KAM-TITAN

KNEE ARTHRODESIS SYSTEM

SURGICAL TECHNIQUE

PETER BREHM
Die Präzision in Titan
für den Menschen

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PRODUCT DESCRIPTION

KAM-TITAN
MODULAR KNEE ARTHRODESIS SYSTEM

Introduction

Based on the design of the MRP-TITAN system, the KAM-TITAN knee arthrodesis system is available in anatomic left and right variants in addition to a neutral module.

Therefore, the axis of the leg is restored at 0° or 6° varus.

Some patients have extremely poor bone stock with minimal opportunity for bony ingrowth. Even in such a situation, the implant stems and knee arthrodesis modules can achieve a secure positive-locking connection between the thigh and the lower leg.

Design concept

The Anchoring Stems are tapered and have longitudinal ribs that give it a stellate cross section. The rough surface texture promotes bony ingrowth for cementless implantation.

The Anchoring Stems Cementless are available as straight implants in two lengths (140 mm and 200 mm) and as anatomic curved implants in three lengths (200 mm, 260 mm, and 320 mm) in diameters that increase in increments of 1 mm.

The longitudinal ribs are arranged symmetrically around the periphery and provide stability against rotation while the tapered stem geometry reliably prevents both rotation and subsidence. The implant is immobile relative to the underlying bone. Gradually increasing weight bearing promotes solid bony ingrowth for biologic fixation. The taper connection between the respective Anchoring Stems and the upper or lower component of the arthrodesis module allows adjustment in situ of tibial rotation relative to the femur. Different variants of the MRP-TITAN Anchoring Stems may be selected to achieve the desired leg length.

Titanium Stems Straight Cemented are optionally available in lengths of 140 and 200 mm with a diameter of 12 mm.

Planning and instrumentation

Radiographs of known magnification visualizing the entire region of the affected knee are required. They should also include any adjacent implants. Radiographic templates are provided for determining the size of the required femoral and tibial stems. The templates allow the surgeon to determine both the probable diameter and the type of stem preoperatively with sufficient accuracy. Anchoring Stems should be selected that ensure good bony support over the longest possible distance.

! NOTE

- The correct selection of the implant (size, shape, composition, etc.) can reduce risks such as loosening.
- 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

  based on laboratory tests according to ISO 7206-4 under specific test conditions (10 cm distal anchorage), the patient weight is limited to 65 kg.

  Notation: This weight limitation applies only for the implant variants tested.
- The weight limitation of the implants must be observed.
- The criterion should also be checked and observed during the follow-up examination
- 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±1 Nm*
  - *Guiding Rods*

  After 45 operations:
  - *Torsionfree Preloading instruments (TOV)*

  If necessary, please contact a representative authorized by PETER BREHM for this purpose.
- 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.

Approaches

! NOTE

No special positioning of the patient and no special access for the implant is required. The surgeon is free to choose his preferred access, but must follow the given steps.

Preparing the medullary canals

It is essential to remove all soft tissue prior to preparing the medullary canals. In revision procedures, all granulation tissue must be completely removed as well as any residual cement. In a postinfectious situation, the medullary canals should be reamed with flexible reamers and broaches. Jet lavage is indicated prior to placement of implants.

! NOTE

Ensure strict axial access to the medullary canal throughout the surgery to avoid transverse forces on the instruments.

Placing the implant stems

The femoral and tibial *TRIAL Anchoring Stems* supplied provide a reliable method of verifying the stem geometry determined in preoperative planning. The surgeon typically begins with a stem of a diameter significantly smaller than the planned size. Successive *TRIAL Anchoring Stems* of the next larger size, increasing in diameter in 1 mm increments, are then placed until the definitive stem diameter is determined. The decisive criteria are the planned implantation depth and secure fixation of the stem in the underlying bone. Occasionally it may be necessary to deviate from the planned length and use a longer implant.

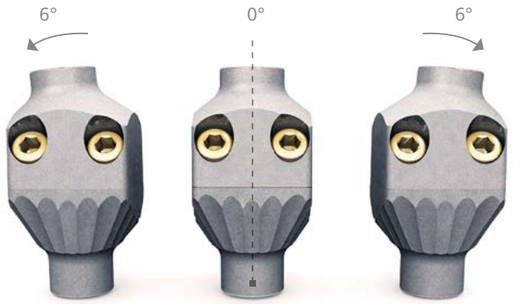
! NOTE

- Pay attention to careful, axis-appropriate implantation.
- Observe correct handling of implant components and instruments.
- Do not use damaged implants.

Once the *TRIAL Stiffening Elements* have been placed and connected, the leg length is evaluated. Once the correct leg length has been obtained, the *TRIAL Stiffening Elements* are removed and the *TRIAL Anchoring Stems* are replaced with definitive implants.

! NOTE

- Do not use implants/TRIAL implants/instruments with visible damage.
- Instruments and TRIAL implants must be checked for fatigue fretting and correct handling/function prior to surgery.
- 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 re-use!



Valgus variants: right, neutral, left

Adjusting and tightening the Knee Arthrodesis Module

After implantation of the femoral and tibial Anchoring Stems and cleaning the cones (*Taper Wiper*), the two Arthrodesis Components are placed, hand-tightened, and aligned in proper rotation. Then the Arthrodesis Components are coupled and the rotation of the tibia with respect to the femur is evaluated. Once correct rotation has been achieved, the respective Anchoring Stem and Arthrodesis Component are secured by pretensioning them with the *Torsionfree Preloading Instrument (TOV)*. Then the KAM-Screw M6 is tightened with the *Torque Limiter 25±1 Nm* and the *Counter Holder*. Then the tibial and femoral components of the arthrodesis module are coupled, connected with two diagonal KAM-Bolts, and secured with the *Torque Limiter 25±1 Nm.*

! NOTE

- Always use counterholders when removing screws, working with the pressing-off instrument, *Torque Limiter* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.
- Use the *Socket Wrench SW3,5* or *Fork Key for Knee-Arthrodesis- Module* as a counter-holder.
- Thoroughly clean implant components.
- Observe correct handling of implant components and instruments.
- Before mounting the morse taper junction, clean it carefully using the *Taper Wiper* (rinse with NaCl 0.9 %) and dry it.
- Pre-tension morse taper junction with the *Torsionfree Preloading Instrument (TOV).*
- Secure KAM-Screw M6 and KAM-Bolts with the *Torque Limiter 25±1 Nm*.
- Ensure that the limiting mechanism of the *Torque Limiter 25±1 Nm* is triggered.
- 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±1 Nm*
- *Guiding Rods*

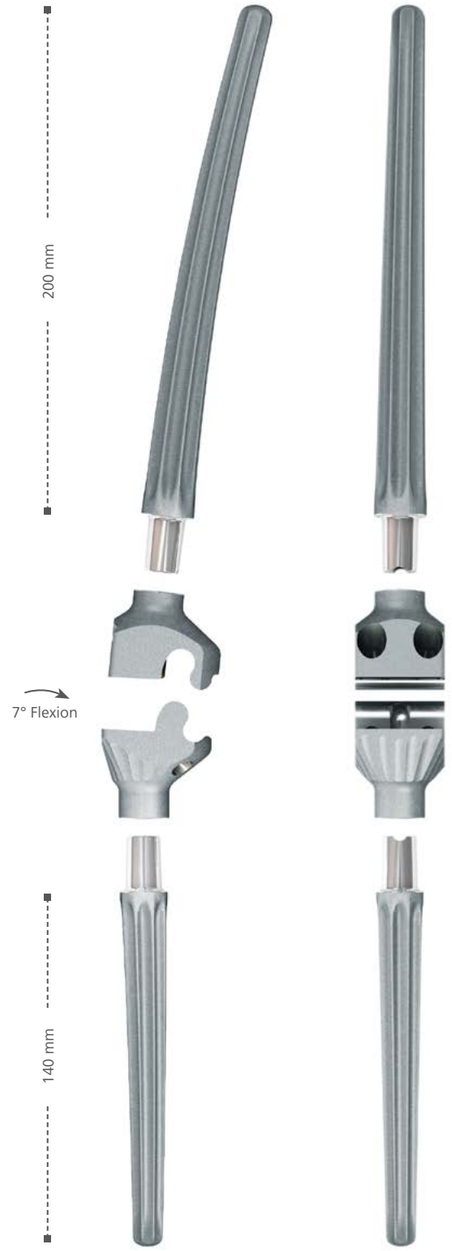
After 45 operations:

- *Torsionfree Preloading Instrument (TOV)*

If necessary, please contact a representative authorized by PETER BREHM for this purpose.

! NOTE

Ensure that there is no contact between products for osteosynthesis for example plates, screws, cerclages and the KAM-TITAN implants except on the intended locations.

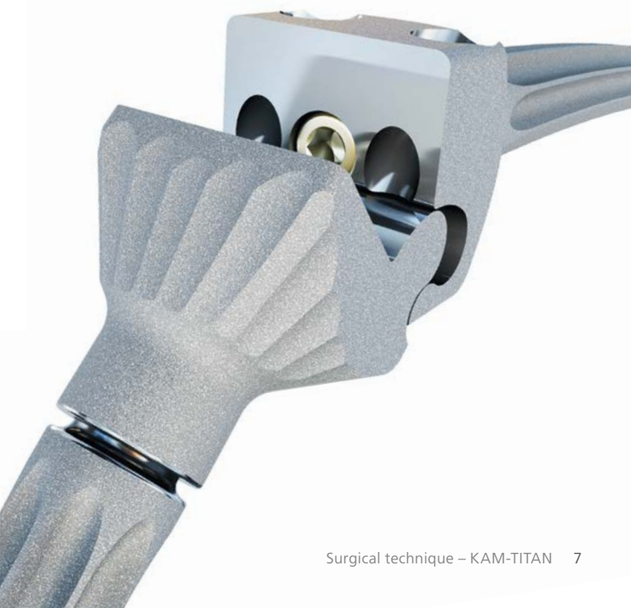


Configuration example: KAM-TITAN neutral (0°)

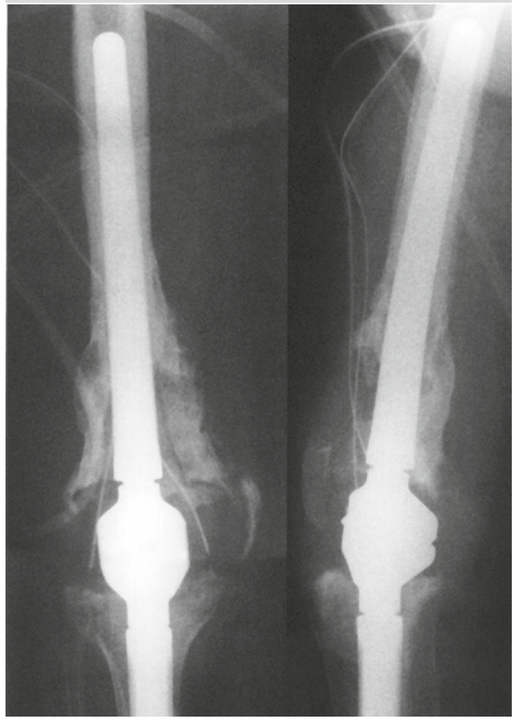
ADVANTAGES AT A GLANCE

The design is based on the diaphyseal fixation philosophy of the proven MRP-TITAN system, which has been in clinical use since 1993.

- Anatomic design with left and right variants (6° valgus, 7° flexion).
- Cementless implantation (optional: cemented stems).
- Freely selectable leg length and continuously adjustable external rotation in situ.
- Intraoperative flexibility in any situation.
- Assembly with TRIAL implants in situ.
- Modules coupled in flexion (from 35°).
- Escape route at every step of the procedure.
- Best results with a high degree of patient satisfaction.[1]

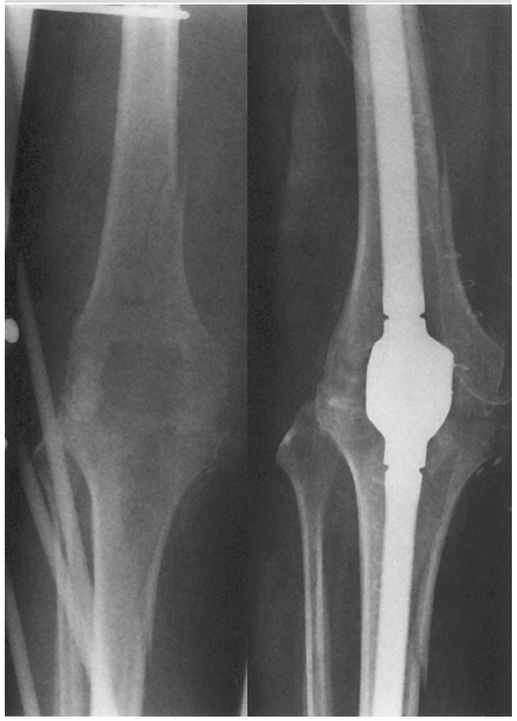


CASE EXAMPLE 1



Postoperative findings: KAM-TITAN (0°) femoral Anchoring Stem Curved 17 x 200 mm, tibial Anchoring Stem Straight 16 x 200 mm.

CASE EXAMPLE 2



Preoperative findings: Status post infected total knee arthroplasty and removal of implants. **Postoperative findings**: KAM-TITAN (right 6° valgus), femoral Anchoring Stem Curved 16 x 260 mm, tibial Anchoring Stem Curved 13 x 260 mm.

! NOTE

Avoid surface damage such as scratches and impact points that could be caused by chisels, hammers, luers, clamps, etc., as well as contact or sparks from electrosurgical instruments [2-7].

