knurled Screw S

Anchoring stem +
neck segment
(S, M, L)
or
Anchoring stem +
extension sleeve
↓
Knurled Screw M and *Sliding Disk*



Anchoring stem +
neck segment (SH,MH, LH)
or
Anchoring stem
+ extension sleeve
+ neck segment (S, M, L)
↓
Knurled Screw L and *Sliding Disk*



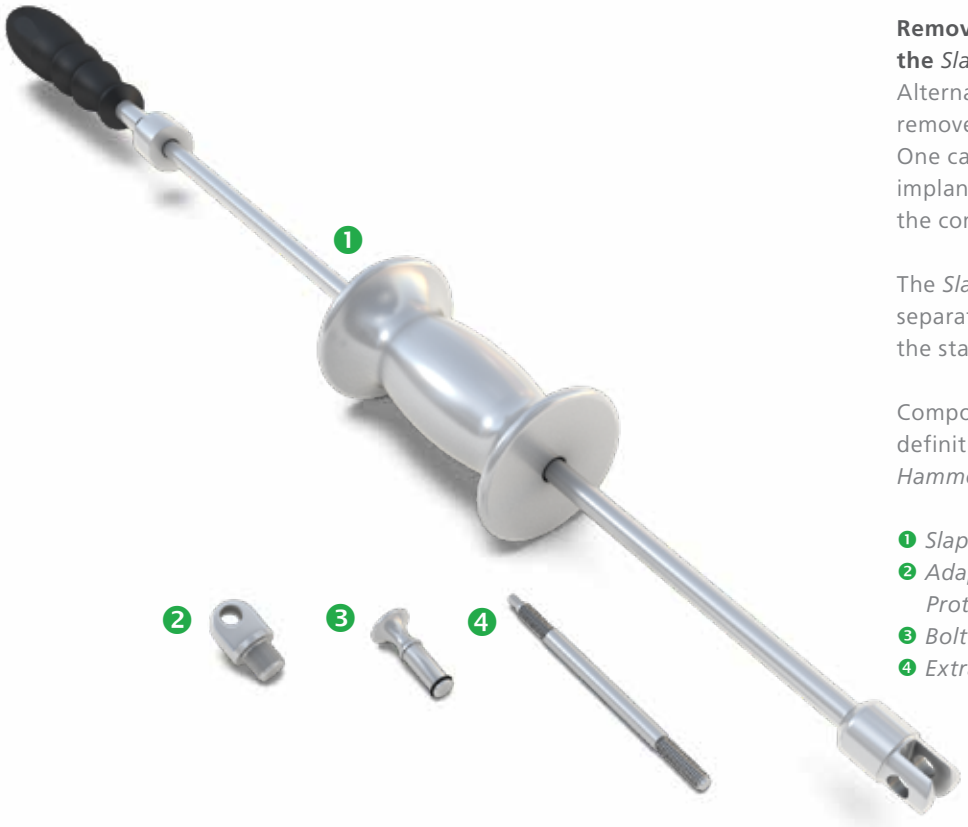
Removing the definitive implant

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

! NOTE

Tighten *knurled screw* again with *Socket Wrench SW3,5.*

23



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:*

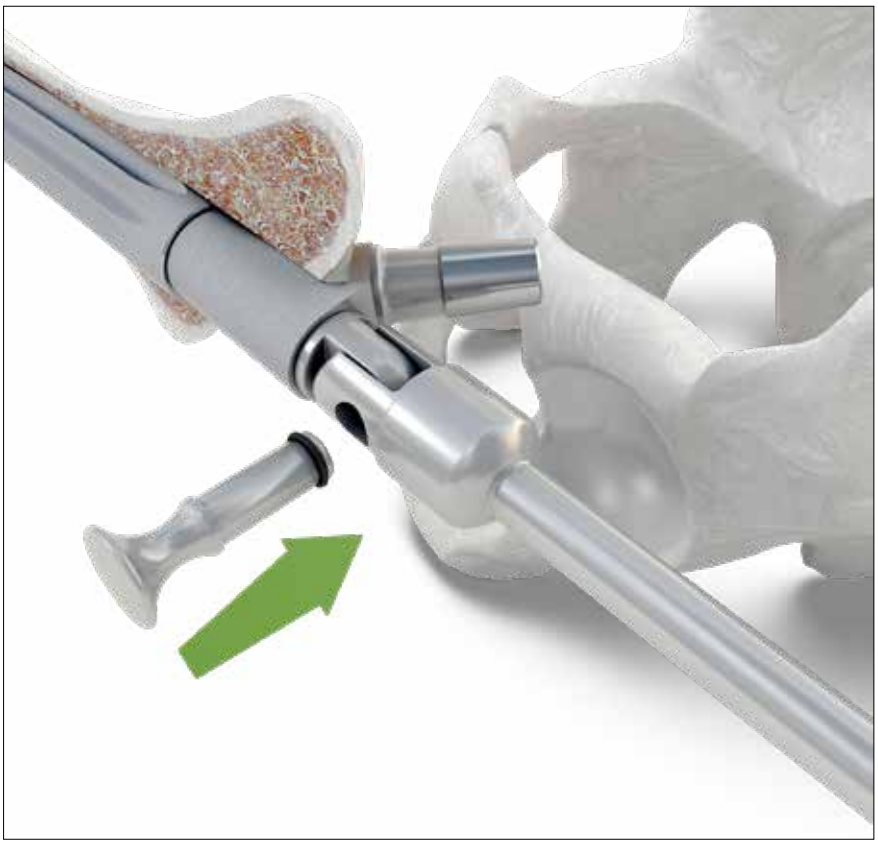
1. *Slap Hammer*
2. *Adapter M 14x1 for Prothesisneck*
3. *Bolt*
4. *Extractor M6*

