MRP-TITAN

THE MODULAR REVISION PROSTHESIS FOR ALL SITUATIONS IN EVERYDAY CLINICAL PRACTICE

SURGICAL TECHNIQUE

PETER BREHM
Die Präzision in Titan
für den Menschen

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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)
- Torsionfree Preloading Instrument (TOV)

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
- Curved anchorings stems are available starting at 250 mm length, with a curvature in the right place
  - reduced risk for fissures
- Four neck versions, CCD angle of 130°, 12/14 taper
- 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 ▸ no galvanically induced osteolysis
- 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 and extension sleeve where indicated
↓↑
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)

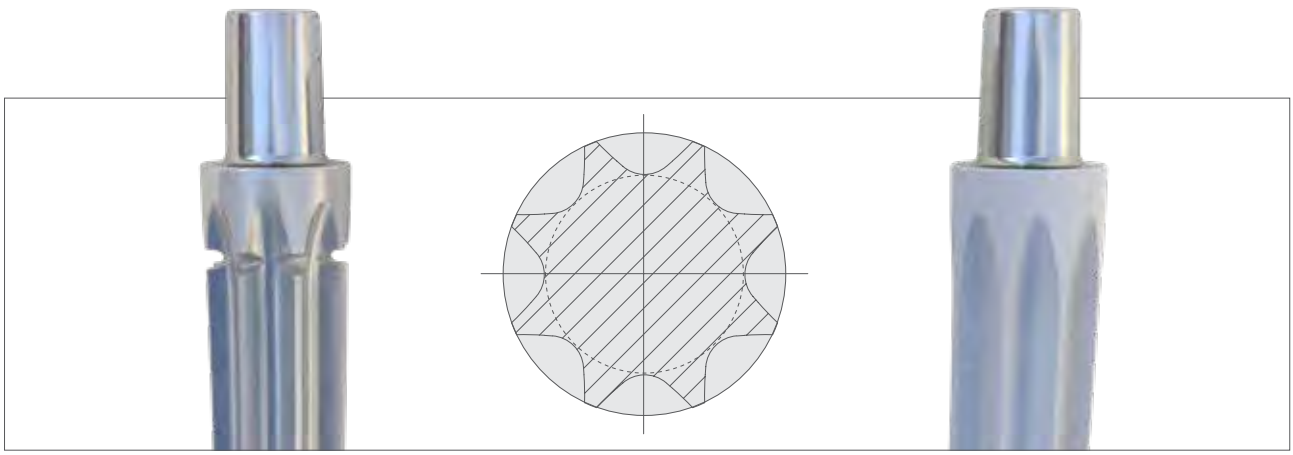
MRP-TITAN mdV (with distal interlocks)
(Tapered, 2 mm slope)

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 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 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.

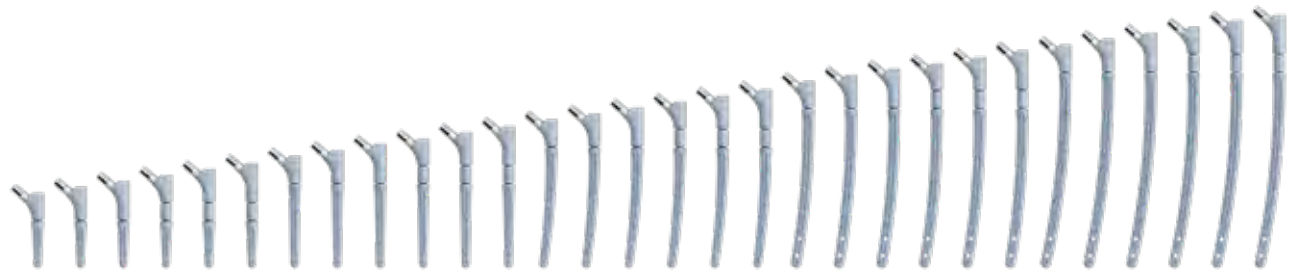
❹ For trochanter segment
Large, CCD angle of 130°
Small, CCD angle of 130°

In case of extreme defects or tumor resections, the proximal part can be completely reconstructed.

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) are available for the modular MRP-TITAN system. An extension sleeve (30 mm) available in various diameters can also be used.

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



MRP-TITAN 80
130 - 180 mm

MRP-TITAN 140
190 - 240 mm

MRP-TITAN 200
250 - 300 mm

MRP-TITAN 260
310 - 360 mm

MRP-TITAN 320
370 - 420 mm

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.

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

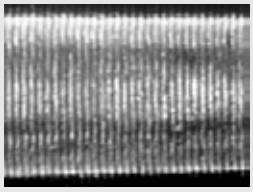
The safety of a morse taper junction depends essentially on the design, the material and the machining. PETER BREHM GmbH consistently and successfully pursues the following points:

- **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

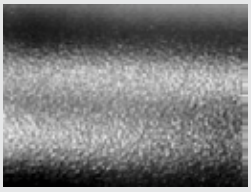
- **Complete manufacturing from one material (TiAl6Nb7 or TiAl6V4): neck segment, anchoring stem and all screws.**
  - reduction of stress peaks, no different e-moduli
  - reduction of contact corrosion (and thus fretting)

- **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

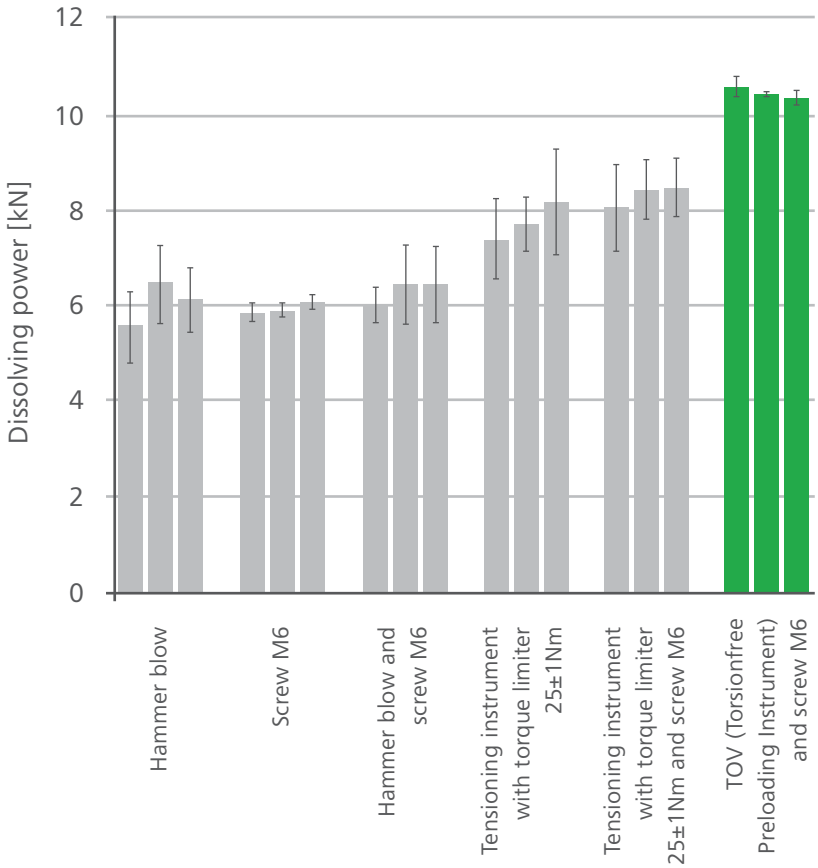


MRP-TITAN
taper shot peened
(steel balls)

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.

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 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 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 the morse taper shows signs of corrosion or damages, the 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

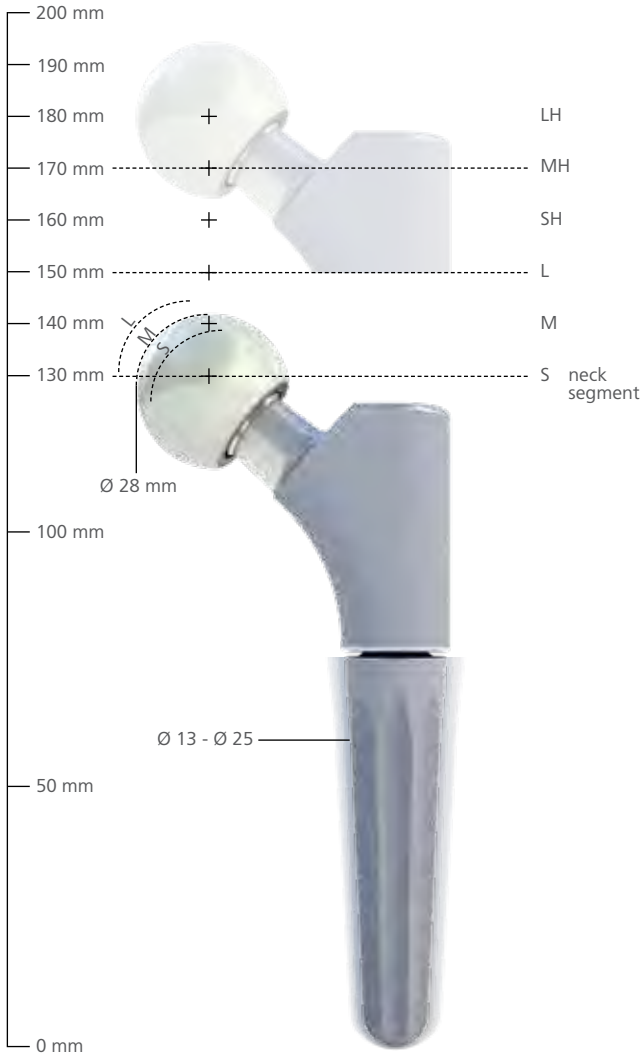
The goal of total arthroplasty is the optimum anatomic reconstruction of the affected joint.