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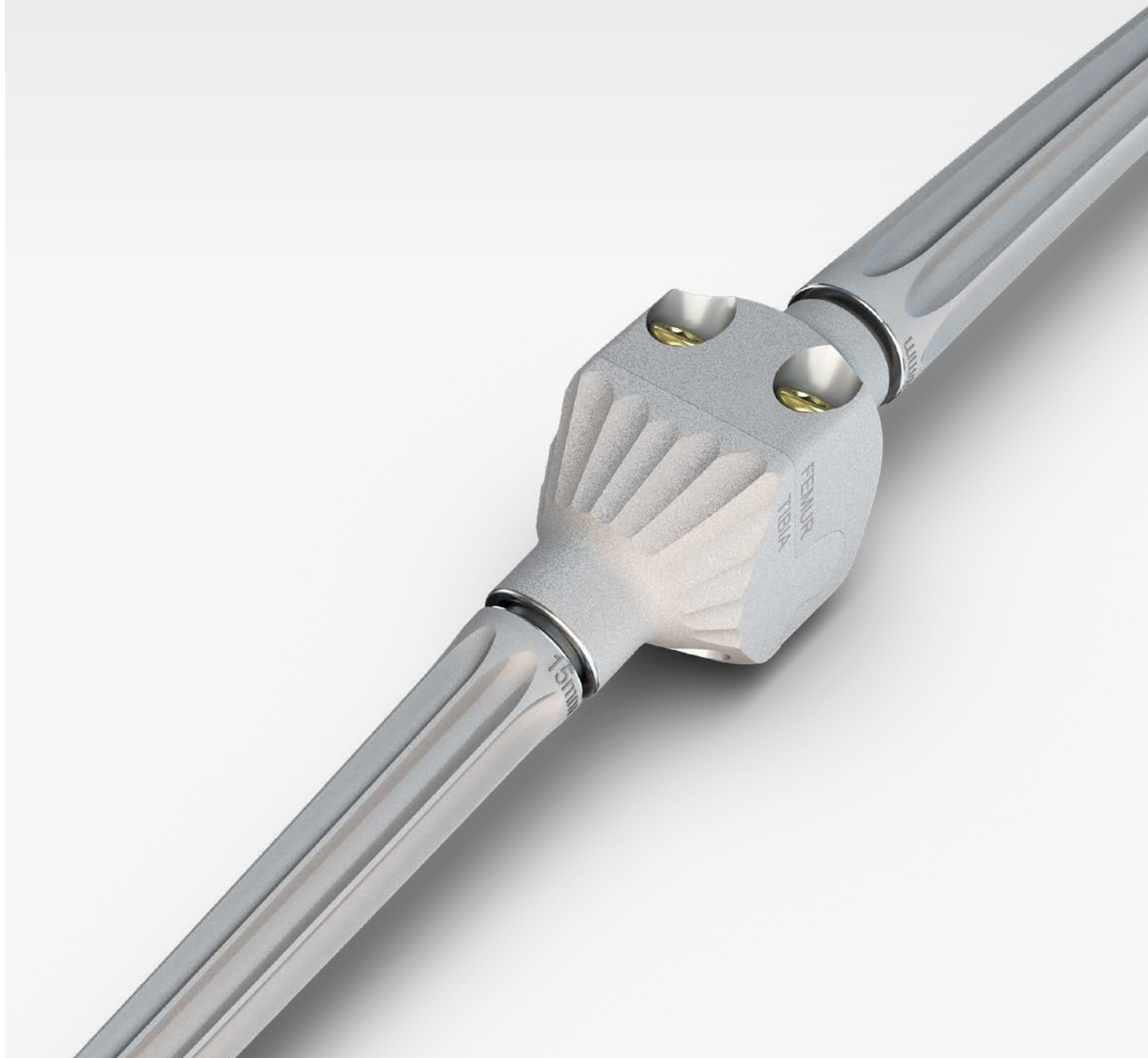


Preparing the tibia

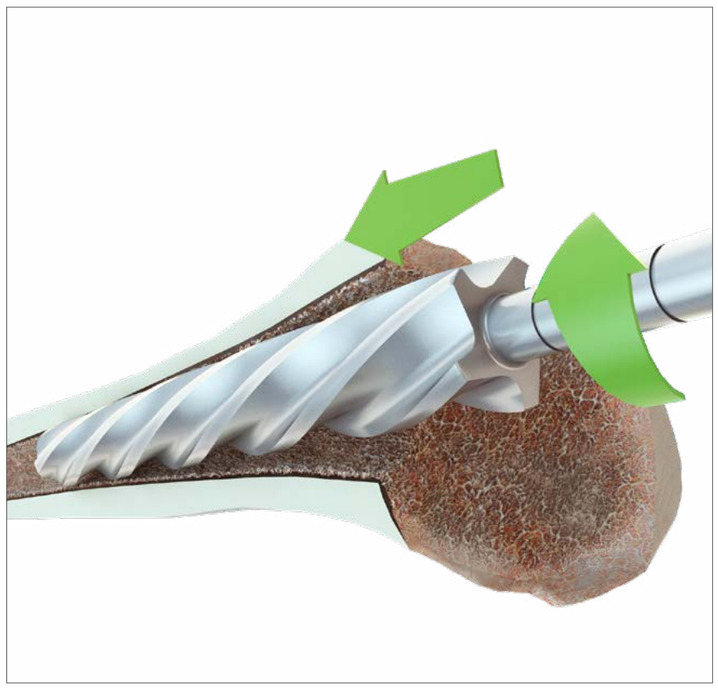
01

Where Anchoring Stems Straight are used, it is recommended to prepare the medullary canal with straight *Rasps with AO-Adapter* and *T-Handle with quick coupling AO*. If these are not available, it is possible to use the flexible drill shaft as described in point 02. The straight *Rasps* are ideally suited for use with the 140 mm and 200 mm Anchoring Stems Straight.

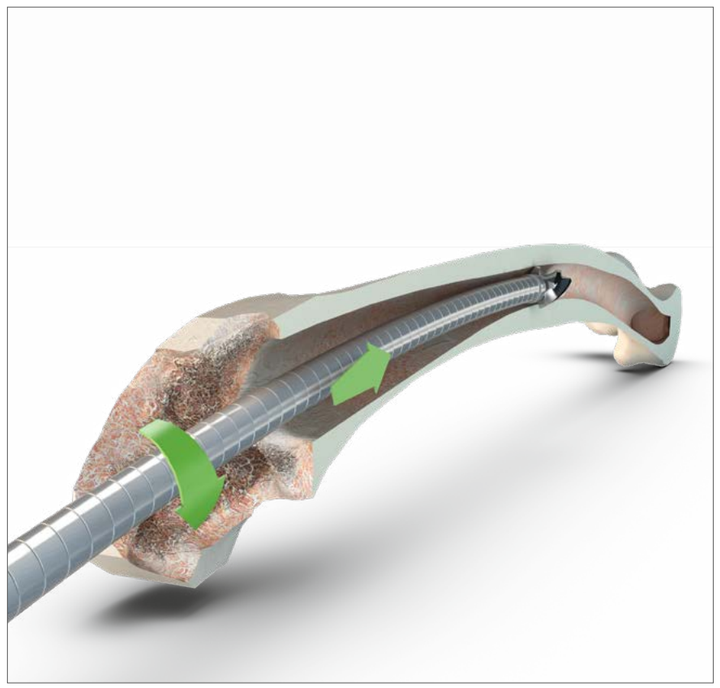
The implant side is reamed incrementally. The proper implant diameter is achieved when increased force is required to rotate the *Rasps with AO-Adapter.*

The implant length can be read from the scale on the instrument.

The imaginary joint line must align with the marking.



Preparing the femur



02

The curvation of the femur requires the use of a flexible drive shaft to prepare the medullary canal. These reamers are introduced over an intramedullary Guide Wire. The femoral canal is machined with Reamer Heads of successively increasing diamters (in increments of 0,5 - 1 mm). This continues until the flexible drive shaft is in contact with the bone in a full circle over a distance of 70 - 100 mm. This will be indicated by the clear high-pitched sound of the cortex. Fluoroscopy must be used to verify that the Reamer Heads remains centered in the medullary canal so that it will not perforate the cortex and deviate into the surrounding soft tissue.

Selecting the diameter of the TRIAL Anchoring Stem

03

The diameter of the last *Rasp with AO-Adapter* used is selected as the initial diameter for the *TRIAL Anchoring Stem*. Then the diameters of the *TRIAL Anchoring Stems* are successively increased in 1 mm increments until stable fixation at the desired location is achieved.

04

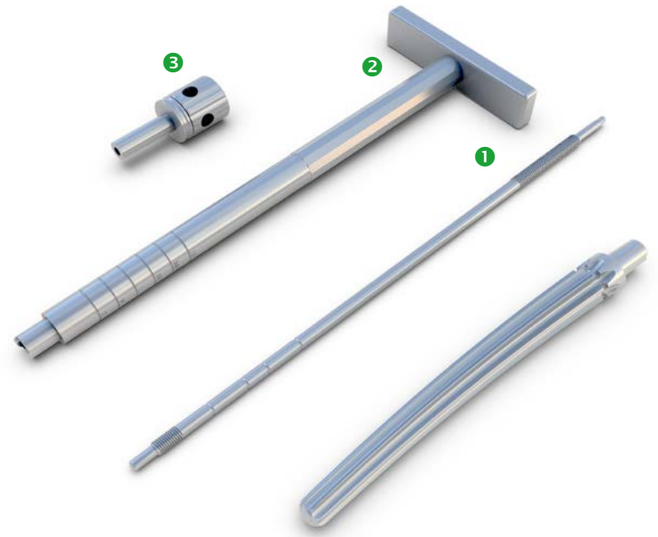
After the femoral canal has been prepared with flexible reamers, the ideal stem diameter is determined. This is done using curved *TRIAL Anchoring Stems* with the same diameter as (or 1 mm less than) the machined diameter. The reason for this is that the physiological femoral curvature can be checked with a thinner *TRIAL Anchoring Stem.* Then the stem diameter is successively increased in 1 mm increments until a good interference fit is achieved.

The rotational stability of the positive-locking connection between the *Handle for Prosthesis Inserter/Remover* and the *TRIAL Anchoring Stems* allows precise impaction of the *TRIAL Anchoring Stems* with minimal force.

! NOTE

The correct selection of the implant (size, shape, composition, etc.) can reduce risks such as loosening.

Assembling the seating instrument



05

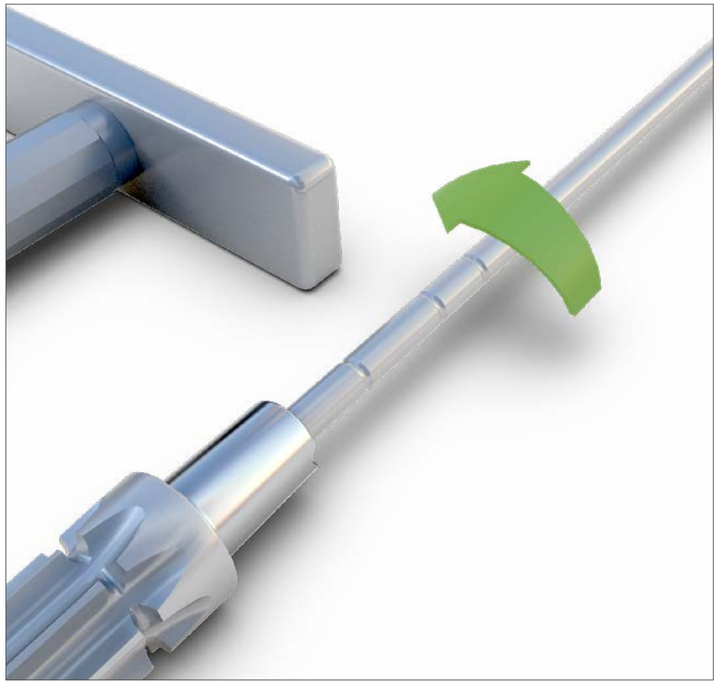
The seating instrument consists of:

1. *Guiding Rod*
2. *Handle for Prosthesis Inserter/Remover*
3. *Knurled Screw S*

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 of the *Guiding Rod* = *TRIAL Anchoring Stem*/ Anchoring Stem

Long threading of the *Guiding Rod* = *Knurled Screw S*



06

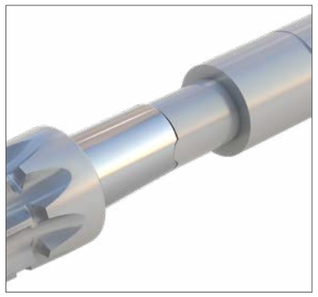
! NOTE

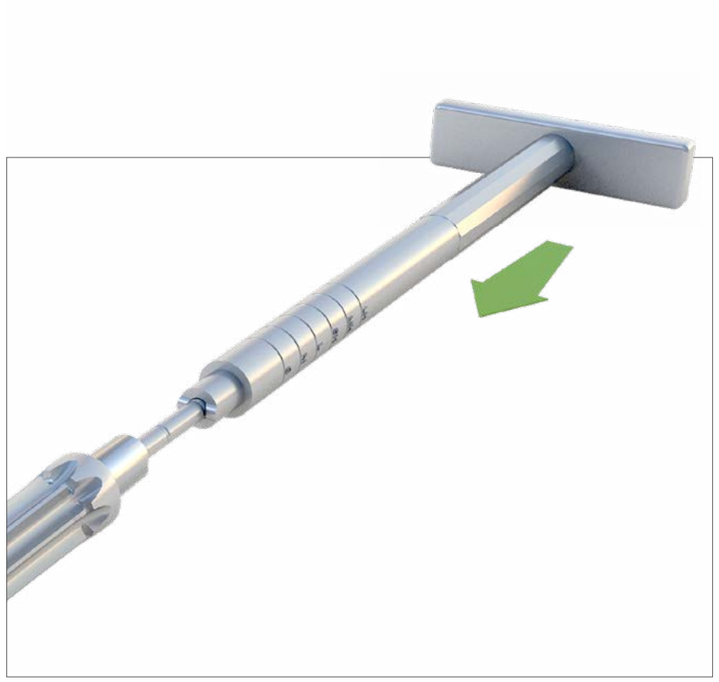
- Before screwing in the *Guiding Rod*, make sure that it is free of contamination.
- It must be ensured that the *Guiding Rod* is completely screwed into the *TRIAL Anchoring Stem*/Anchoring Stem manually or with the *Socket Wrench SW3,5*.
- Use TRIAL implants exclusively for the selection of corresponding permanent implants.
- Ensure that TRIAL implants are not implanted permanently.