! NOTE

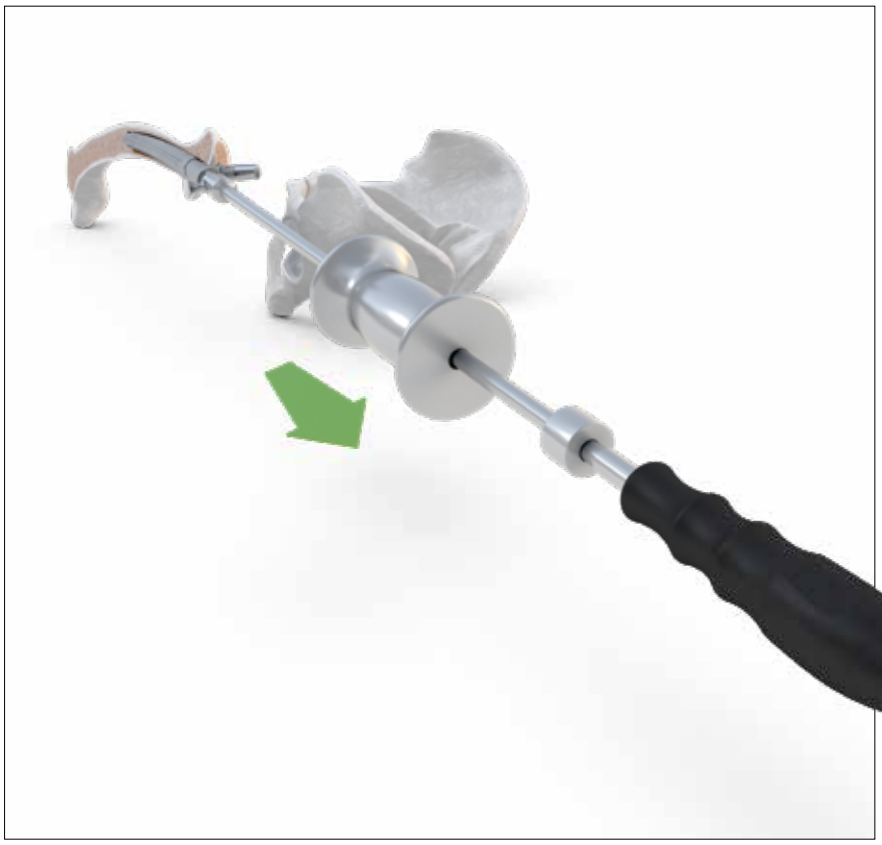
Remove the sealing screw M14x1 and screw M6 first. Use the *counter holder* and the *allen key SW5 + Tommy Bar* for this (see page 45).

Before the *Slap Hammer* can be connected, the *Adapter M 14x1 for Prothesisneck* must be screwed into the neck segment.

Then the *Adapter M 14x1 for Prothesisneck* and *Slap Hammer* are connected with the *Bolt.*



Removing the definitive implant



The implant is extracted by moving the sliding weight on the *Slap Hammer.*

! NOTE

Always hold the prosthesis extractor axially in the direction of force.

24

Removing the anchoring stem with the *Slap Hammer*
To remove the anchoring stem, the *Extractor M6* is screwed into the anchoring stem.

The *Adaptor for Extractor* is mounted on the *Extractor M6.*

Then the *Slap Hammer* is connected to the *Adapter for Extractor,* secured with the bolt and then the anchoring stem is extracted.