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 the use of the longest possible neck segment without lateralization.

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

Strict axial access to the medullary canal during throughout the surgery is essential for safe instrumentation. Force exerted by transverse forces on the instruments (e. g. by pressing the soft tissues) must be excluded by positioning or choosing another surgical approach.

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)

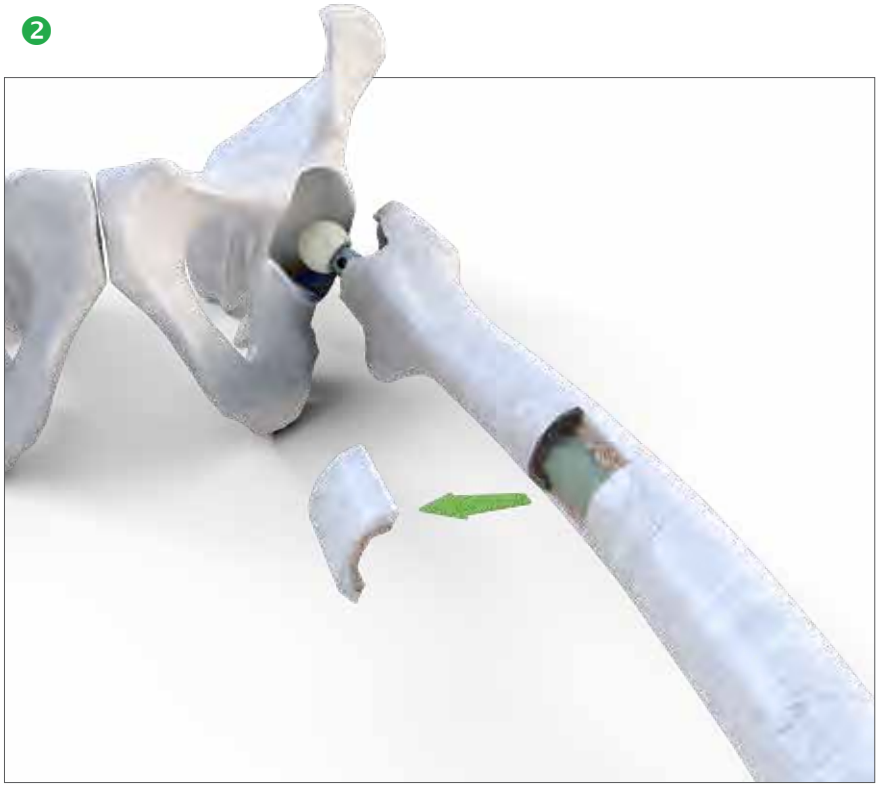
05

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).

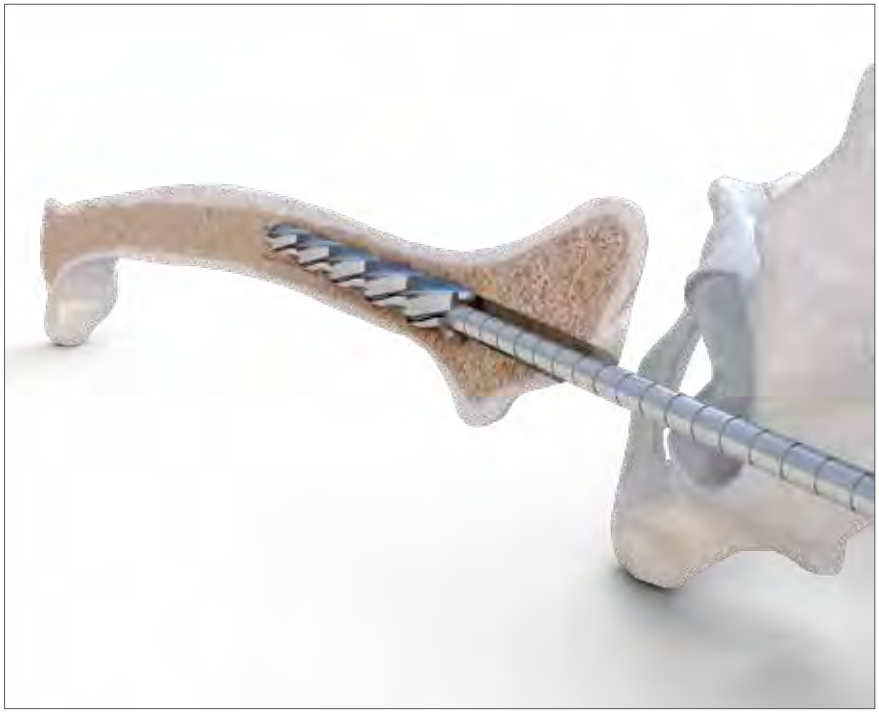
❷



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

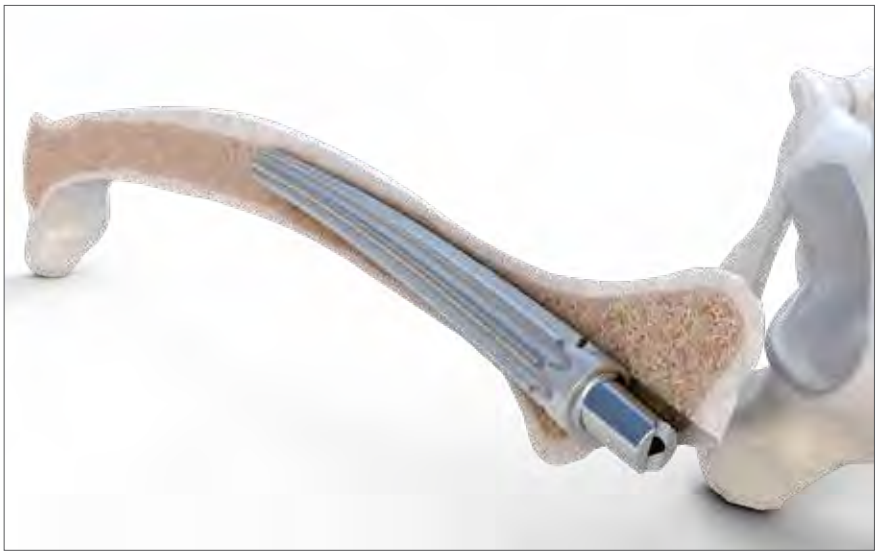
Straight anchoring stems
Where straight anchoring stems are used, it is recommended to prepare the medullary canal with the straight *Rasps with AO Adapter.* If these are not available, it is possible to use the flexible reamers as described above (06). The implant bed is reamed incrementally. The implant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

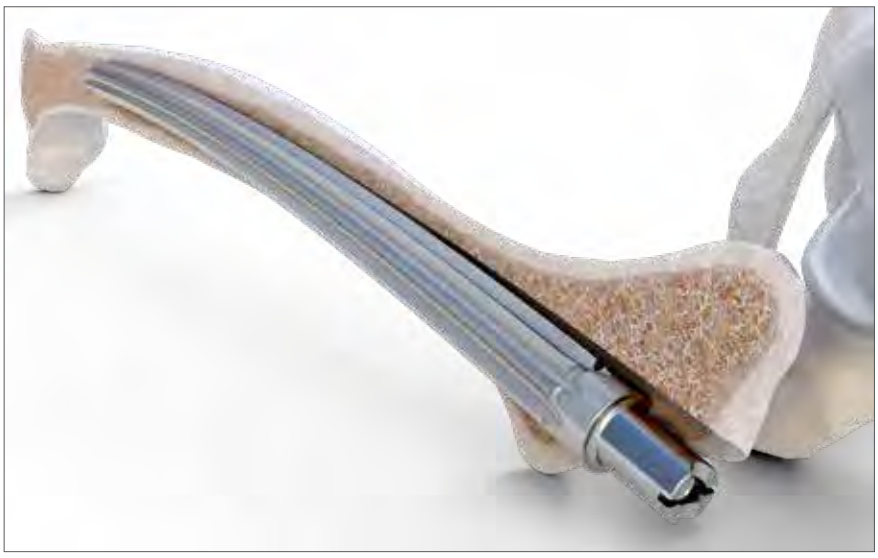
Trial assembly

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 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.



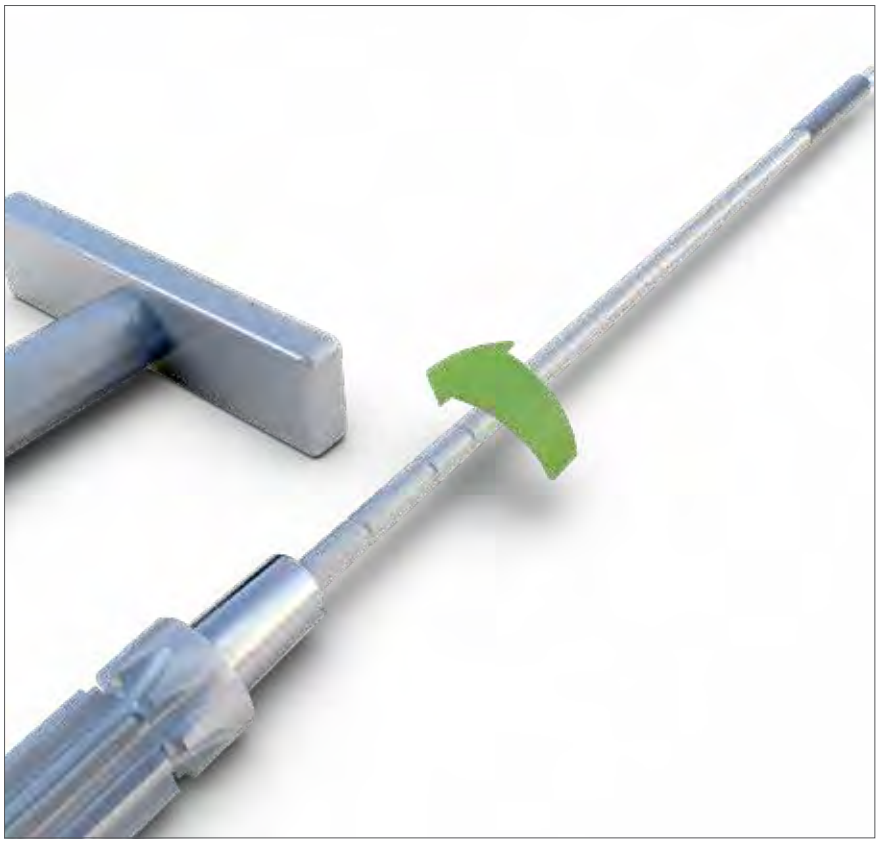


09

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 the guide rod, always make sure that it is free of contamination (e. g. blood and tissue residues).