Assembling the inserter/remover

07

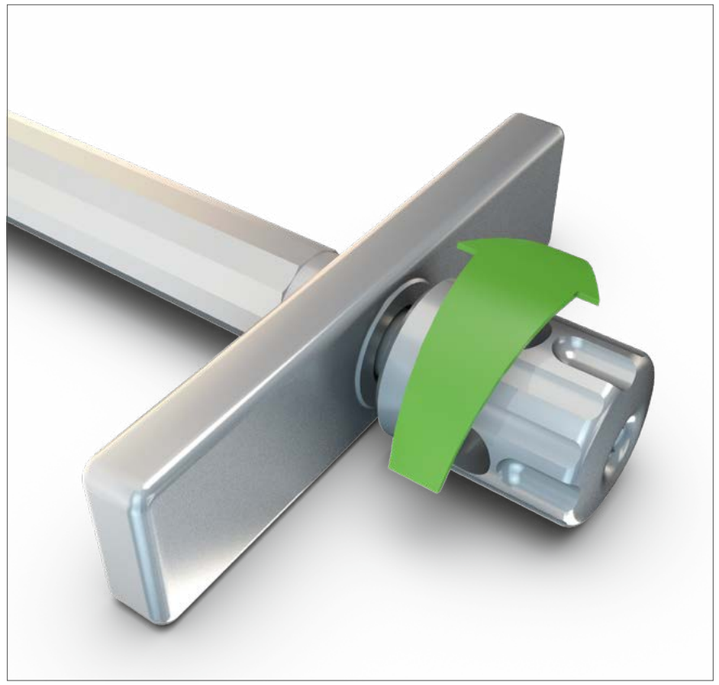
Ensure that the nose of the *Inserter/Remover* fits exactly into the groove of the *TRIAL Anchoring Stem*.





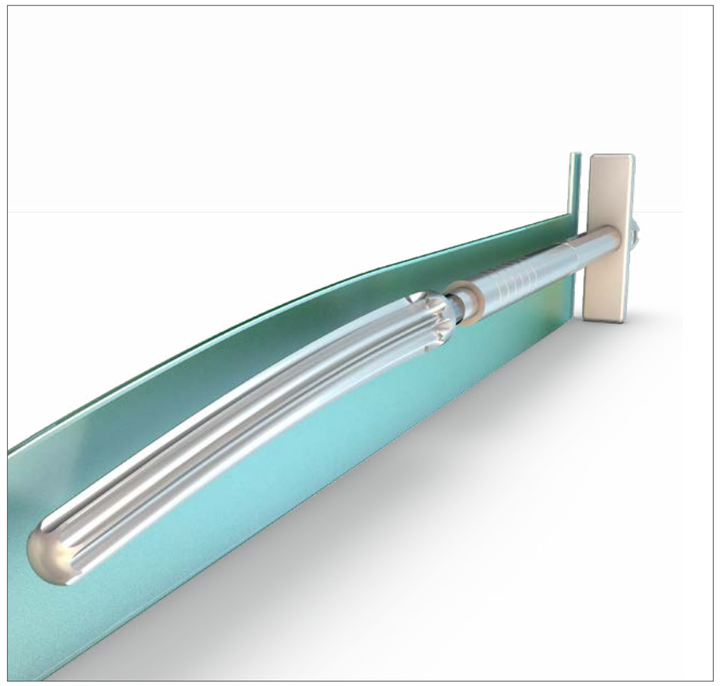
08

The *Knurled Screw S* is tightened as far as it will go.



09

To secure the connection, tighten the *Knurled Screw S* with the *Socket Wrench SW3,5* inserted at a right angle, giving the wrench an additional half turn clockwise to secure the construct.



10

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

! NOTE

- The curvation of the *TRIAL Anchoring Stems* and the Anchoring Stems always alignes in the same plane as the grip of the *T-Handle*.
- 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.

Placing the TRIAL Anchoring Stem

11

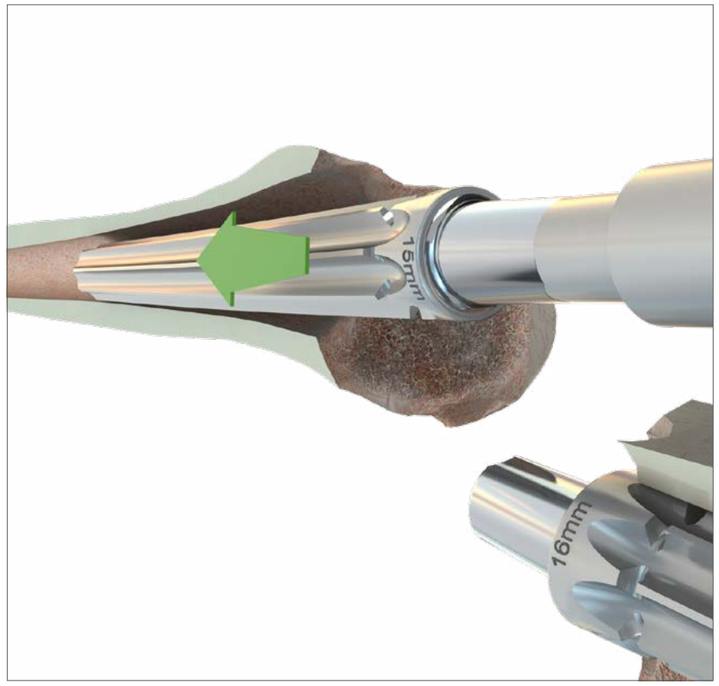
The curved *TRIAL Anchoring Stem* is placed in the femur.

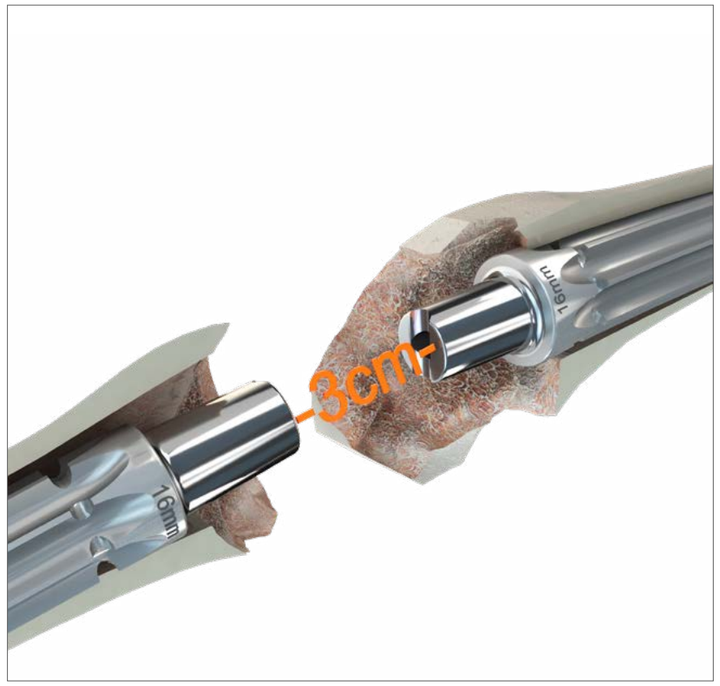
12

The straight *TRIAL Anchoring Stem* is placed in the tibia.

! NOTE

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





13

! NOTE

In order to insert the *TRIAL Femur Stiffening Element* and the *TRIAL Tibia Stiffening Element* (TRIAL Module), a space of at least 3 cm must be available between the two cone ends of the anchored *TRIAL Anchoring Stems*.

If the clearance is greater or less than 3 cm, then one can select a larger or smaller stem diameter to change the penetration depth. This will change the leg length as well.

! NOTE

- 1 mm change in the stem diameter corresponds to approx. 2 cm change in the penetration depth.
- Do not combine Anchorng Stems with Extension Sleeves.

Preparing the module box

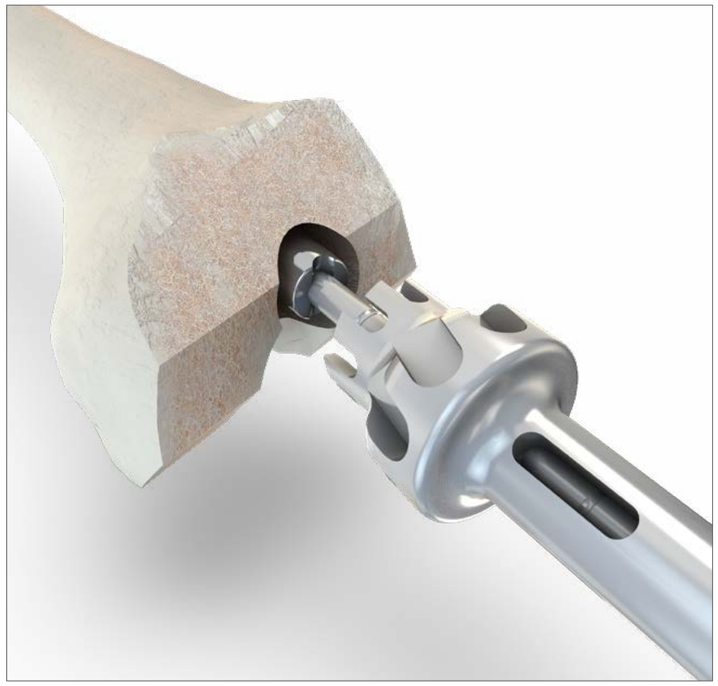
14

The *Cutter* is used to prepare the bone for the Arthrodesis Components.

An integrated stop in the *Cutter* prevents it from damaging the taper of the *TRIAL Anchoring Stem*.

! NOTE

Use the *Cutter* only in combination with the *Guiding Rod*. The *Cutter* is not suitable for use with a mechanical drive.

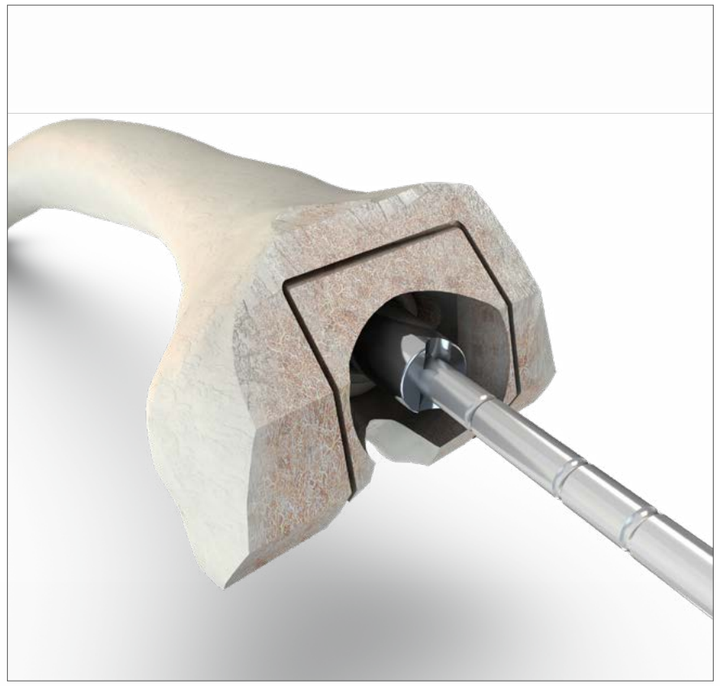


15

Then the *Box-Shaped Gauge for KAM-TITAN* is gently driven in with a hammer over the *Guiding Rod* as far as it will go.

! NOTE

Observe labelling of the *Box-Shaped Gauge*.

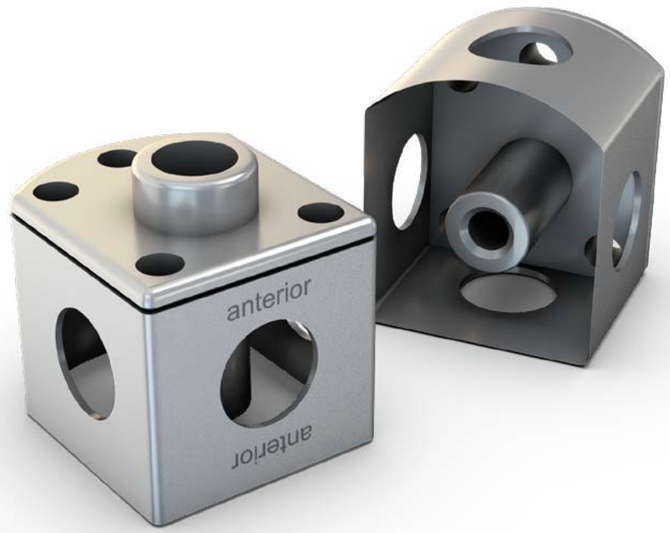


16

The bone within the square osteotomy is resected with forceps, hammer, and osteotome.

! NOTE

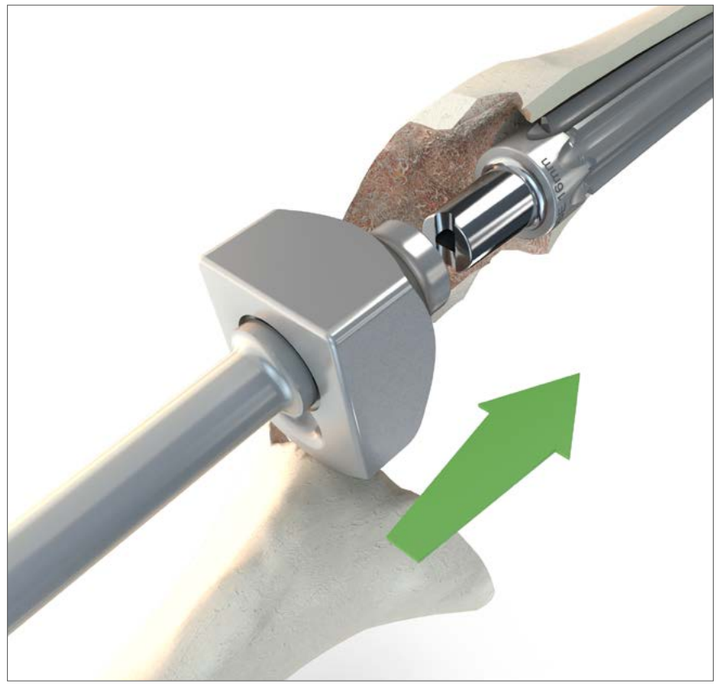
Avoid surface damage such as scratches and impact points that could be caused by chisels, hammers, luers, clamps, etc., as well as contact or sparks from electrosurgical instruments [2-7].



Placing the TRIAL Stiffening Elements

17

Screw the *Setting Instrument* into the *TRIAL Stiffening Element*.



18

Once the tapers have been cleaned and the *Guiding Rods* have been removed, the two *TRIAL Stiffening Elements* can be placed. The *TRIAL Stiffening Elements* are fixed in place by lightly tapping the assembled *Setting Instrument* with a hammer.