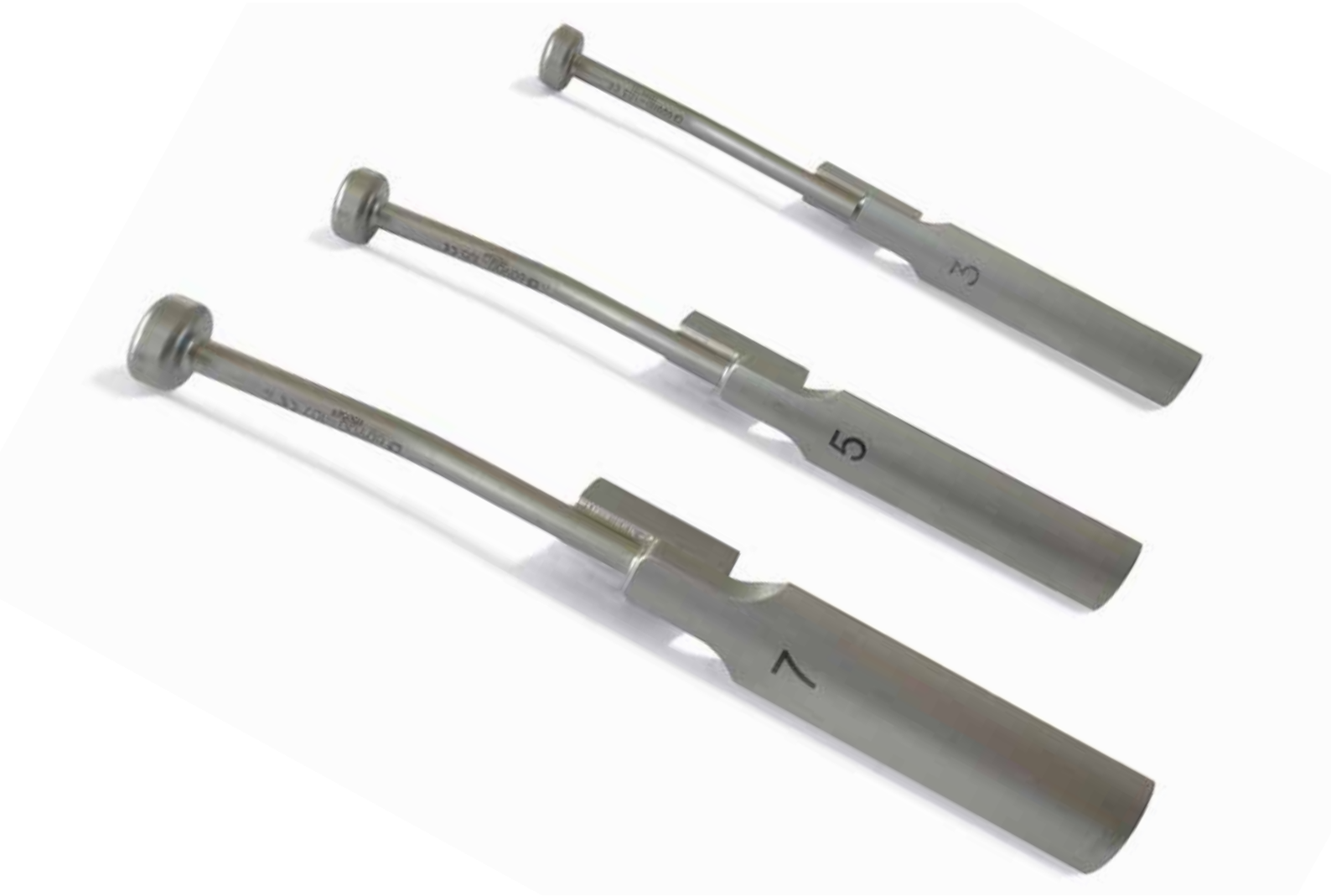
! NOTE

Always hold the prosthesis extractor axially in the direction of force.

MRP-TITAN

SUPPLEMENTARY PRODUCTS

Impaction Grafting System (IGS)



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

- Guided mallet system

MRP-TITAN mdV Aiming device

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 radiation as the locking bolt can be placed without fluoroscopic control.

KAM-TITAN

Advantages of the system

- Neutral or anatomic (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°)
- Retreat options at every step of the procedure
- Can be used without restriction where bony ingrowth is absent or unlikely

MRS-TITAN Comfort

Advantages of the system

- Stable bridging of defects
- Anatomic implant design
- 3 mm thick reinforcement ring
- Optimal defect reconstruction (biological and metallic)
- Restoration of physiological joint geometry, optimal alignment of anteversion and inclination
- Trial reduction possible
- Completely cementless implantation

! NOTE

The MRS-TITAN Comfort can only be combined with products released by PETER BREHM GmbH.