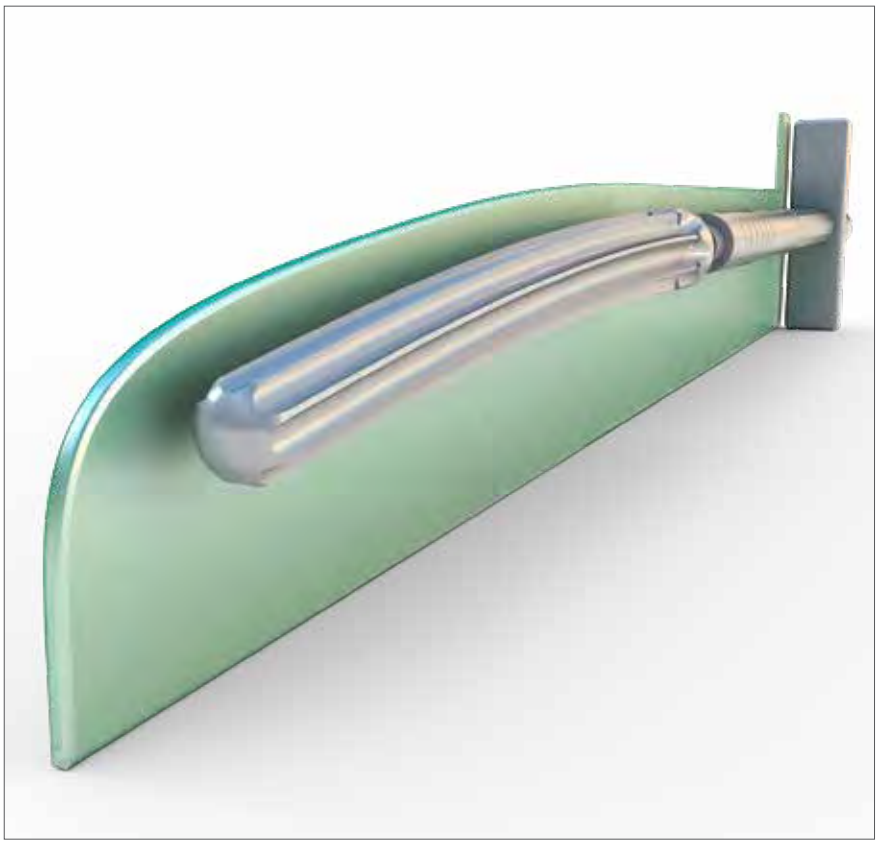
Trial assembly

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.

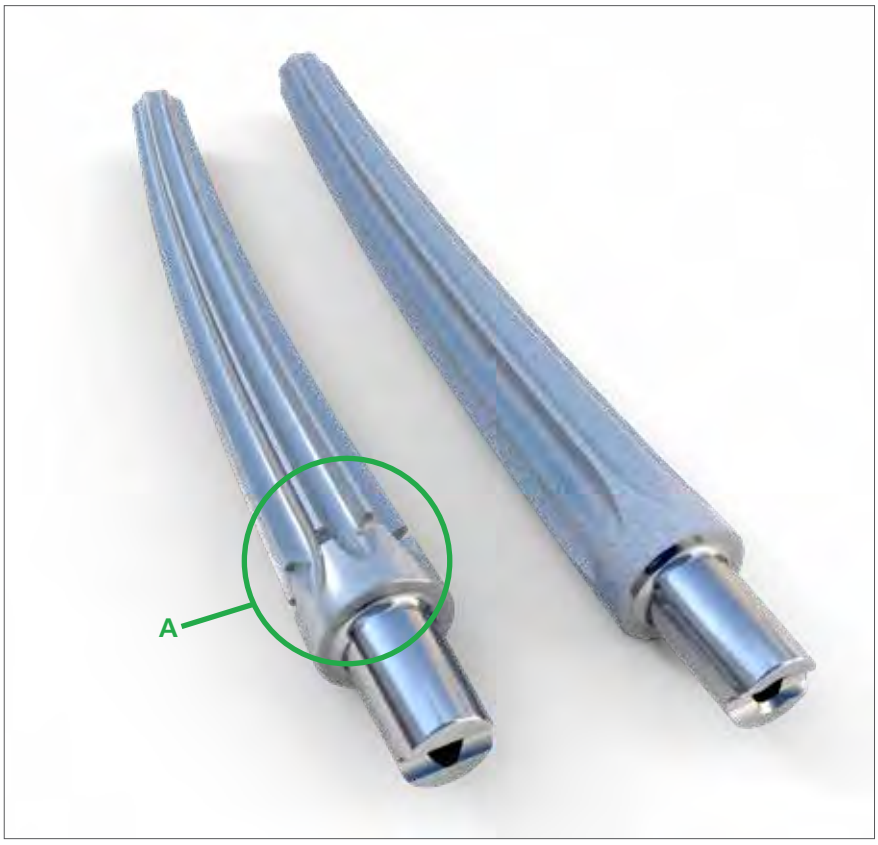
The *Trial Anchoring Stem* is then impacted into the prepared femur and securely seated with hammer blows.

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



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

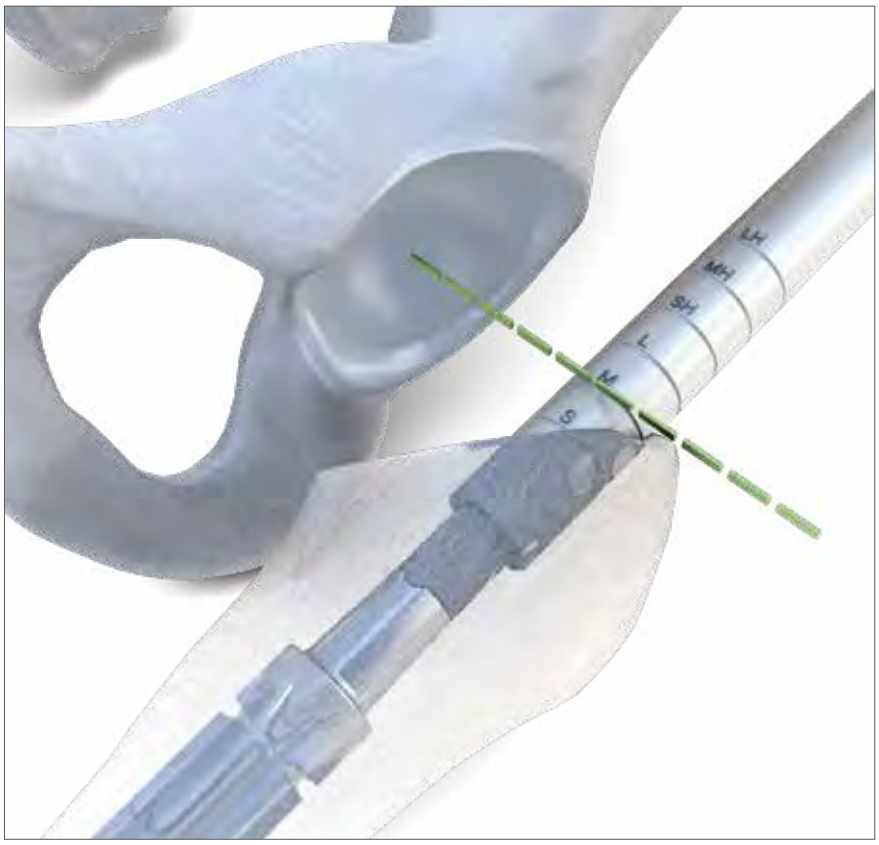
A notch *(A)* in the *Trial Anchoring Stem* identifies it on radiographs.

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).