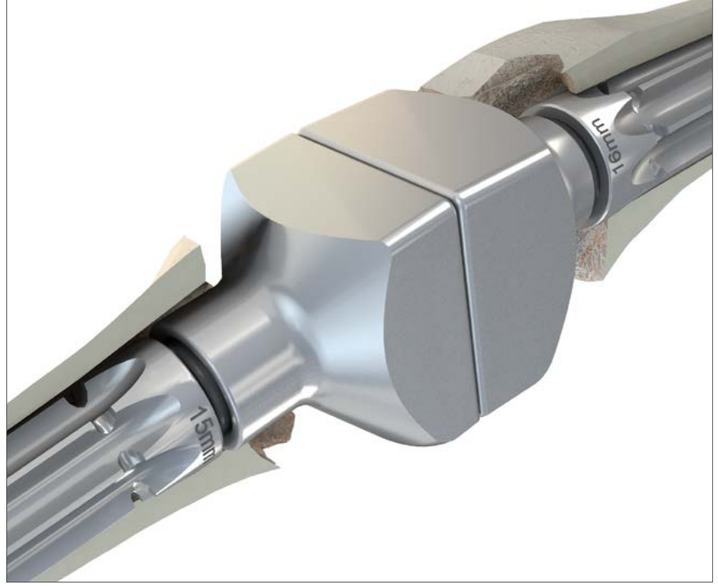
Trial reduction

19

After the *Setting Instrument* has been removed, a trial reduction should be performed. This is done to verify correct leg length.

! NOTE

The aim is to shorten the leg by one centimeter so that the patient can swing the leg freely.



Separating the untightened TRIAL Stiffening Element

20

Overview of instrumentation for separating the *TRIAL Stiffening Elements*.

1. *Handle for Impression Instrument*
2. *Impression Threaded Rod for Impression Instrument*
3. *Spindle*
4. *Socket Wrench SW3,5*

! NOTE

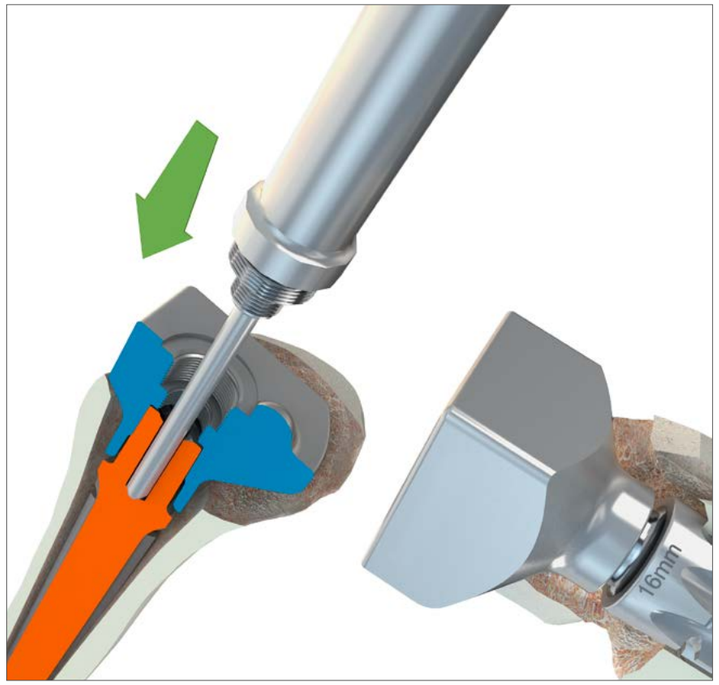
- Use TRIAL implants exclusively for the selection of corresponding permanent implants.
- Ensure that TRIAL implants are not implanted permanently.

Separating the untightened TRIAL Stiffening Element

21

Assemble the impression instrument to seperate the *TRIAL Stiffening Element*.

The *Handle for the Impression Instrument* is screwed into the *TRIAL Arthrodesis Module*. Then the *Impression Threaded Rod for Impression Instrument* is inserted. Afterwards the assembled instrument is screwed into the central M14 thread.

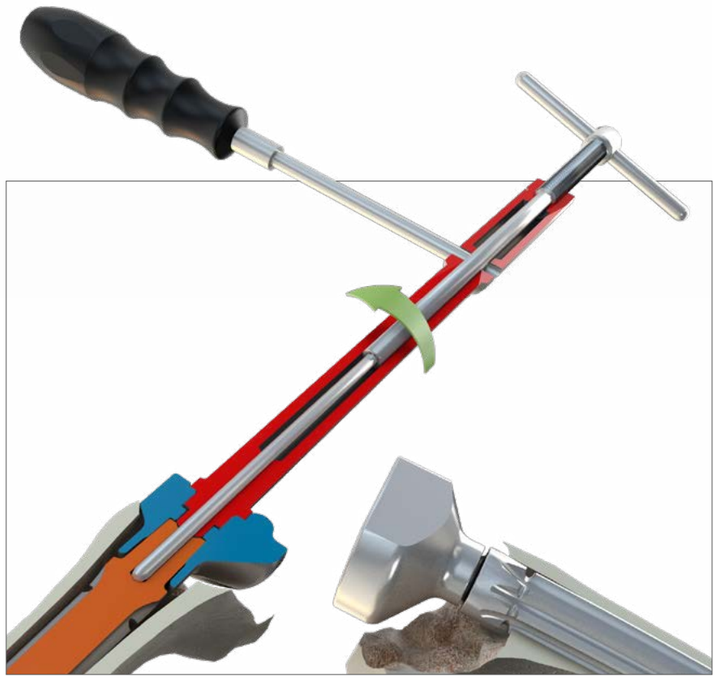


22

The *Spindle* is screwed in clockwise to separate the *TRIAL Stiffening Element.*

! NOTE

Use the *Socket Wrench SW3,5* or *Fork Key for Knee-Arthrodesis-Module* as a counter-holder.

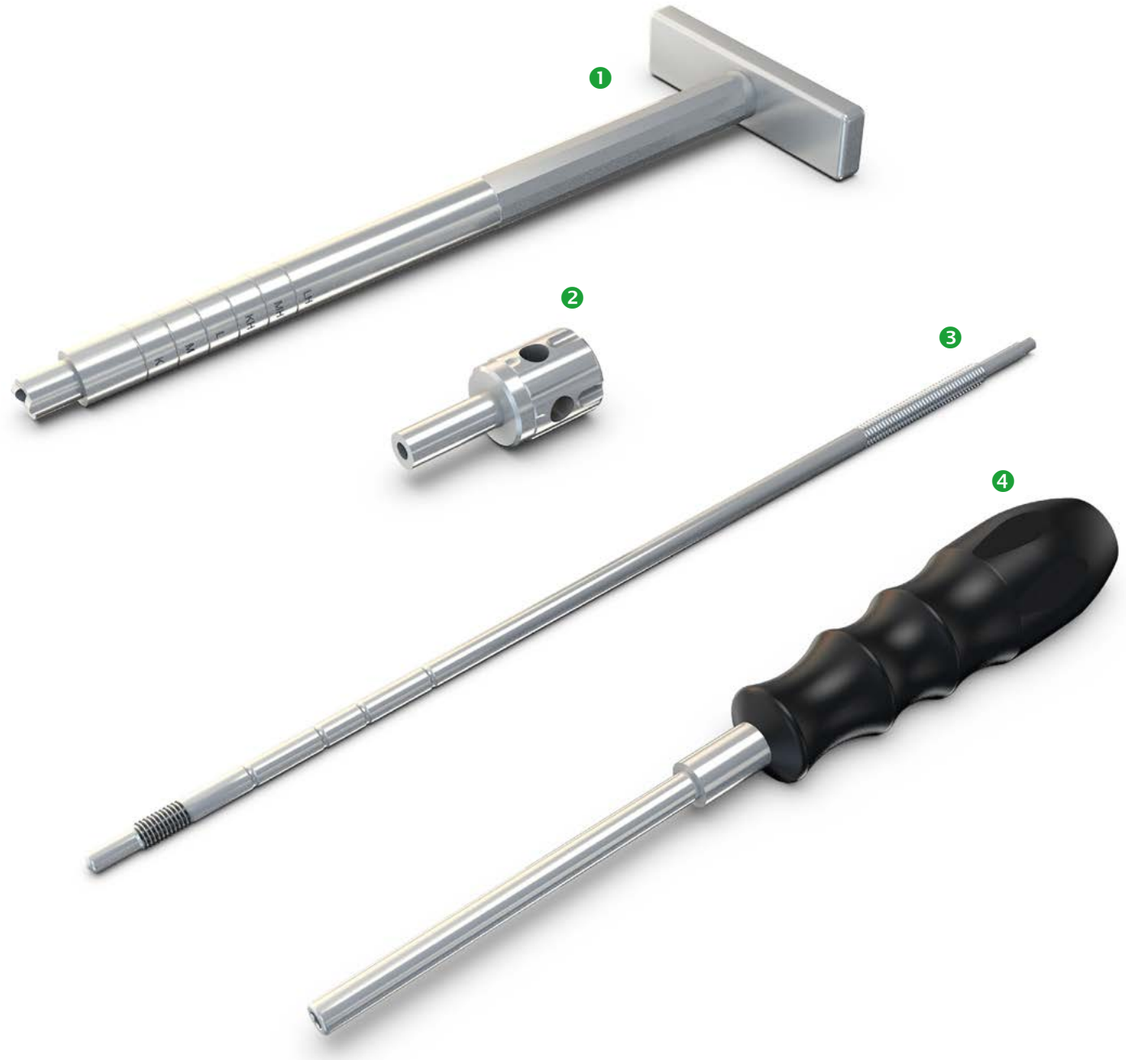


Removing the TRIAL Anchoring Stems

23

Overview of instrumentation for removing the *TRIAL Anchoring Stems.*

1. *Handle for Prosthesis Inserter/Remover*
2. *Knurled Screw S*
3. *Guiding Rod*
4. *Socket Wrench SW3,5*



Removing the TRIAL Anchoring Stems

24

The *Guiding Rod* is screwed into the *TRIAL Anchoring Stem*.

! NOTE

- Before screwing in the *Guiding Rod*, make sure that it is free of contamination.
- It must be ensured that the *Guiding Rod* is completely screwed into the *TRIAL Anchoring Stem*/Anchoring Stem manually or with the *Socket Wrench SW3,5*.

25

The *Handle for Prosthesis Inserter/Remover* is slid over the *Guiding Rod*.

26

To secure the connection, screw in the *Knurled Screw S* 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.

27

The *TRIAL Anchoring Stem* is extracted.

! NOTE

Again tighten *Knurled Screw S* with *Socket Wrench SW3,5*.

Placing the definitive implants

28

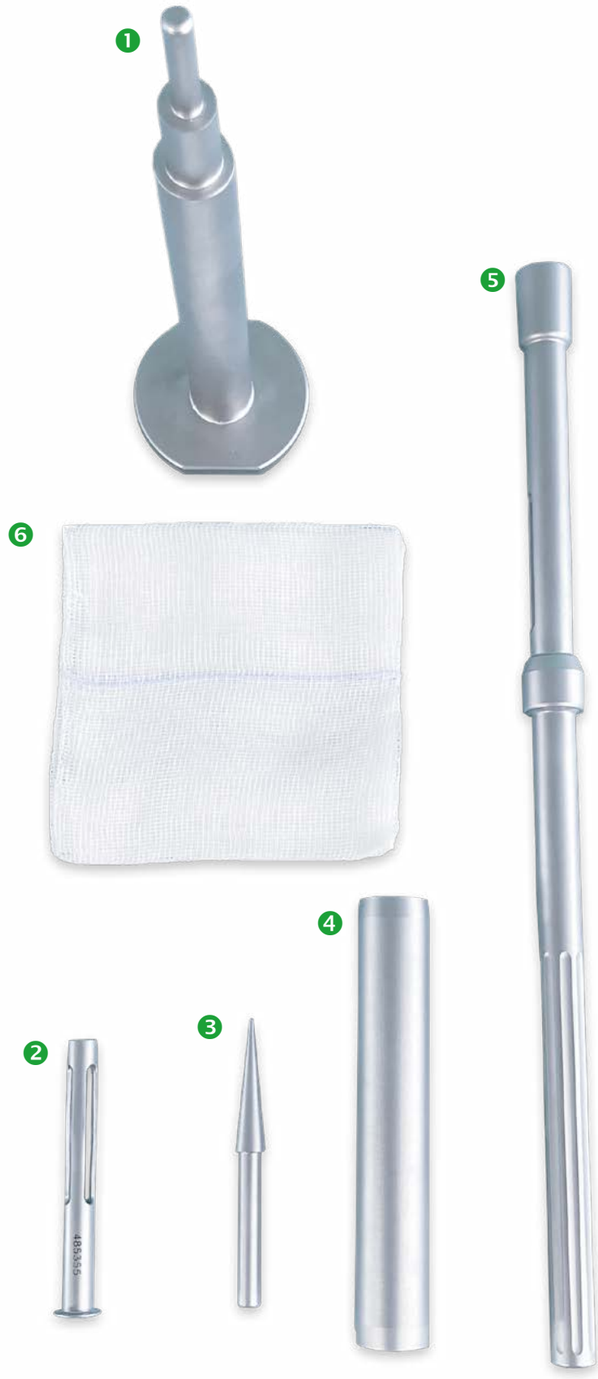
The definitive Anchoring Stem is impacted in the same manner as the *TRIAL Anchoring Stem* (assembling the Seating Instrument see Point 5 ff.). The definitive Anchoring Stem is mounted on the *Handle for Prosthesis Inserter/Remover* and impacted afterwards.

! NOTE

- PETER BREHM GmbH recommends the obligatory use of intraoperative x-rays to assess the correct positio ning of the implant and to detect any bone fractures.
- Carry out implantation carefully.
- Consider precautionary X-ray check.
- Set cerclages if necessary.
- Repeated milling for the Arthrodesis Component 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.
- Before mounting the morse taper junction, clean it carefully using the *Taper Wiper* (rinse with NaCl 0.9 %) and dry it.

Cleaning the morse taper connection

Reliable joining is only possible if the taper is cleaned and dried correctly [8-15],
For this reason, the taper must be cleaned using the *Taper Wiper* before the original modules are connected.



29

Cleaning the morse taper connection

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

! NOTE

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

Cleaning the morse taper connection

Mounting *Taper Wiper*

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

! NOTE

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

Cleaning the morse taper connection

- Put down the *Mounting stand*
- Slide on the *Tissue protection sleeve*

Slide on *Sleeve slotted* with plate facing downwards.