MRS-TITAN Standard and Maximum

Advantages of the system

- The system is suitable for a broad spectrum of indications as it covers a large range of bone defects (Paprosky types I - IIIb)
- Innovative surface structure: Open-pored, trabecular, and rough for high initial stability and long-term osseointegration
- No use of cobalt and chrome (CoCrMo alloy)
- Modular iliac peg provides a high degree of flexibility
- Optimized screw position with or without anatomical strap, with or without iliac peg
- Screw holes can be sealed, reducing the risk of osteolysis due to polyethylene particulate wear
- Clear intuitive technique with a few selected instruments
- Fast surgical technique

! NOTE

The MRS-TITAN Standard and Maximum can only be combined with products released by PETER BREHM GmbH.

References

1. Wirtz D C, Morlock M, Schröder R. (Hrsg.). Leitfaden Modulare Revisionsendoprothetik. Erfolgsfaktoren für einen gelungenen Schaftwechsel. Springer-Verlag Berlin Heidelberg 2017
   E-book (German): peter-brehm.de/downloads

2. Wirtz D C, Morlock M, Schröder R (Hrsg.). Einfluss einer Querkraft auf das Fügeverhalten von Steck-Konus-Verbindungen. In: Leitfaden Modulare Revisionsendoprothetik. Erfolgsfaktoren für einen gelungenen Schaftwechsel. Springer-Verlag Berlin Heidelberg 2017, S. 30

3. Huber G, Weik T, Morlock MM. Schädigung eines Hüftendoprothesenschafts durch Einsatz eines Hochfrequenzmessers. Orthopäde 2009;38:622-625

4. Konrads C, Wente MN, Plitz W, Rudert M, Hoberg M. Implantatschädigung durch Einsatz eines Hochfrequenzmessers. Analyse von vier Hüftendoprothesenschaftbrüchen. Orthopäde 2014;43:1106-1110

5. Kubacki GW, Sivan S, Gilbert JL. Electrosurgery Induced Damage to Ti-6Al-4V and CoCrMo Alloy Surfaces in Orthopaedic Implants In Vivo and In Vitro. J Arthroplasty 32(2017):3533-3538

6. Ceretti M, Falez F. Modular titanium alloy neck failure in total hip replacement: analysis of a relapse case. SICOT J. 2016 Apr 29;2:20 https://www.ncbi.nlm.nih.gov/pubmed/27163109

7. Grupp TM, Weik T, Bloemer W, Knaebel HP. Modular titanium alloy neck adapter failures in hip replacement - failure mode analysis and influence of implant material. BMC Musculoskelet Disord. 2010 Jan 4;11:3
   https://www.ncbi.nlm.nih.gov/pubmed/20047653

8. Krull A, Morlock MM, Bishop NE. The Influence of Contamination and Cleaning on the Strength of Modular Head Taper Fixation in Total Hip Arthroplasty. J Arthroplasty 2017 Oct;32(10):3200-3205

9. Lavernia CJ, Baerga L, Barrack RL, Tozakoglou E, Cook SD, Lata L, Rossi MD. The effects of Blood and Fat on Morse Taper Disassembly Forces. Am J Orthop (Belle Mead NJ). 2009 Apr;38(4):187-90
   https://www.amjorthopedics.com/sites/default/files/issues/articles/038040187.pdf

10. Pennock AT, Schmidt AH, Bourgeault CA. Morse-type tapers: factors that may influence taper strength during total hip arthroplasty. J Arthroplasty 2002 Sep;17(6):773-8

11. Wirtz D C, Morlock M, Schröder R (Hrsg.). Reinigen, Trocknen und Montieren der Konusverbindung. In: Leitfaden Modulare Revisionsendoprothetik. Erfolgsfaktoren für einen gelungenen Schaftwechsel. Springer-Verlag Berlin Heidelberg 2017, S. 20 E-book (German): peter-brehm.de/downloads

! NOTE

With the introduction of the new monoblock neck segments in 2024, only the implantation of MRP-TITAN monoblock neck segments is described in the instrumentation guide. In the chapters on „Disassembly“ and „Removing the definitive implant“, the two situations of monoblock neck segments (new from 2024) and extension sleeve (old before 2024) are described.

This brochure is intended for physicians only and is not suitable as a source of information for laypersons. The information about the products and/or procedures described in this brochure is of a general nature and does not represent a medical advice or a medical recommendation. 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.

PETER BREHM
Die Präzision in Titan
für den Menschen

PETER BREHM GmbH
Am Mühlberg 30
91085 Weisendorf
Germany

Phone + 49 9135 7103-0
Fax + 49 9135 7103-16
info@peter-brehm.de

peter-brehm.de

CE 0482

op-LBL609-21-20250327-EN-MDR

Join us on