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 the use of the longest possible neck segment 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

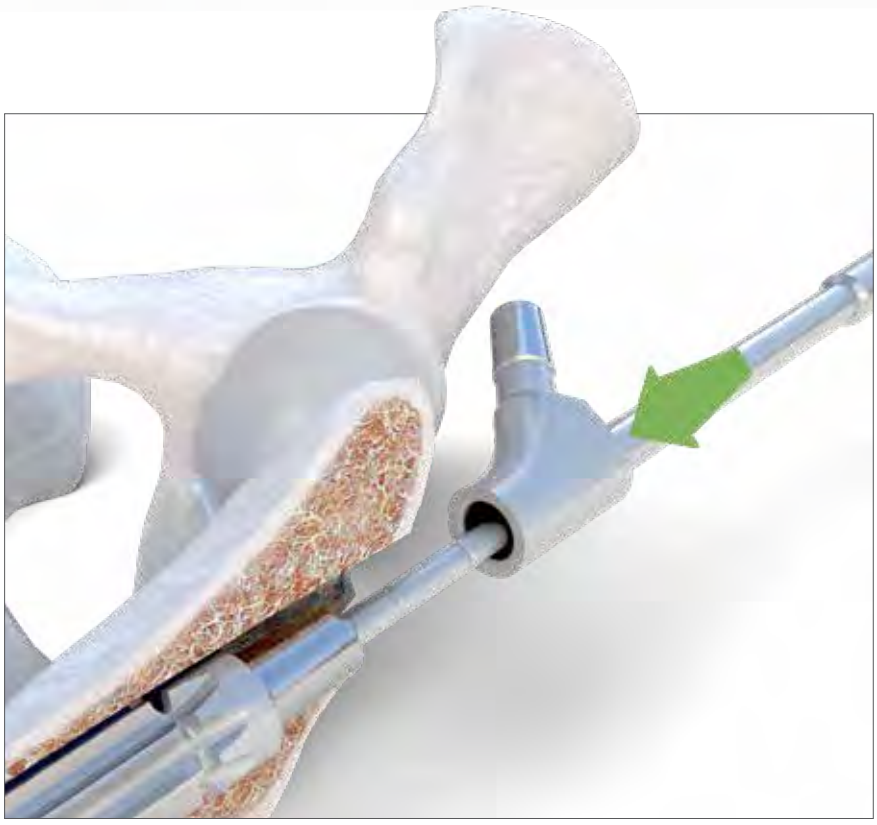
When placing and reaming for the neck segment, always use the *Guiding Rod*.
Surface damages due to improper use of the *Guiding Rod* and other instruments (forceps, high-frequency instruments, hooks, etc.) should be avoided intraoperatively.
Contact between high-frequency electrocauterization instruments and metal implants must be avoided. The fatigue strength of the implant can be severely impaired by flashover, so that implant fracture can occur later.[3,4,5]

Trial assembly

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

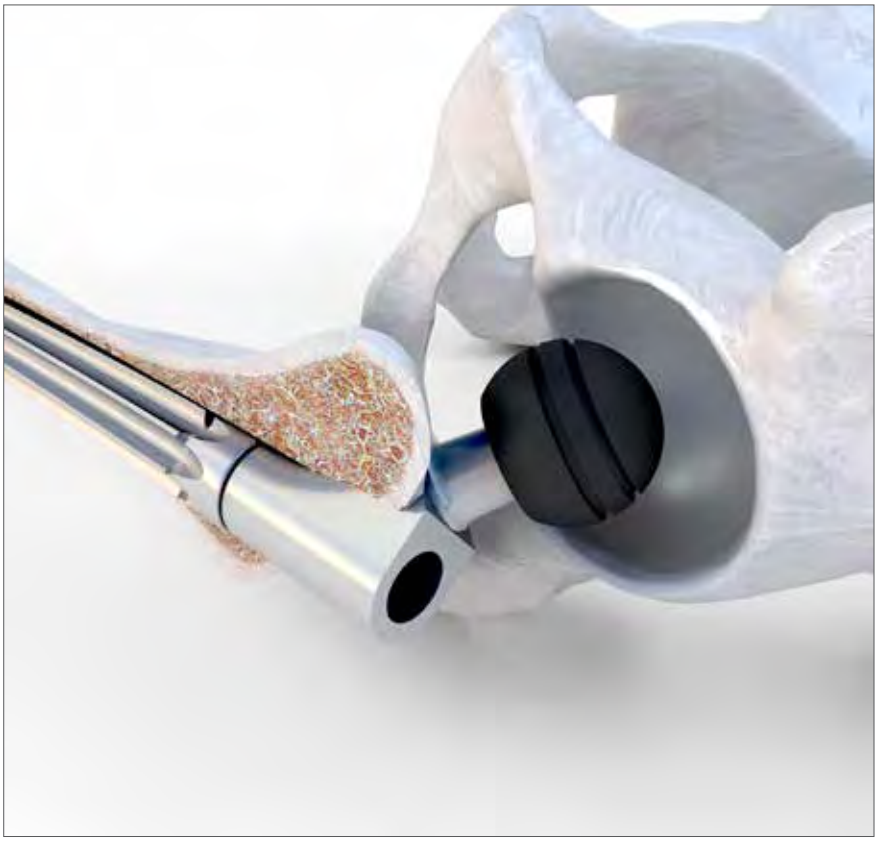
After the taper surface on the end of the stem has been cleaned, the *Seating instrument prothesis Neck* for the selected *Trial Neck Segment* is inserted over the *Guiding Rod* in a defined manner. The *Trial Neck Segment* can be fixed in the desired anteversion by tapping it lightly with a hammer.

If an extension sleeve is also required, then the *Trial Neck Segment* and the *Trial Extension Sleeve Ø 16mm* are first assembled by pressing them tightly together before they are seated.



! NOTE

Only one extension sleeve may be used.



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, unless that checking the correct leg length, soft tissue tension and function was positive.

12

Disconnecting the trial assembly
The impression instrument facilitates controlled release of the individual components *Trial Anchoring Stem*, *Trial Extension Sleeve Ø 16mm*, 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 Ø 16mm*
2. *Trial Extension Sleeve Ø 16mm* 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 Ø16 mm* (❶), then you must use the *Impression Threaded Rod for Impression Instrument* (separating rod with threading).

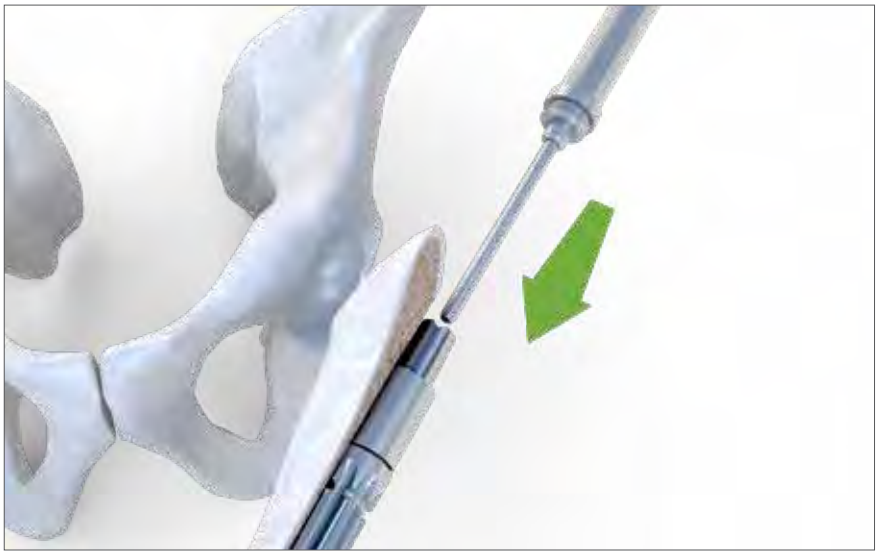
The *Impression Rod for Impression Instrument* is screwed into the *Trial Extension Sleeve Ø 16mm* with the *Socket Wrench SW 3.5*. The assembled impression instrument is slid over the rod and screwed into the *Trial Neck Segment*.

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

! NOTE

Always use counterholders when working with the pressing-off instrument to prevent the transfer of rotational forces to the bone.

If the *Trial Extension Sleeve Ø 16mm* 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 Ø 16mm*. The assembled impression instrument is slid over it and screwed into the *Trial Extension Sleeve Ø 16mm.*

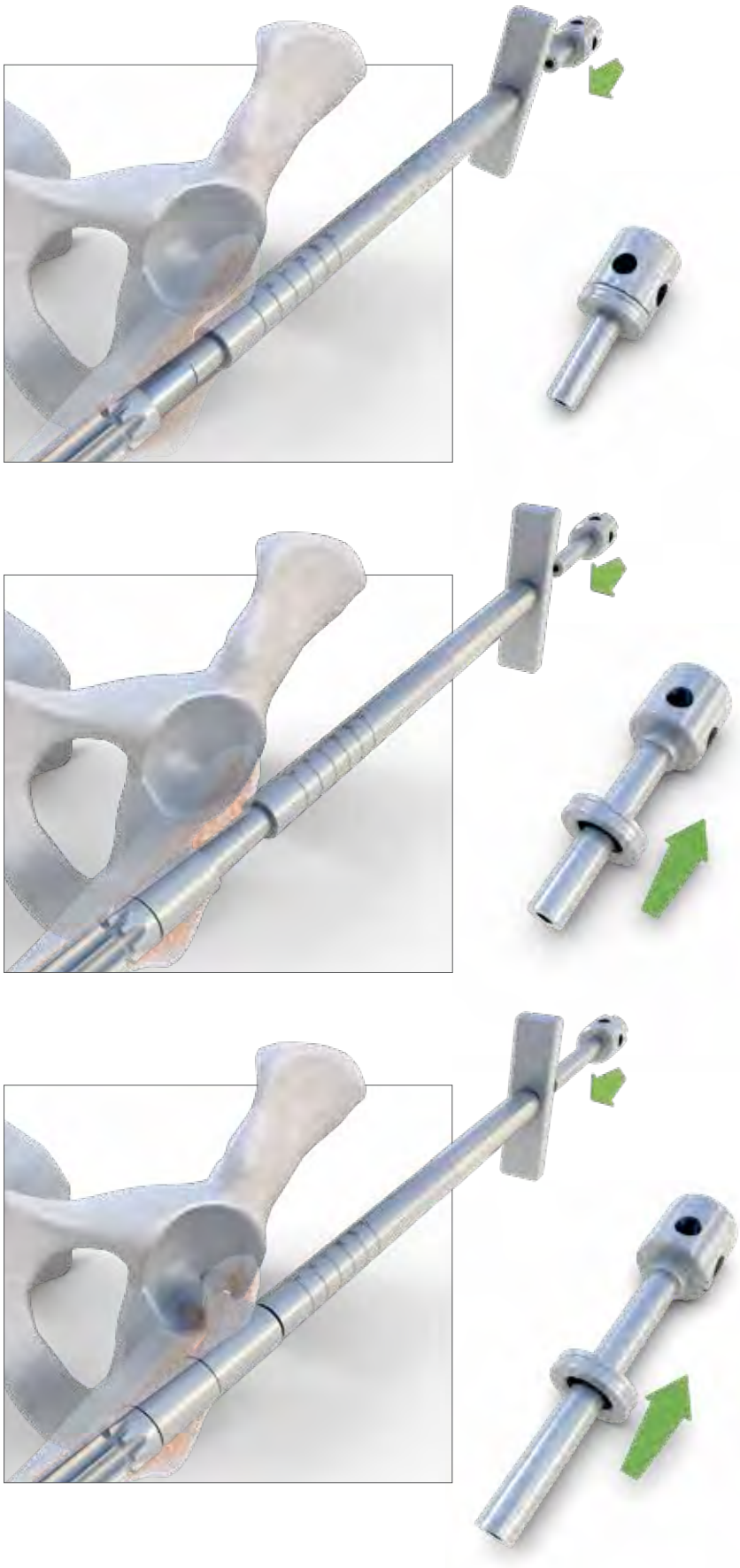
Then the components are separated from each other by turning the *Spindle*.