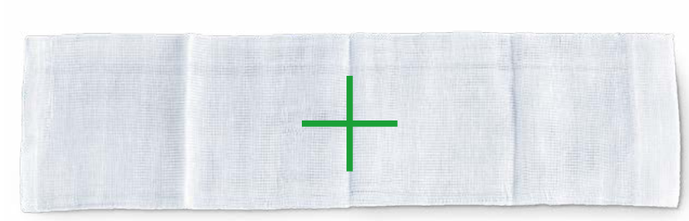
Cleaning the morse taper connection

Insert *Thorn* into *Sleeve slotted*.
Tip upwards.

Overall construction assembly:

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

Cleaning the morse taper connection



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.

Cleaning the morse taper connection

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

Cleaning the morse taper connection

Hold the *Handle* in position and push the *Tissue protection sleeve* upwards to the stop with the other hand.

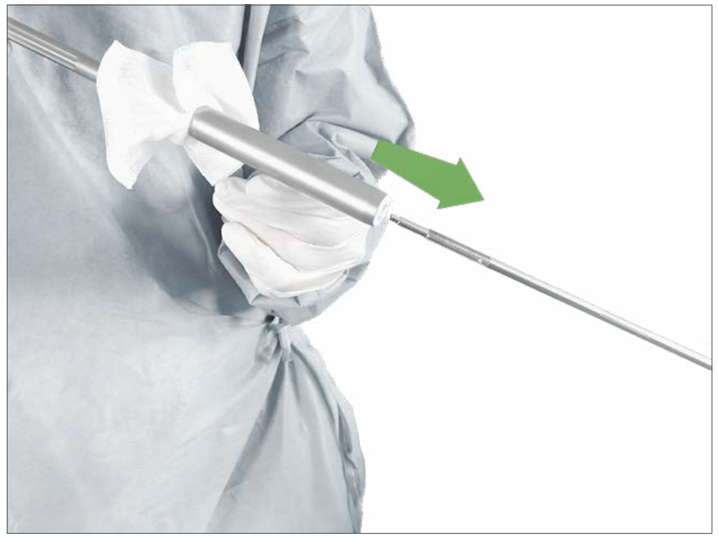
Gauze swab becomes visible.

Remove the mounted *Taper Wiper* from the *Mounting stand*.

Cleaning the morse taper connection

! 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*/Anchoring Stem manually or with the *Socket Wrench SW3,5*.



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*.

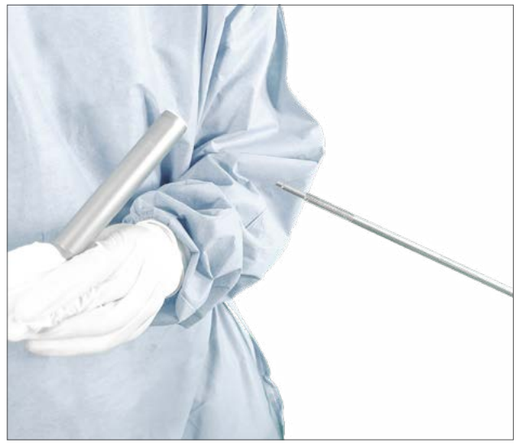
Cleaning the morse taper connection

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

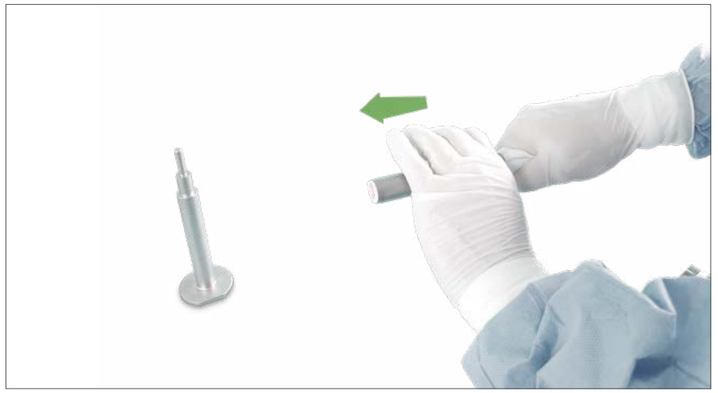
Carefully remove *Taper Wiper* from cone and *Guiding Rod*.

! HINWEIS

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



Cleaning the morse taper connection



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*.

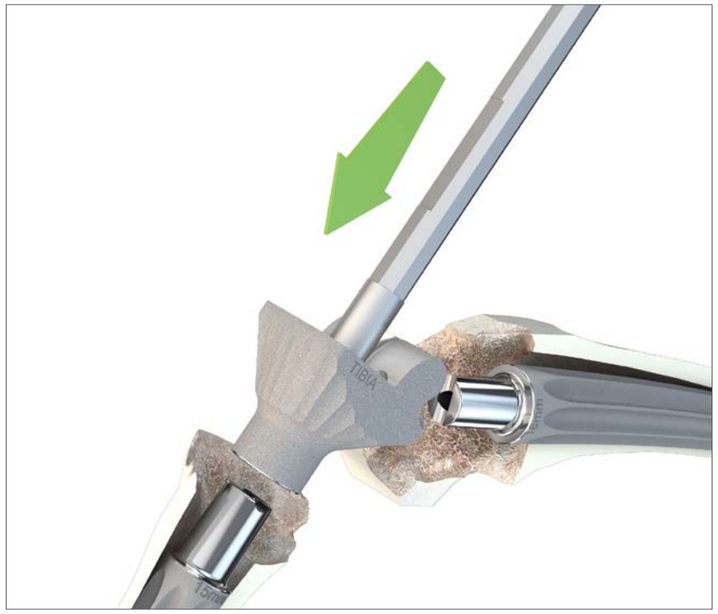
Unthread the *Sleeve slotted* from the *Gauze swab*.
Repeat all procedures → at least two cleaning cycles.

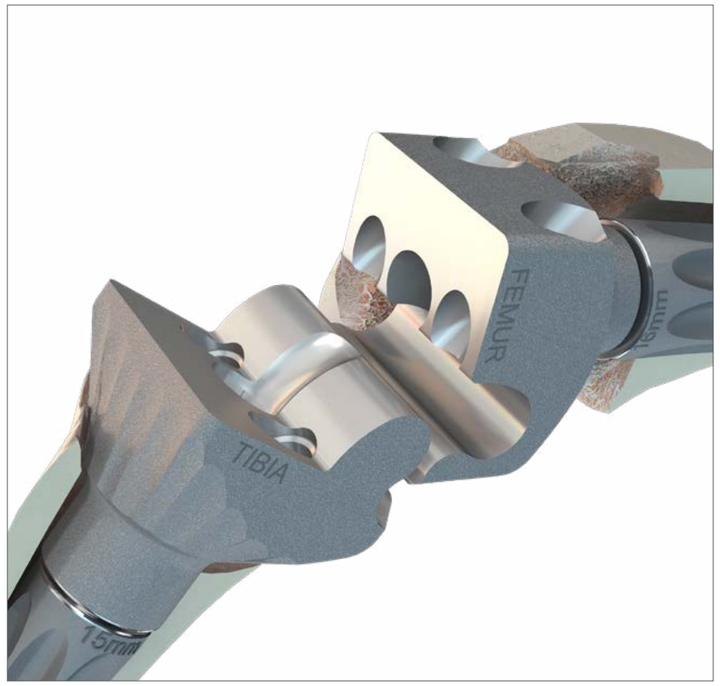
30

! NOTE

- Observe the right/left variants.
- KAM-TITAN must be combined with products released by PETER BREHM GmbH only.
- Do not combine Anchoring Stems with Extension Sleeves.
- Thoroughly clean Implant components.
- Pay attention to careful, axis-appropriate implantation.

Carefully clean, dry and mount the morse-taper connections and connection surfaces. Make sure that the cones are thoroughly cleaned of foreign bodies (e.g. bone residue, blood, grease, other liquids, etc.). After cleaning the cones and removing the *Guiding Rod* fit the Arthrodeses Components with the *setting tool*.





! NOTE

A flexion of at least 35° is required to couple the components.

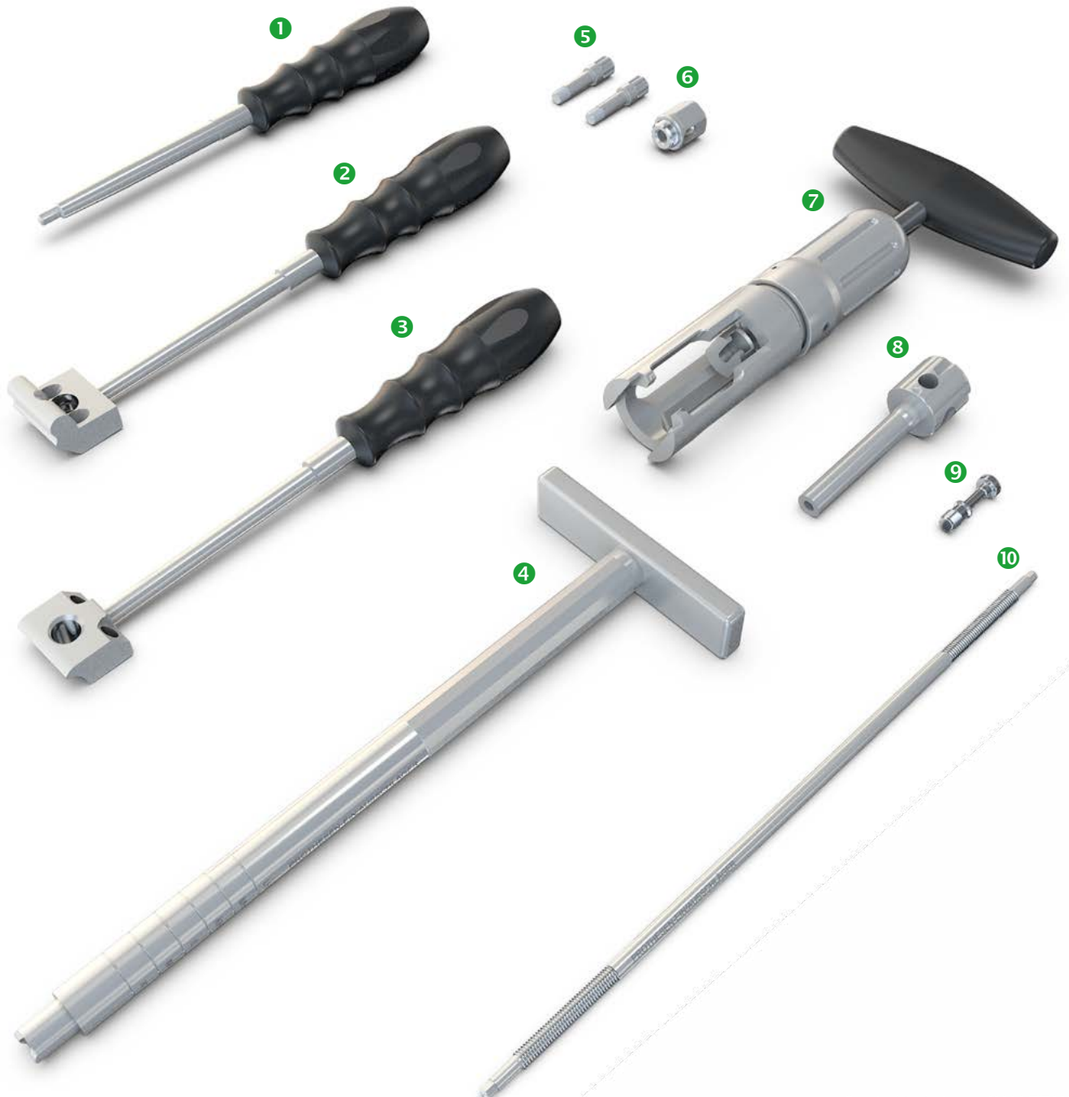
Leg length and external rotation of the lower leg should be repeatedly evaluated.

Pretensioning the definitive implants

31

Overview of required instrumentation:

1. *Allen Key SW5*
2. *Femur Adapter Counter Holder*
3. *Tibia Adapter Counter Holder*
4. *Handle for Prosthesis Inserter/Remover*
5. *Bolts for Counter Holder*
6. *Sleeve for Prefixing*
7. *Torsionfree Preloading Instrument (TOV)*
8. *Knurled Screw M*
9. *Stud Bolt*
10. *Guiding Rod*

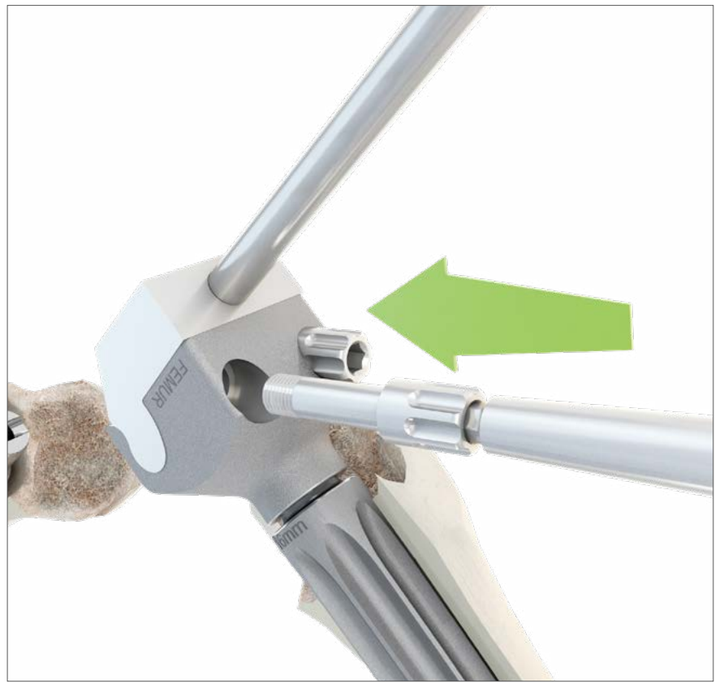


32

For definitive pretensioning, the appropriate *Femur Adapter Counter Holder* (*right/left/neutral*) or *Tibia Adapter Counter Holder* is attached and secured to the respective implant with the *Bolts for Counter Holder.*

! NOTE

Always use the *Femur Adapter Counter Holder (right/left/neutral)* to tension and secure the components.