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 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 Neck Segment*
Or:
Trial Anchoring Stem and
Trial Extension Sleeve Ø 16mm
↓
Knurled Screw M
and Sliding Disk

Removal of the *Trial Anchoring Stem* and *Trial Neck Segment* and *Trial Extension Sleeve Ø 16mm*
↓
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.

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

14

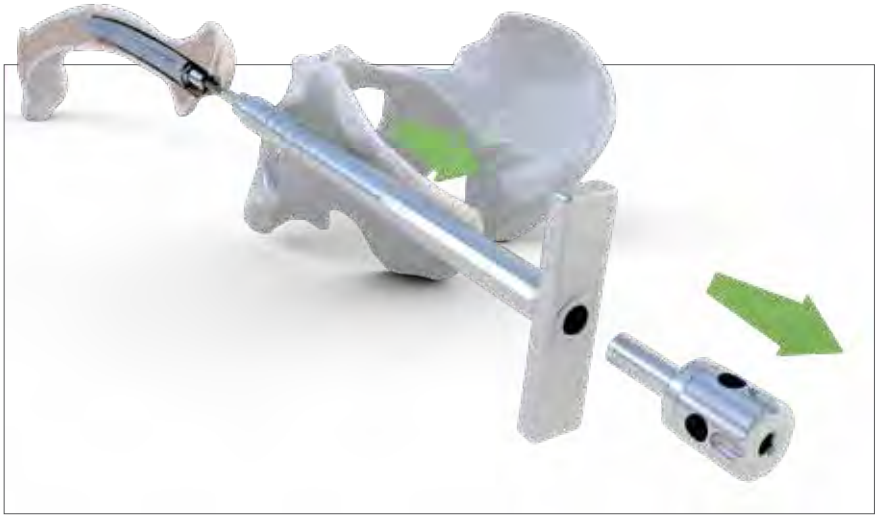
Placing the anchoring stem
The definitive anchoring stem is placed in the same manner as the *Trial Anchoring Stem*. The first step is to screw the *Guiding Rod* all the way into the anchoring stem. The *Handle for Prosthesis Inserter/Remover* is slid over it and the *Knurled Screw S* is screwed all 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

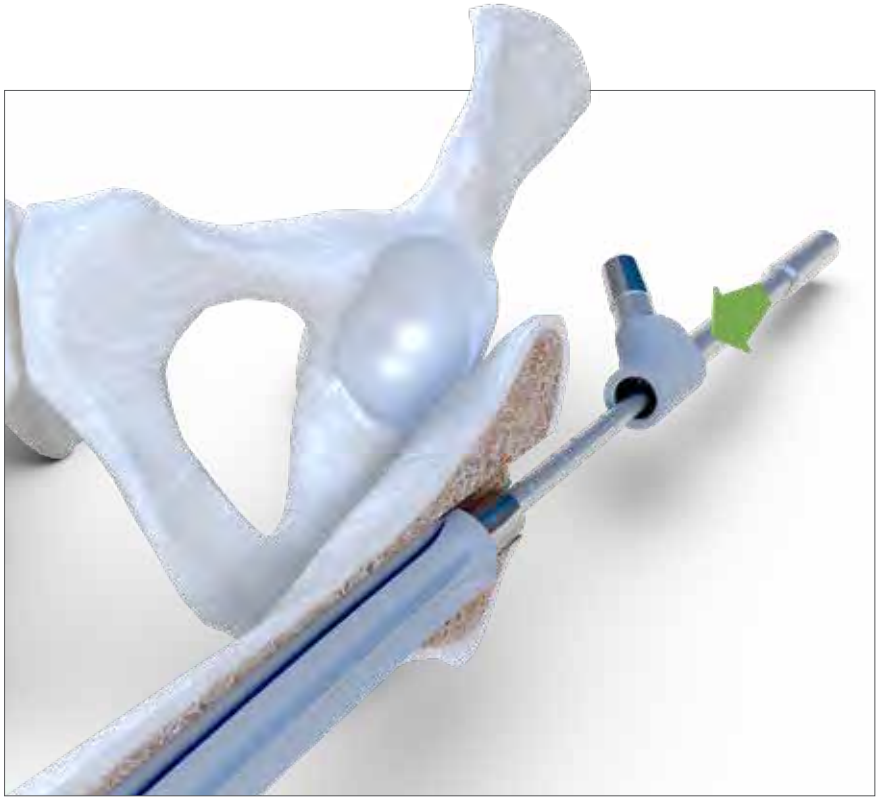
Before screwing in the *Guiding Rod* always make sure that it is free of contaminants such as blood or tissue residues.

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.



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



Make sure that the morse tapers are thoroughly cleaned from foreign bodies (e. g. bone residuals, blood, fat, other fluids, etc.) before joining. Only with correct cleaning and drying a safe joining is possible.[6-11]

! NOTE

Carefully clean, dry, and assemble the morse taper junction.

Pay attention to careful 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 the use of the longest possible neck segment 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. If required, an extension sleeve can be placed separately or in combination with the implant neck.

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

15

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

It must be ensured that no transverse forces act on the instruments, as these lead to a reduction in the joining forces![2]

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

Anchoring stem and neck segment

↓

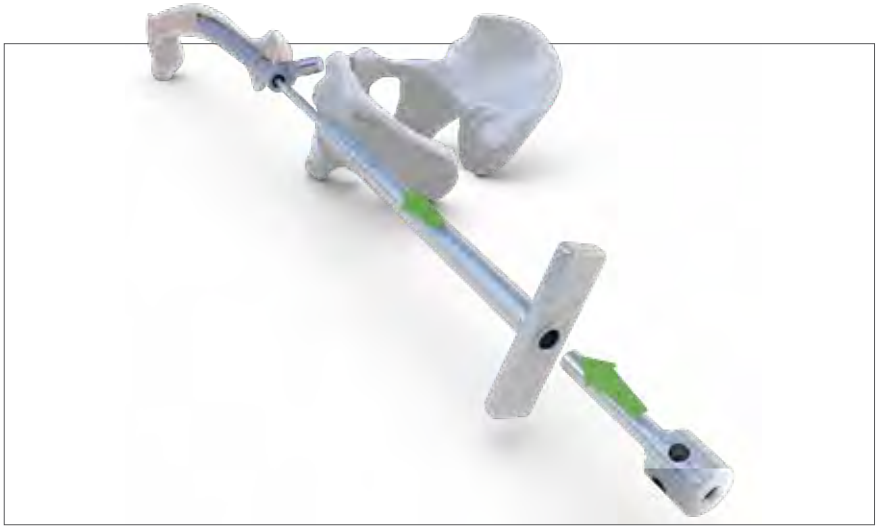
Knurled Screw M

Anchoring stem, neck segment, and extension sleeve

↓

Knurled Screw L

All 3 components are tensioned in one step together.



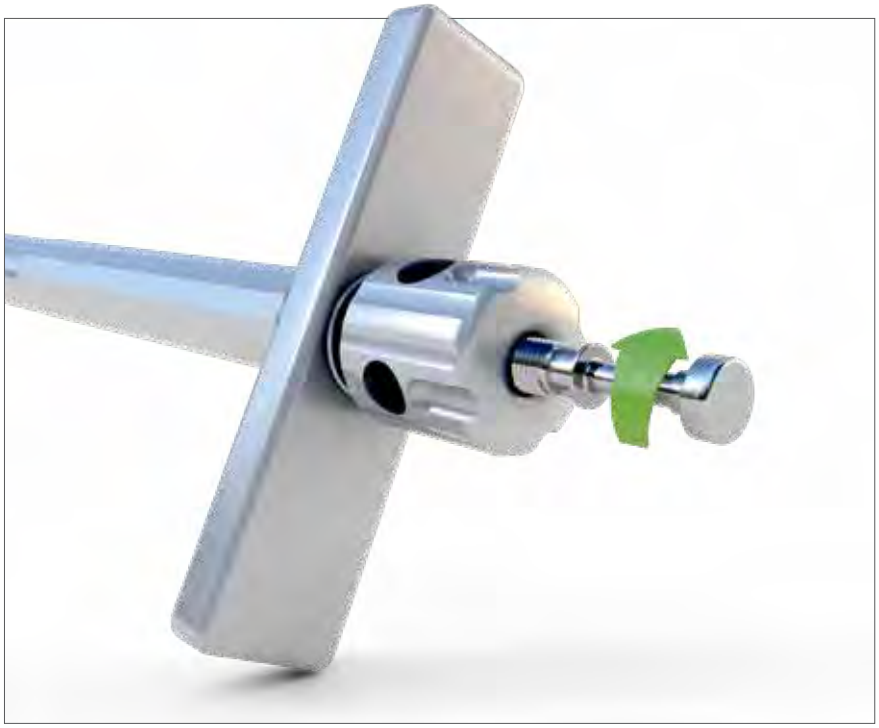
For definitive pretensioning, the *Handle for Prosthesis Inserter/Remover* is slid over the *Guiding Rod* (which is screwed in as far as it will go) and secured with the appropriate *Knurled Screw* for torsion-free preloading.

! 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 *Torsion-free 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

When working with the *TOV (Torsionfree Preloading Instrument)*, always use the *Counter Holder 12/14* 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

Always use a new *Stud Bolt* even if it had not been destroyed during the first aborted attempt.

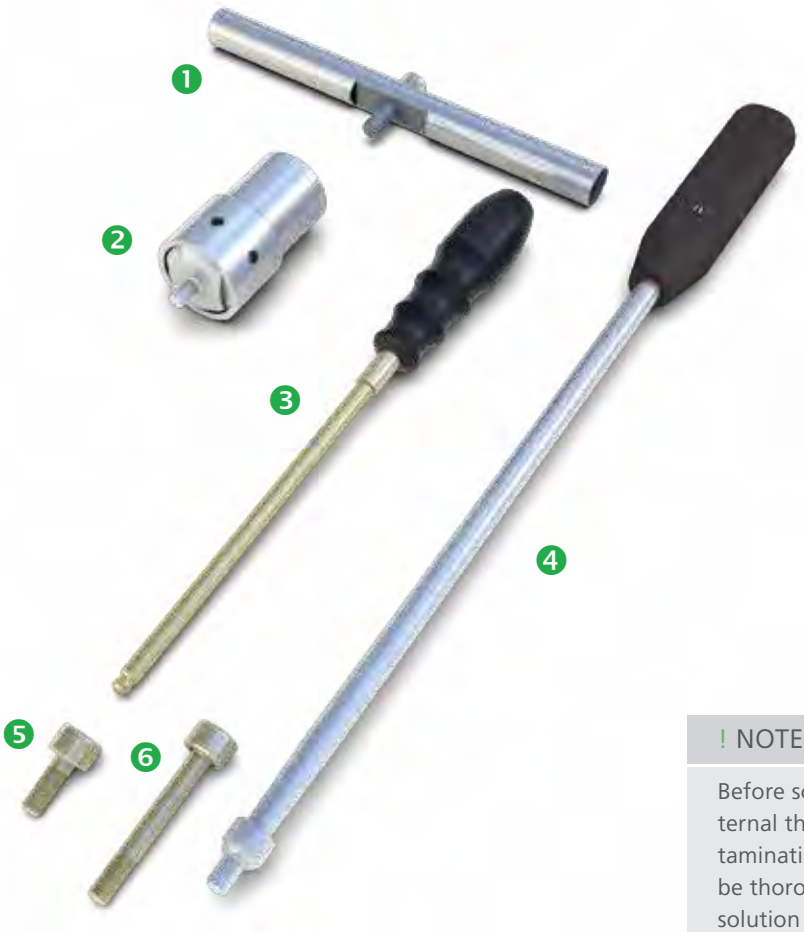
In case of a prematurely aborted tensioning attempt, dispose the *Stud Bolt.*

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 has been turned counterclockwise to the original position.



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

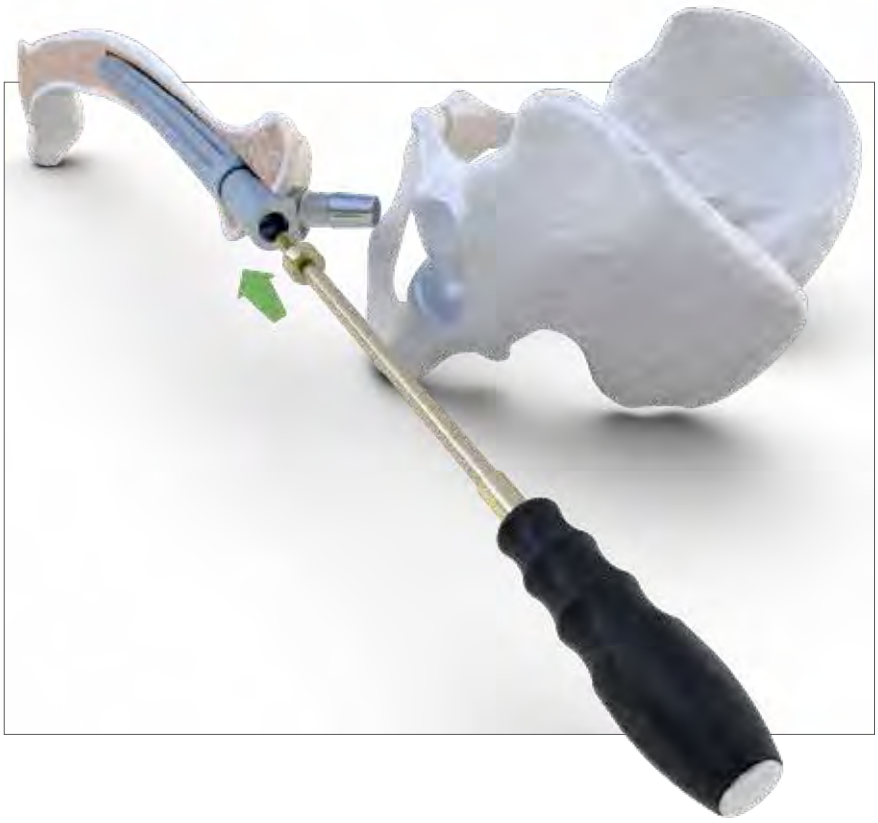
1. *Tommy Bar f. Socket Head Wrench AF 6*
2. *Torque Limiter 25±1 Nm*
3. *Allen Key SW5 Ball Head*
4. *Allen Key SW5*
5. Screw M6 (short)
6. Screw M6 (long)

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

Anchoring stem, neck segment
(S, M, L) + extension sleeve
= screw M6 (long)

! 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

To set the M6 screw, the *Allen key SW5 ball head* must be used, as it tolerates slight angular deviations during insertion. The M6 screw centres itself in the thread. It must be possible to screw in the M6 screw up to the support of the screw head with little effort. Make sure that the screw M6 itself is free of contaminants such as blood or tissue residues before you insert it.

Placing the definitive implant

To tighten the screw M6 to a defined torque, use the *Allen Key SW5* 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

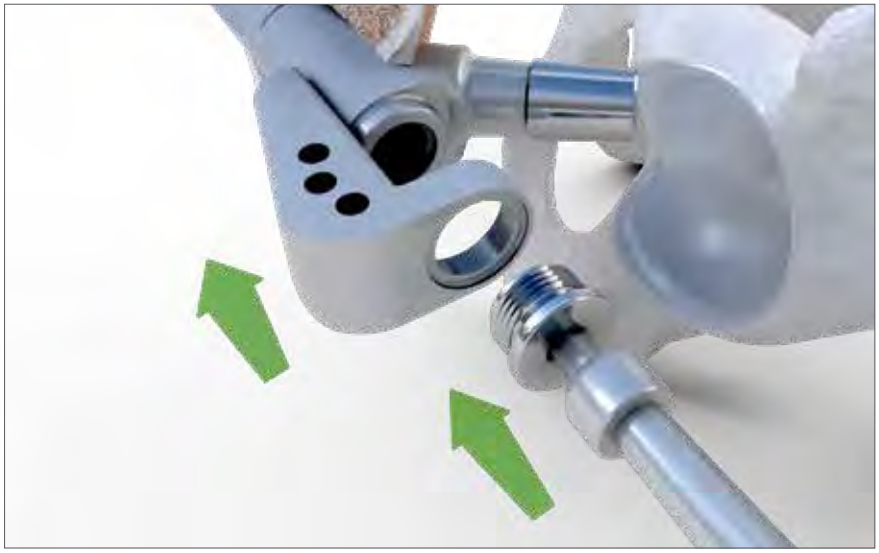
Secure the M6 screw with the torque limiter.

Ensure that the limiting mechanism of the torque limiter is triggered.

Always use the *Counter Holder 12/14* when working with the torque limiter to prevent the transfer of rotational forces to the bone.

16

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.



17

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

Ensure that the limiting mechanism of the torque limiter is triggered.

Always use the *Counter Holder 12/14* when working with the torque limiter to prevent the transfer of rotational forces to the bone.

Placing the definitive implant

18

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.
- In order to keep the stress on the morse taper junction as low as possible, PETER BREHM GmbH recommends the use of the longest possible neck segment 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*.
- Do not use implants/instruments with visible damage and/or contamination.
- 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

19

Releasing the pretensioned components and disassembling the implant
The sealing screw and the screw M6 are unscrewed and removed with the *Allen Key SW5* 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 23, item 12).