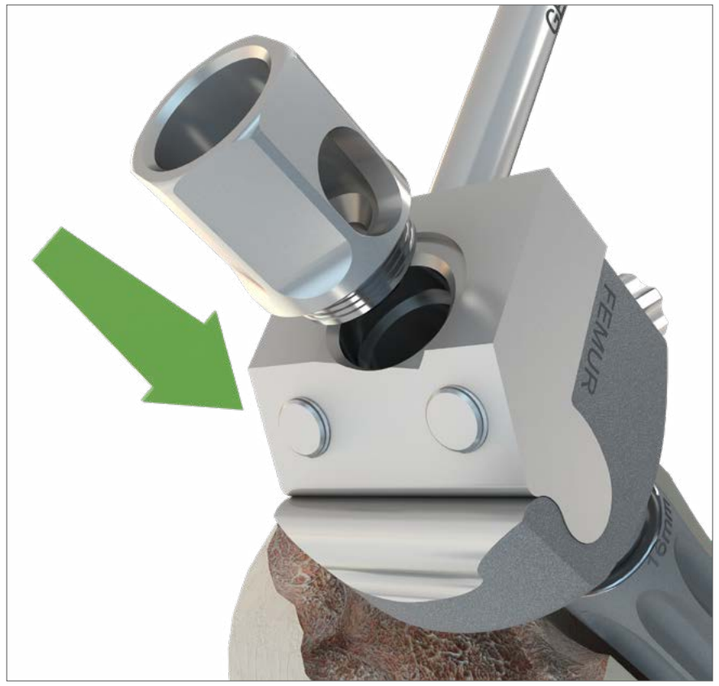
33

The *Bolts for Counter Holder* are screwed in hand-tight using the *Allen Key SW5*.

Pretensioning the definitive implants

34

The *Sleeve for Prefixing* is screwed into the *Femur* or *Tibia Adapter Counter Holder.*

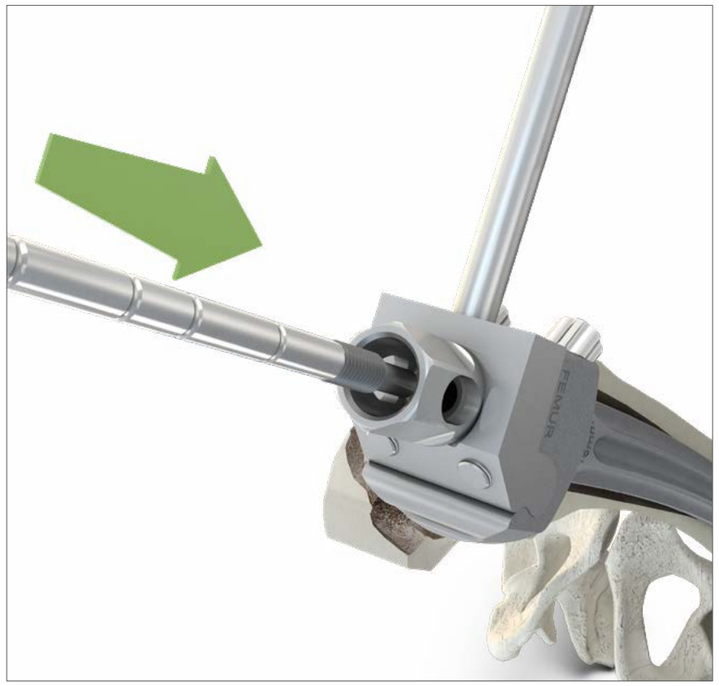


35

The *Guiding Rod* is screwed into the Anchoring Stem through the *Sleeve for Prefixing.*

! NOTE

It must be ensured that the *Guiding Rod* is completely screwed into the *TRIAL Anchoring Stem*/Anchoring Stem manually or with the *Socket Wrench SW3,5*.



36

The *Handle for Prosthesis Inserter/Remover* is slid over the *Guiding Rod*.

37

The assembly is secured with the *Knurled Screw M* from the instrumentation for the *Torsionfree Preloading Instrument (TOV)*.

! NOTE

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

Pretensioning the definitive implants

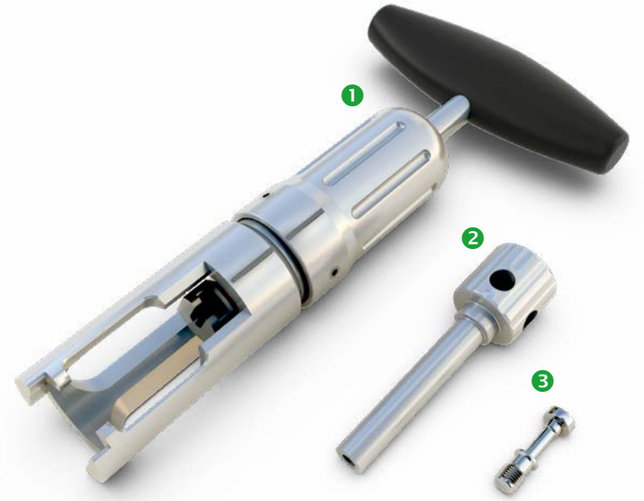
38

Components of the TOV system:

1. *Torsionfree Preloading Instrument (TOV)*
2. *Knurled Screw M*
3. *Stud Bolt*

! NOTE

- Pre-tension morse taper junction with the *Torsionfree Preloading Instrument (TOV)*.
- 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.



39

The *Stud Bolt* is screwed into the *Knurled Screw M* as far as it will go.

40

Bring the markings on the instrument into alignment.

41

Place the device on the *Handle for Prosthesis Inserter/Remover* and push it sideways over the *Knurled Screw M* and *Stud Bolt*.

! NOTE

Make sure that the *Torsionfree Preloading Instrument (TOV)* and *Stud Bolt* is fully engaged.

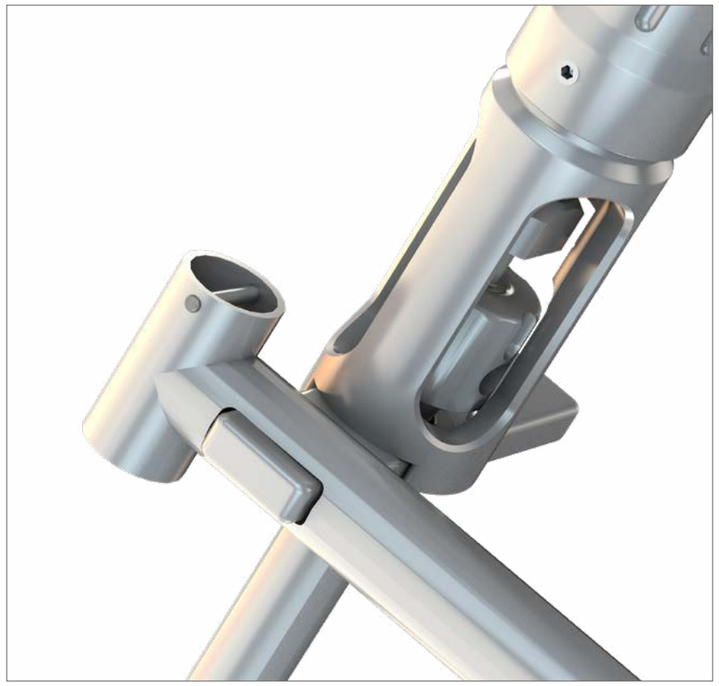
Pretensioning the definitive implants

42

In addition to the *Femur/Tibia Adapter Counter Holder*, the *Counter Holder 12/14* can also be attached to the *Handle for Prosthesis Inserter/Remover.*

! NOTE

- Always use counterholder also when removing screws, working with the pressing-off instrument, *Torque Limiter 25±1 Nm* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.
- Despite strictly axial access, care must be taken to ensure that no soft tissue act on the instruments during pretensioning and securing [16].

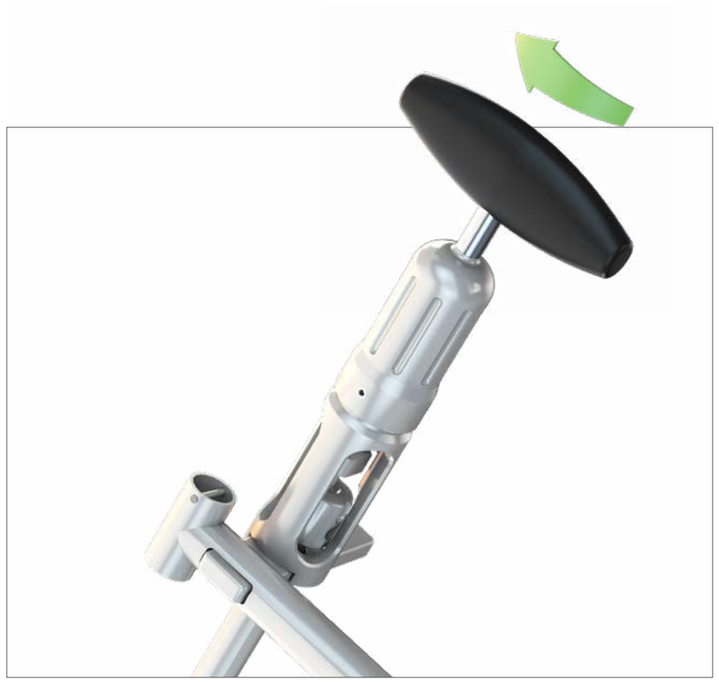


43

Turn the handle of the *Torsionfree Preloading Instrument (TOV)* clockwise until the *Stud Bolt* is cut apart. The components are now locked together.

! NOTE

As long as the *Stud Bolt* has not been divided, the handle of the *Torsionfree Preloading Instrument (TOV)* springs back.



44

Remove the *Torsionfree Preloading Instrument (TOV)* from the *Knurled Screw M*.

! NOTE

The upper part of the *Stud Bolt* remains in the instrument until it has been turned counterclockwise to the original position.

45

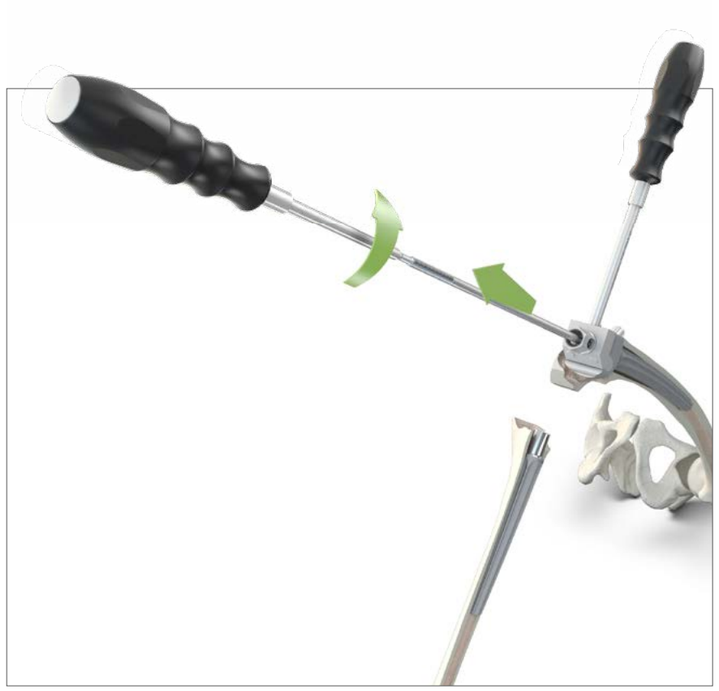
The *Knurled Screw M* is removed, and then the *Handle for Prosthesis Inserter/Remover* is withdrawn.

The defined pretensioning of the plug-in cone connections is ensured by the strictly axial use of the *Torsionfree Pretensioning Instrument (TOV)* in combination with the *Stud Bolt*.

Pretensioning the definitive implants

46

The *Guiding Rod* can be removed with the *Socket Wrench SW3,5*.



47

The *Socket Wrench SW3,5* can be used to release the *Sleeve for Prefixing*.

Securing the definitive implants

48

The KAM-Screw M6 is screwed through the Arthrodesis Component into the Anchoring Stem to achieve redundant locking of the modular implant.

! NOTE

- Before screwing in the KAM-Screw M6 or KAM-Bolts, make sure that the internal thread of the cone of the prosthesis stem or KAM-Arthrodesis Components is free of contamination. Therefore, the internal thread must always be rinsed with at least 100 ml of saline solution (NaCl 0.9%) using a syringe. Care must be taken to ensure that the thread is not damaged.
- The KAM-Screws M6 and KAM-Bolts must themself be free of contamination before screwing in.
- Always use the *Allen Key SW5* to screw in the KAM-Screws M6 and the KAM-Bolts. It must be possible to screw in the KAM-Screws M6 and the KAM-Bolts 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.
- Always use counterholder also when removing screws, working with the pressing-off instrument, *Torque Limiter 25±1Nm* and *Torsionfree Preloading Instrument (TOV)* to prevent the transfer of rotational forces to the bone.
- A safe and durable assembly is only guaranteed if the KAM-Screw M6 is used.
- Tighten KAM-Screws M6 and KAM-Bolts with the *Torque Limiter 25±1 Nm* defined.

KAM-Screw M6 is tightened using the *Torque Limiter 25±1 Nm*, and *Tommy Bar for Socket Head Wrench AF 6*. Then the *Bolts for Counter Holder* securing the *Counter Holder* are removed.