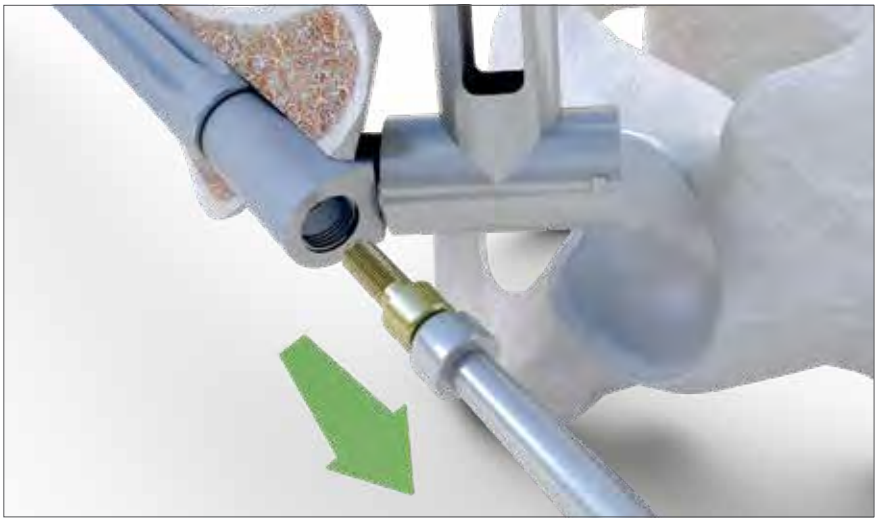
! NOTE

As soon as a morse taper shows signs of corrosion/damage, the component 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.

! NOTE

When loosening the sealing screw and the screw M6, always work with a counter holder 12/14.



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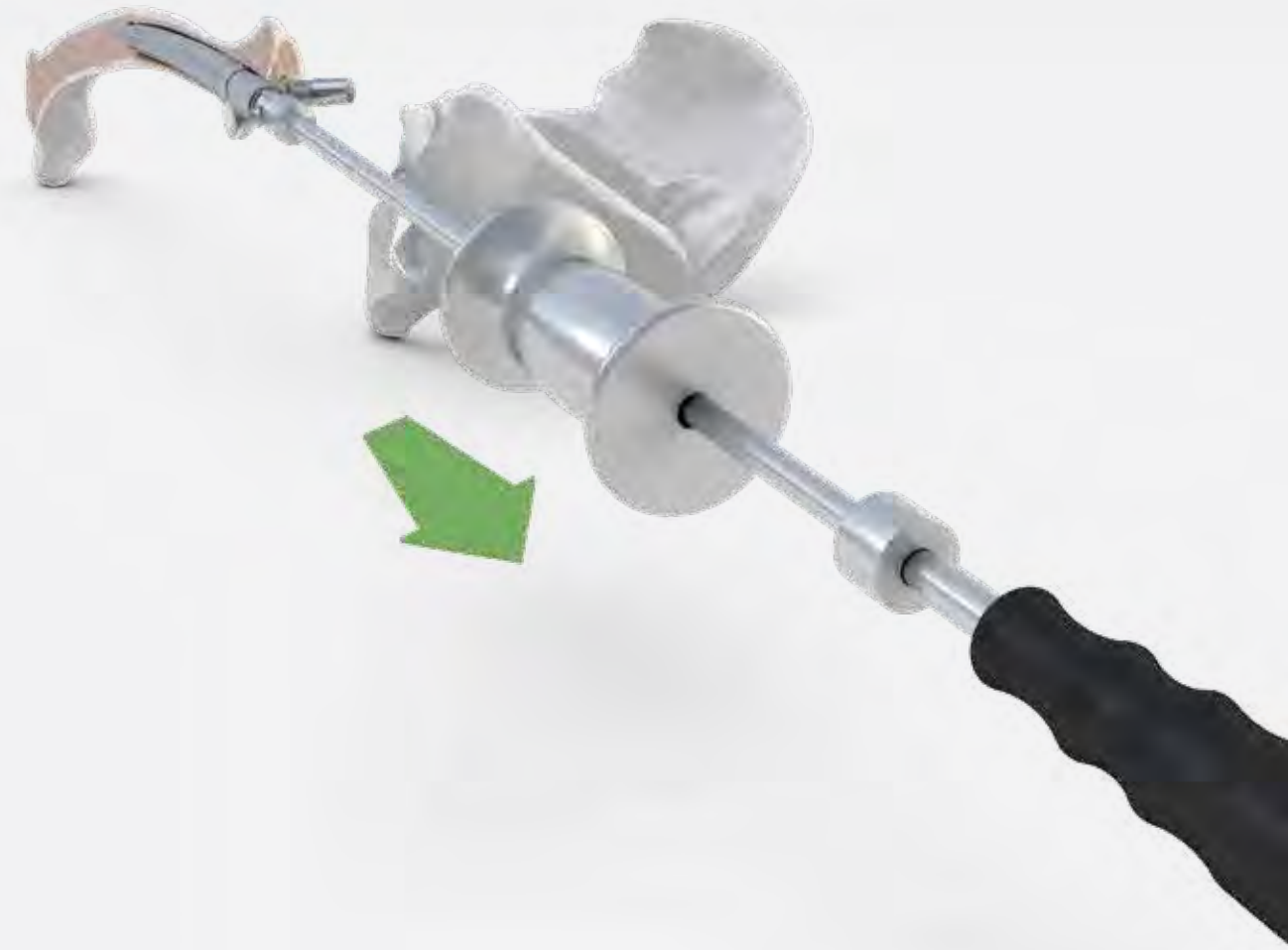
SUPPLEMENTARY SURGICAL TECHNIQUE



Removing the definitive implant

20

Removing with the *Handle for Prosthesis Inserter/Remover*
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.

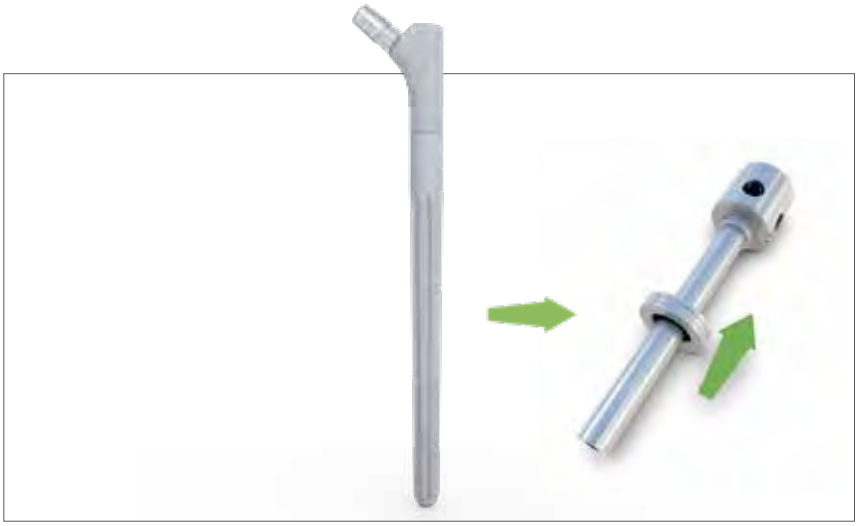
Components for removing the definitive implant:

❶ *Handle for Prosthesis Inserter/Remover*
❷ *Guiding Rod*
❸ *Knurled Screw S*
❹ *Knurled Screw M and Sliding Disk*
❺ *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

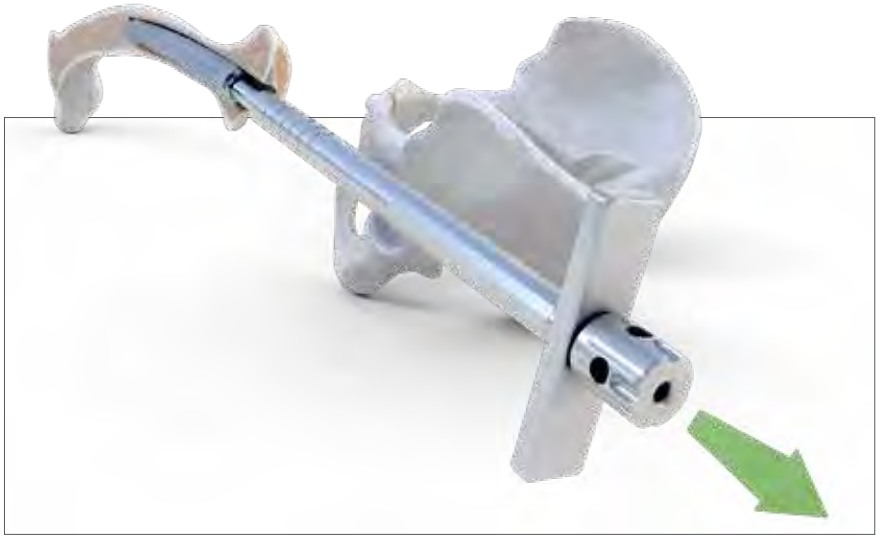
Anchoring stem and
neck segment
or:
Anchoring stem and
extension sleeve
↓
Knurled Screw M and *Sliding Disk*



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.



21

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.

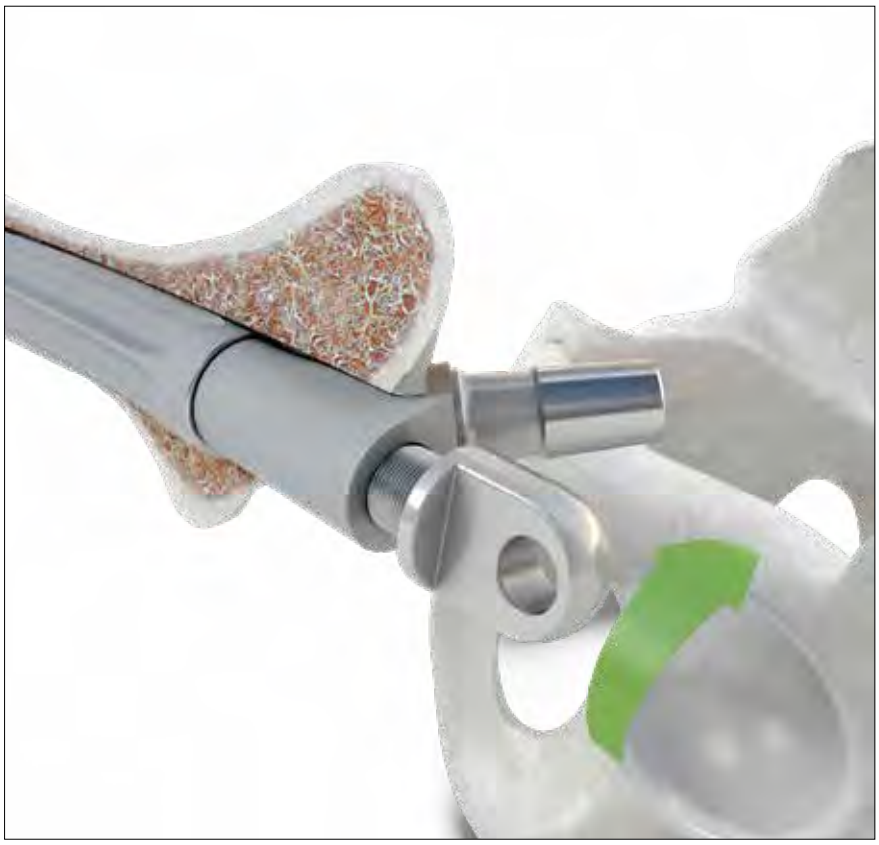
The *Slap Hammer* must be ordered separately as it is not included in the standard instrumentation set.

Components for removing the definitive implant with the *Slap Hammer:*

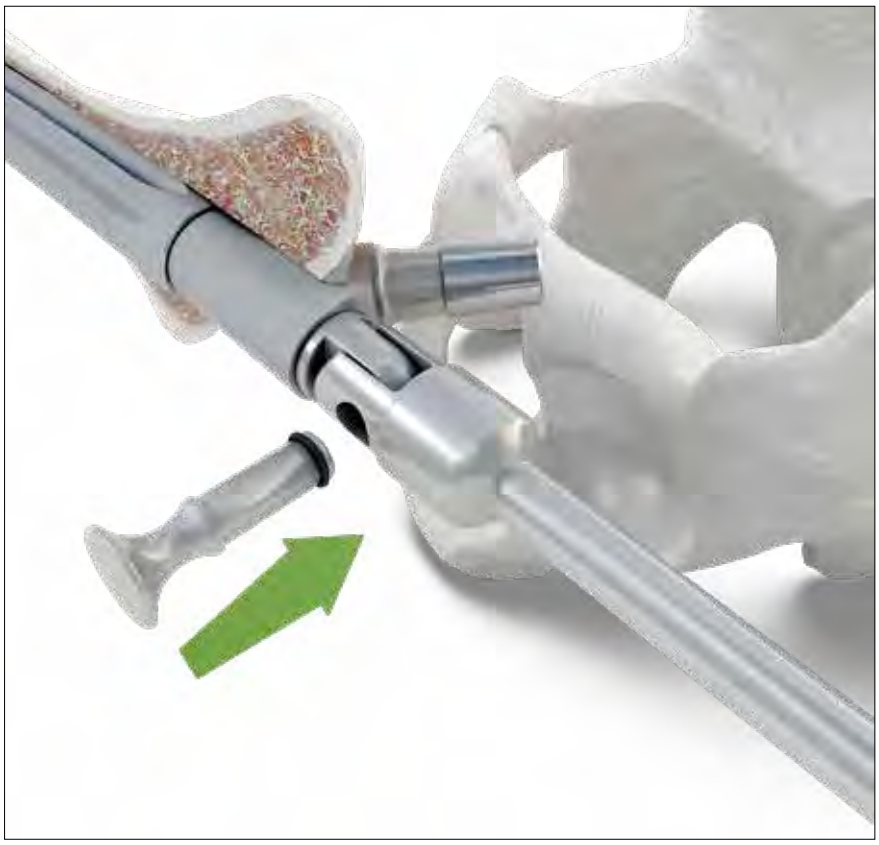
❶ *Slap Hammer*
❷ *Adapter M 14x1 for Prothesisneck*
❸ *Bolt*
❹ *Extractor M6*

! NOTE

First remove the sealing screw M14x1 and the screw M6. To do so, use the *Counter Holder 12/14* and the *Allen Key SW5* and *the Tommy Bar for Socket Head Wrench AF 6.* (see p. 42).



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



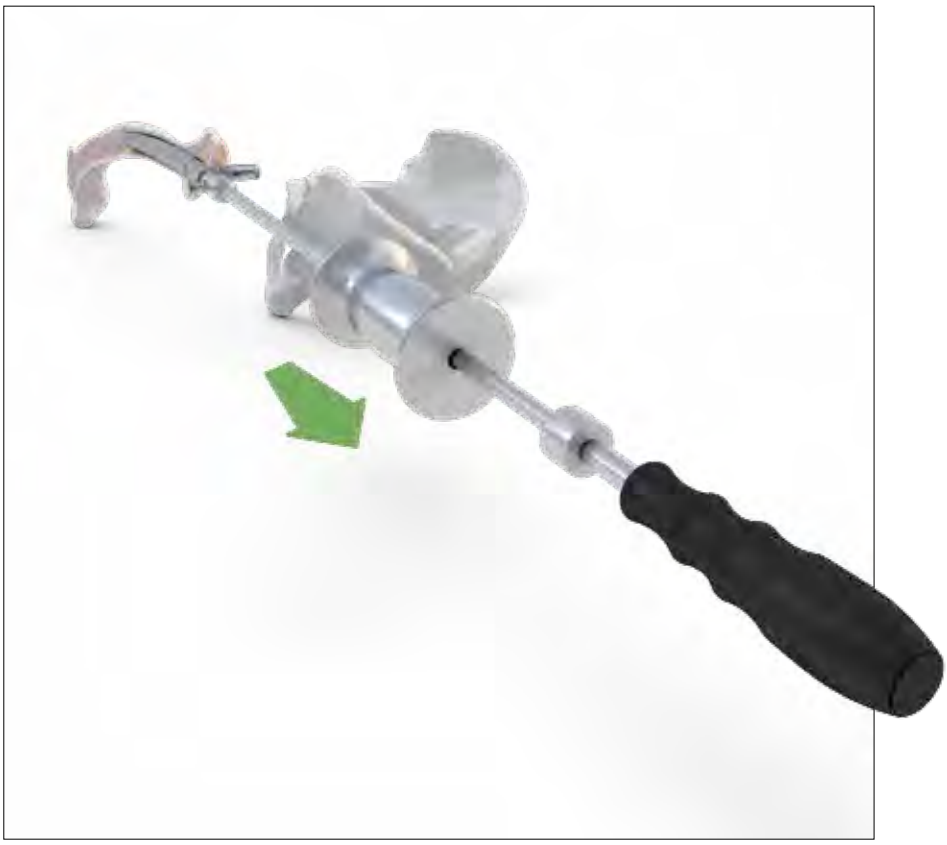
Then the *Adapter M 14x1 for Prothesisneck* and *Slap Hammer* are connected with the *Bolt.*

Removing the definitive implant

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

! NOTE

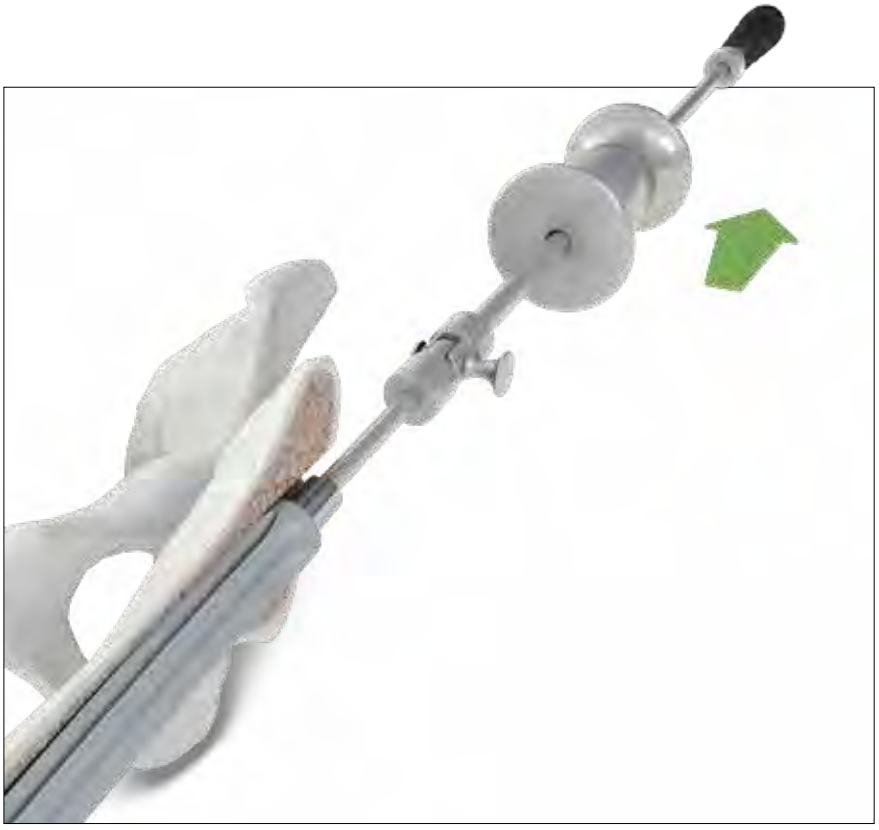
Always hold the *Slap Hammer* in the direction of force.



22

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.

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.

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

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für den Menschen

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