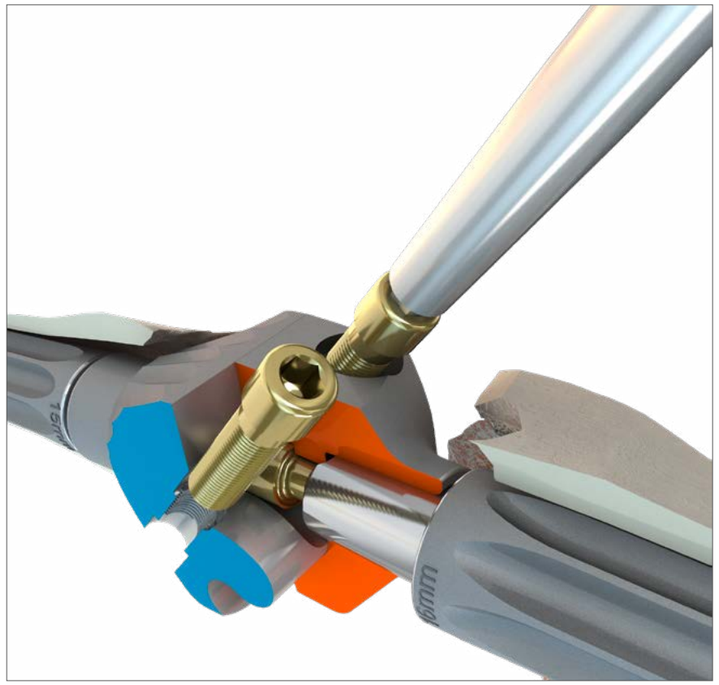
Securing the definitive implants

49

Finally, the Arthrodesis Components are assembled, connected with two KAM-Bolts and tightened to a defined torque using the *Torque Limiter 25±1 Nm* and the *Tommy Bar for Socket Head Wrench AF6*. Care must be taken to ensure that the threads are free of bone remnants, tissue, blood and other fluids.

! NOTE

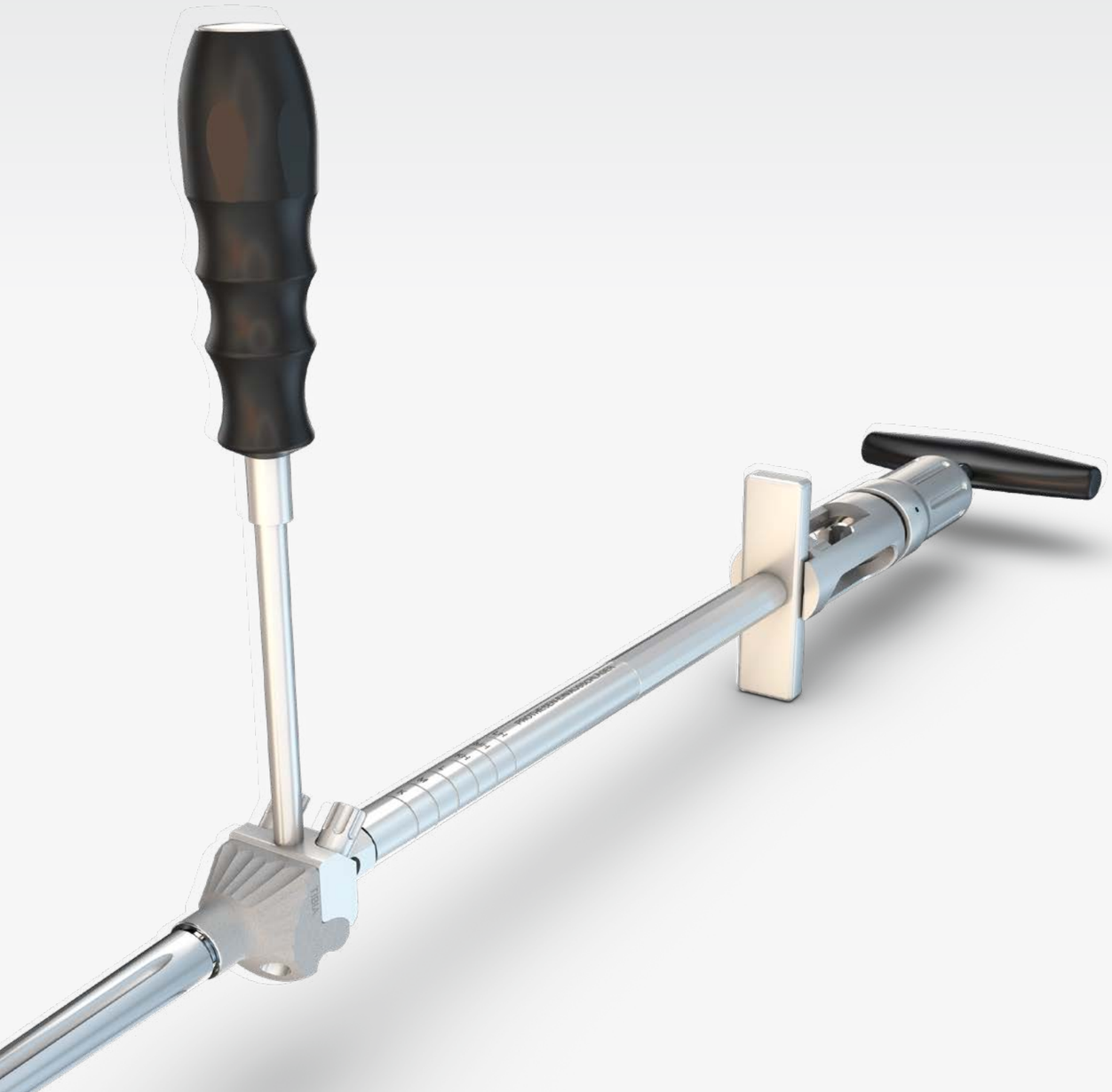
- Tighten KAM-Screws M6 and KAM-Bolts with the *Torque Limiter 25±1 Nm* defined.
- Ensure that the limiting mechanism of the *Torque Limiter 25±1 Nm* is triggered.
- The KAM-Screw M6 and the KAM-Bolts are only approved for single use with torque, do not reuse!



Always use the *Fork Key for Knee-Arthrodesis-Module* as a counter holder when tightening the assembly. Make sure to tighten the assembly until the *Torque Limiter 25±1 Nm* begins to slip.

KAM-TITAN

SUPPLEMENTARY SURGICAL TECHNIQUE



Arthrodesis Modul with Titanium Stem Straight Cemented

01

Cemented fixation is an option particularly in patients with poor bone stock. Titanium Stems straight Cemented (diameter 12 mm) are available in 140 mm and 200 mm lengths.

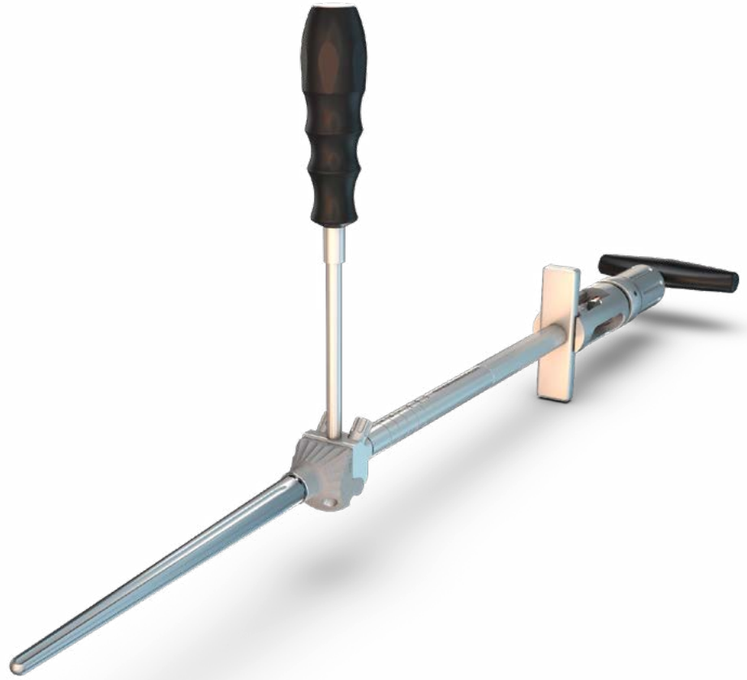
Titanium Stems straight Cemented and Arthrodesis Components are assembled before implantation to protect the taper connection. The two components are fixed in place by pressing them together hand-tight.

! NOTE

- 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.

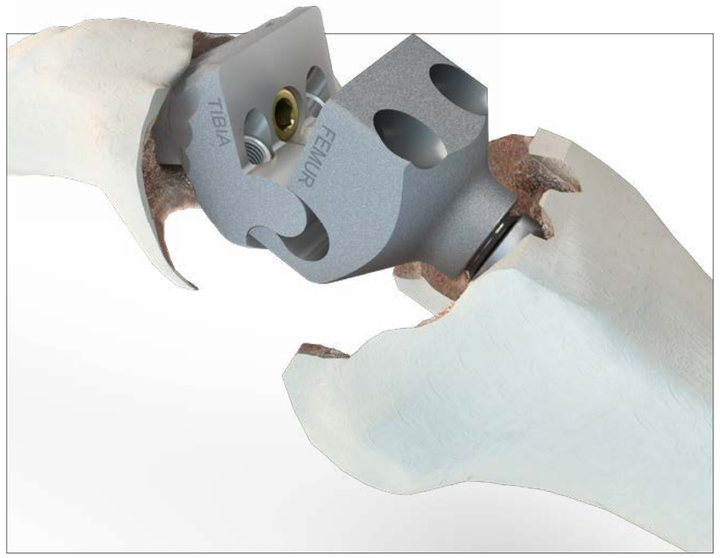
02

The cemented version is pretensioned before implantation in the same manner as the cementless version (see item 30 ff.).



03

The KAM-Screw M6 is screwed in with the *Torque Limiter 25±1 Nm* to achieve redundant locking of the modular implant.



04

The pretensioned stem components are initially placed without cement in the prepared femur and tibia, respectively, to evaluate the quality of the connection and the actual change in leg length.

To transfer the trial positioning to the final implantation, the distance between the end of the bone and the joint line (center of total module) can be measured.

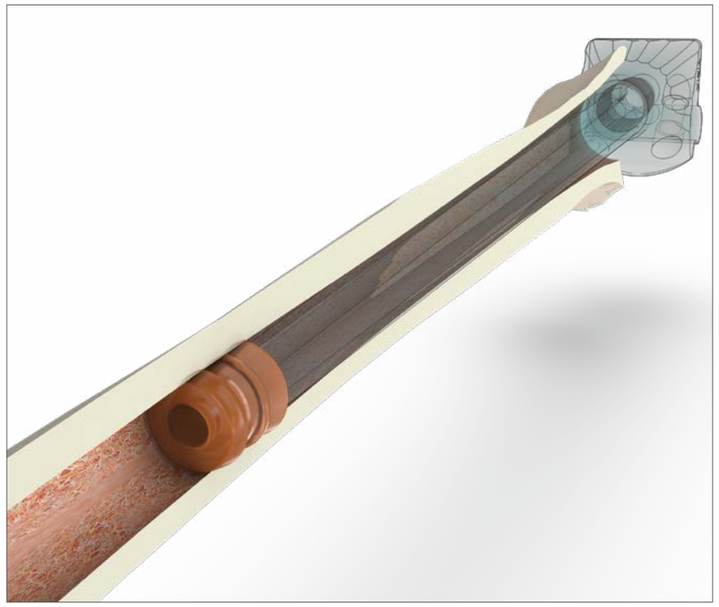
Arthrodesis Modul with Titanium Stem Straight Cemented

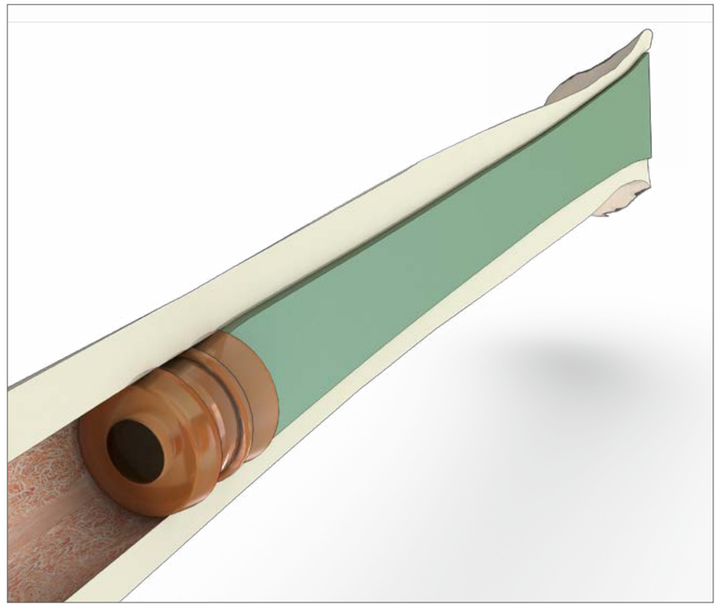
05

The *Bolts Tibia cemented* are screwed completely into the Tibia Arthrodesis Component to prevent bone cement from penetrating the threading.

06

Cement restrictors must be placed prior to application of cement. The KAM-TITAN system from PETER BREHM GmbH does not provide standard equipment for placing cement restrictors. When third-party systems are used, it is important to compare the length of the setting instrument to the implant length to ensure that the cement restrictor will be placed below the tip of the prosthesis.



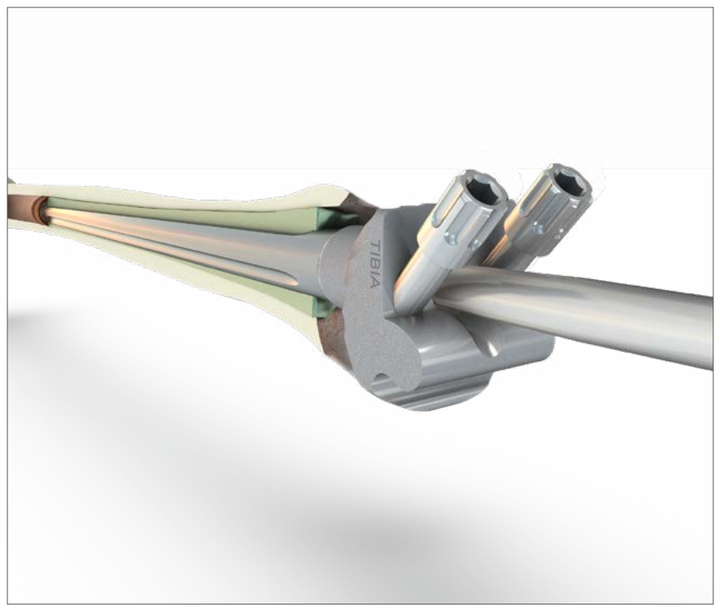


07

After the cement is mixed, the medullary canal is filled in retrograde fashion using a cement gun.

! NOTE

When using bone cement, user information of the cement manufacturer must be observed. Ensure, the implant is fully cemented at the bony site.



08

The Titanium Stems Straight Cemented with the respective Arthrodesis Components are pressed in at the proper angle of external rotation using the *Alley Key SW5*. Any excess cement is removed. Once the cement has hardened, the *Bolts Tibia cemented* are removed from the Tibia Arthrodesis Component. Then the Tibia and Femur Arthrodesis Components are connected.

Arthrodesis Modul with Titanium Stem Straight Cemented

09

Finally, the Arthrodesis Components are screwed together with two KAM-Bolts and then tightened to a defined torque using the *Torque Limiter 25±1 Nm* and the *Tommy Bar for Socket Head Wrench AF6*. Always use the *Fork Key for Knee-Arthrodesis-Module* as a counter holder.

KAM-Monoblock – Patient-Matched (cementless)

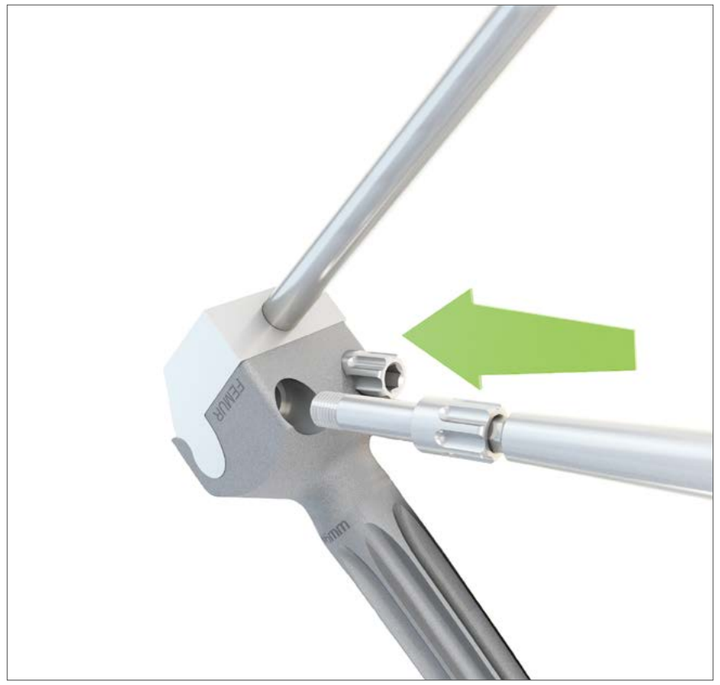
For patients presenting risk factors such as high body weight and/or high activity level, a "patient-matched" implant is available, after the user has weighed up the residual risks and, if necessary, ordered appropriate postoperative behavioral measures. The patient-matched implant offers hereby a specially adapted stem anchorage with an optimized anchoring distance. This special adaptation is achieved by the monoblock design of KAM-TITAN, taking into account the physician's specifications (e.g. joint line, leg length).

01

The decision for Anchoring Stem Straight or Anchoring Stem Curved is predetermined by the preoperative planning. Diameter and stem length is predetermined as well.

The intramedullary canals are prepared in accordance to point 01 (Anchoring Stem Straight) or 02 (Anchoring Stem Curved) of the general surgical technique, at which an iterative procedure must be applied to approach the preoperative determined diameter. The starting diameter of the rasp must be significant smaller in comparison to the stem diameter of the KAM-Monoblock. With the final diameter of the rasp, a primary stable anchorage of the stem at the predetermined joint level must be expected to ensure replication of the planed total leg length.

Cavities for the coupling elements of the KAM-Monoblock at the femur and/or the tibia are prepared in accordance to point 16 of the general surgical technique, while preparation tools are limited to forceps, hammer, and osteotome.



02

The *Femur Adapter Counter Holder (right/left/neutral)* or the *Tibia Adapter Counter Holder* are secured on the KAM-Monoblock with *Bolts for Counter Holder.*

KAM-Monoblock – Patient-Matched (cementless)

03

The *Setting Instrument* is mounted onto the Femur *Adapter Counter Holder (right/left/neutral)* or the *Tibia Adapter Counter Holder.*

Place the KAM-Monoblock in the intramedullary canal and impact it to the predetermined position.

! NOTE

- Observe, that the primary stable anchorage of the KAM-Monoblock is not disabled as a result of the coupling elements getting in contact to bone structures while impacting.
- Ensure correct rotational alignment while impacting the KAM-Monoblock.

04

KAM-Monoblock is coupled and secured with two KAM-Bolts as described in the general surgical technique.

Separating the pretensioned Knee Arthrodesis Module

01

Remove the two KAM-Bolts from the Arthrodesis Module with the *Allen Key SW5* and *Tommy Bar* for *Socket Head Wrench AF6.* Always use a *Fork Key for Knee-Arthrodesis-Module* as a counterholder

! NOTE

- Do not use *Torque Limiter* to loosen screw connections.
- When loosening screw connections, always use the counterholder to prevent the transfer of rotational forces to the bone.
- Use only implants/TRIAL implants/instruments without visible contamination.
- The KAM-Screw M6 and the KAM-Bolts are only approved for single use with torque, do not reuse!

02

To remove the KAM-Screw M6 the appropriate *Counter Holder* is attached to the Arthrodesis Component with the *Bolts for Counter Holder*. Next the KAM-Screw M6 is removed with the *Allen Key SW5* and the *Tommy Bar for Socket Head Wrench AF6*.

Separating the pretensioned Knee Arthrodesis Module

03

The assembled impression instrument including the *Impression Rod for Impression Instrument* is screwed all the way into the *Counter Holder.*

04

The Arthrodesis Component is then separated by turning the *Spindle* clockwise.

! NOTE

- 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.
- In the case of tight morse taper junction, it is advisable to strike the *Spindle* with a metal hammer with repeated light blows in axial direction. The impulses of the hammer blows can cause the loosening.

To remove the Anchoring Stem screw in the *Guiding Rod* completely into the stem, push the *Handle for Prosthesis Inserter/Remover* over the *Guiding Rod*, screw the *Knurled Screw S* in completely and secure it with a cross-inserted *Socket Wrench SW3,5* with an additional half a turn clockwise.

! NOTE

Again tighten *Knurled Screw S* with *Socket Wrench SW3,5*.

Explantation of a knee arthrodesis

01

The femoral and tibial components can also be extracted as assemblies without first separating the Arthrodesis Components.

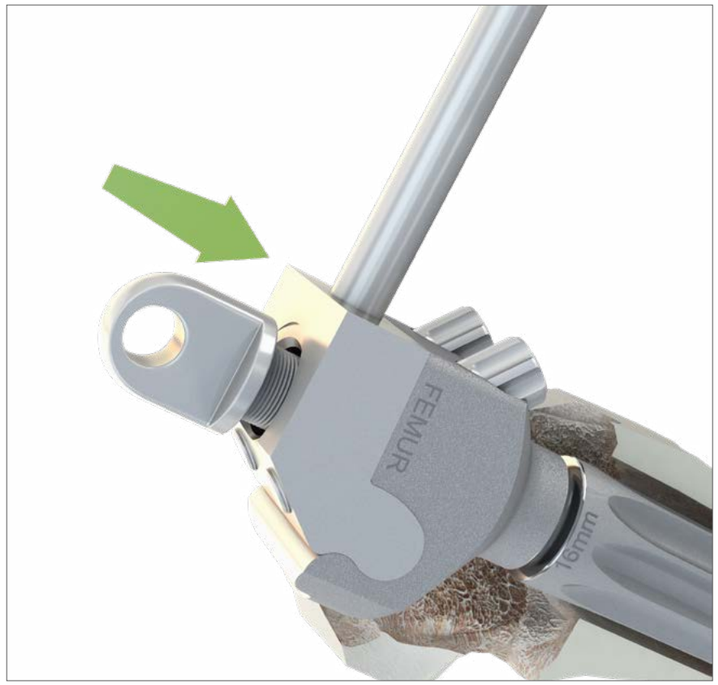
The *Slap Hammer* can be used for this purpose. It must be ordered separately as it is not included in the standard instrumentation set.

Always remove the KAM-Screw M6 short first. Use the appropriate *Tibia-* or *Femur Adapter Counter Holder* and the *Allen Key SW5*.

Explantation of a knee arthrodesis

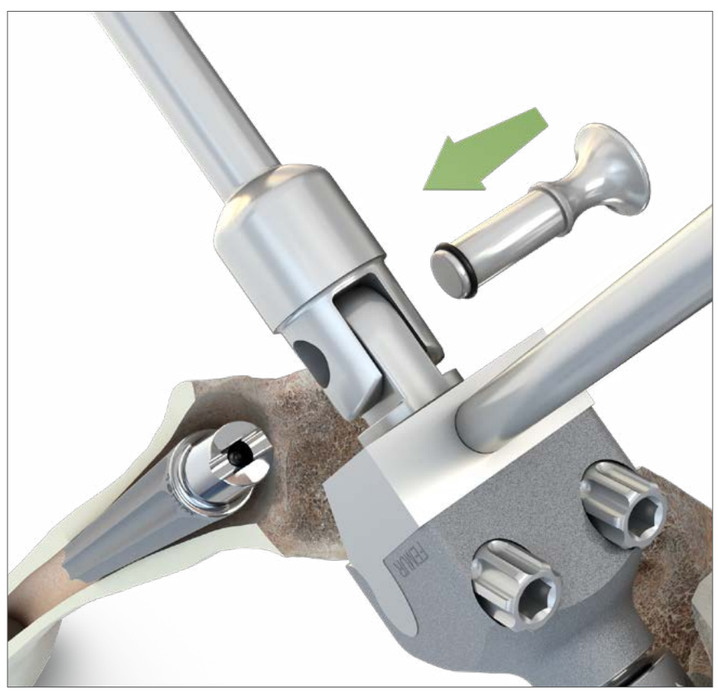
02

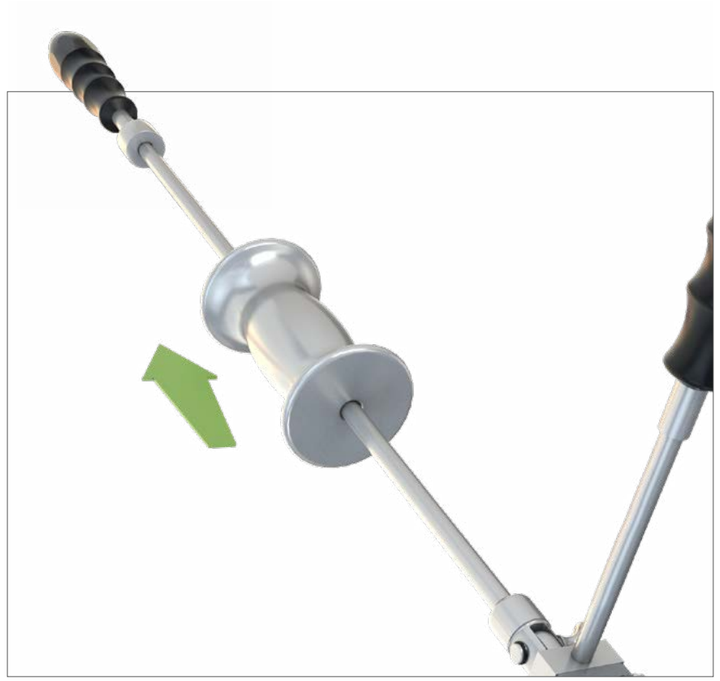
Before the *Slap Hammer* can be connected the corresponding *Adapter Counter Holder (right/ left/neutral)* or the *Tibia Adapter Counter Holder* must be attached. Then remove the KAM-Screw M6 and screw in the *Adapter M14x1 Adapted for Prosthesis Neck*.



03

Then the *Adapter M14x1 Adapted for Prosthesis Neck* and the *Slap Hammer* are connected with the *Bolt*.





04

The module is extracted by sliding the head of the *Slap Hammer*. Always hold the *Slap Hammer* in the direction of force.

! NOTE

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

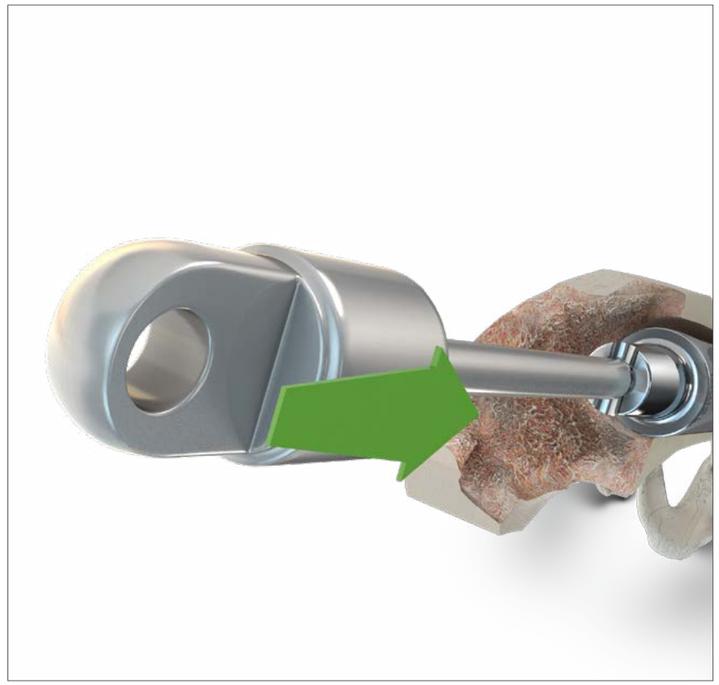
05

To remove the Anchoring Stem, the *Nail Extractor M6* is screwed into the taper.

Explantation of a knee arthrodesis

06

The *Adapter Threaded Pin Connection Piece* is mounted to the *Nail Extractor M6*.



07

Then the *Slap Hammer* is connected to the *Adapter Threaded Pin Connection Piece* and the Anchoring Stem is extracted.

! NOTE

- Do not use implants/instruments with visible damage.
- Instruments and TRIAL implants must be checked for fatigue fretting and correct handling/function prior to surgery.
- 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 re-use!
- Do not touch rough surfaces with cloths or any materials that produce lint.
- Avoid surface damage such as scratches and impact points that could be caused by chisels, hammers, luers, clamps, etc., as well as contact or sparks from electrosurgical instruments.

! NOTE

- Carry out implantation carefully (setting cerclages if necessary).
- Ensure strict axial access to the medullary canal throughout the surgery to avoid transverse forces on the instruments.
- Observe correct handling of implant components and instruments.
- Ensure that there is no contact between products for osteosynthesis for example plates, screws, cerclages and the KAM-TITAN implants except on the intended locations.

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! NOTE

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