EnduRo™ Hinge Knee System

Surgical Technique

Aesculap Orthopaedics

AESCULAP®
Implant Systems

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1. System Overview

Besides revision arthroplasty, rotating hinge knee systems have been used in primary cases with severe ligament instability, excessive varus/valgus deformity and/or bone loss. The specific challenges of hinged knee systems require an implant that performs the functions of lateral ligamentous support without restricting essential joint functions such as bending and rotating. Ensure your treatment plan for long-term success and high patient satisfaction with the EnduRo™ Hinge Knee System.

Designed for knee revision and complex primary arthroplasty cases, the EnduRo Hinge Knee System addresses the issues plaguing conventional hinge designs. Utilizing a rotating platform, mobility is achieved through the accommodation of a flexion angle up to 140° with 24° rotation.

- **Achieve Stability –** The connection between the femur and the tibia comprises a morse-taper junction and a locking nut affixed within the hinge hood, which provides security against subluxation and enables safe distraction.[1]
- **Kinematic Loading –** Positioning the rotation center close to the hinge axis promotes condylar loading and reduces stress at the cement/bone interface.
- **Minimal Bone Resections –** Remove minimal bone due to a narrow femoral box width of 23mm.
- **Technology for Endurance –**
  - Axle bearings made of carbon fiber-reinforced PEEK demonstrated in vitro results of high creep and wear resistance.[2*]
  - Overall surface bearing featuring Advanced Surface Technology demonstrated in vitro results of an 88% reduction in wear and an effective barrier to the release of metal ions.[2*]

* The results of in vitro wear and metal ion testing have not been proven to quantitatively predict clinical performance.

References

1 Ward W., et al. 92005). Dislocation of Rotating Hinge Knee Prosthesis. J. Bone Joint Surg. May 87(5), 1108-1112. Doi:10.2106/JBJS.008377pp.

2 Grupp TM., et al. (2013) Biotribology of a New Bearing Material Combination in Rotating Hinge Knee Articulation. Acta Biomaterials. http://dx/doi.org/10.1016/j.actbio.2013.02.030.

2. Indications and Contraindications

EnduRo Total Knee System
Indicated for use in reconstruction of the diseased knee joint caused by osteoarthritis, rheumatoid arthritis, post-traumatic arthritis, the need to revise failed arthroplasties or osteotomies where pain, deformity or dysfunction persist, and for patients suffering from correctable valgus or varus deformity and moderate flexion contracture.

Hinge knee systems are designed for use in patients in primary or revision surgery, where the posterior cruciate ligament and one or both of the collateral ligaments are absent or insufficient. The femoral and tibial augments are to be attached to their respective components with a fixation screw or screws.

Warning: The EnduRo Knee System is intended for cemented use only.

Contraindications

Contraindications include, but are not limited to:

- Joint conditions that can be treated by reconstructive surgery (e.g. osteotomy)
- Acute or chronic infections near the joint, or systemic infections
- Secondary diseases that could influence joint implant functionality
- Systemic diseases and metabolic disorders
- Severe osteoporosis or osteomalacia
- Severely damaged bone structures that could prevent stable implantation of implant components
- Bone tumors in the region of implant fixation
- Bone malformations, axial misalignments or other bone conditions that rule out implantation of a prosthetic joint
- Predictable overload of the joint implant (e.g. due to adiposity)
- Dependency on pharmaceutical drugs, drug abuse or alcoholism
- Fever, infection or inflammation (systemic or local)
- Pregnancy
- Mental illness
- Severe osteopenia (or any other medical or surgical finding) that would preclude any benefit from the implants
- Combination with implant components from other manufacturers
- Inadequate patient compliance
- Foreign body sensitivity to the implant materials
- All cases not listed under indications

Note: *The EnduRo Advanced Surface Technology knee system is used in cases of severe primary bone defects, collateral ligament insufficiency and in cases where revision is indicated. In these cases, varus/valgus and rotational forces are brought to bear on the linked femoral and tibial components, resulting in a potentially increased risk of loosening. Aesculap therefore recommends the femoral and tibial components for the EnduRo Advanced Surface Technology knee system only be implanted with extension stems. The surgeon may deviate from this at his/her own discretion.*

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3. Precautions & Warnings

Precautions

Aesculap Knee Systems are intended to be used by surgeons specializing in orthopedic surgery who have a thorough knowledge of knee arthroplasty, joint morphology and the biomechanical principles of the knee.

Preoperative assessment of the suitability of the patient's anatomy for receiving implants is made on the basis of X-Rays, CT scans and other radiological studies.

Only patients that meet the criteria described in the Indications for Use section should be selected.

Correct selection of the implant is extremely important. The morbidity as well as patient weight, height, occupation and/or degree of physical activity should be considered.

Proper implant handling before and during the operation is crucial. Handle the implant components properly. Ensure packaging integrity for implant sterility. Do not use any implant where the packaging has been breached. Do not resterilize an implant. Do not allow the implants surfaces to be damaged.

Adequately instruct the patient. The physician should inform the patient about knee implant advantages and disadvantages, post-operative limitations, weight/load bearing stresses which could affect bone healing, implant limitations and the fact that premature physical activity and full weight/load bearing stresses have been implicated in premature loosening, damage and/or fracture of knee prostheses.

Aesculap Knee Systems have not been evaluated for safety and compatibilityin the MR environment. Aesculap Knee Systems have not been tested for heating or migration in the MR environment.

Warnings and Potential Risks

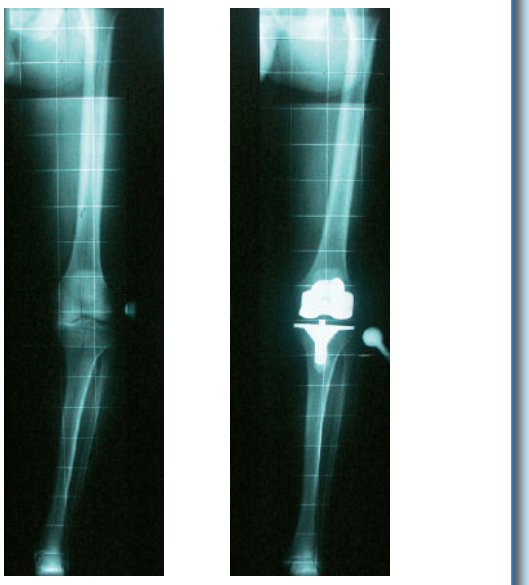
Implants are designed for single patient use only and must never be reused. As with all other orthopedic implants, the components should never be reimplanted under any circumstance.

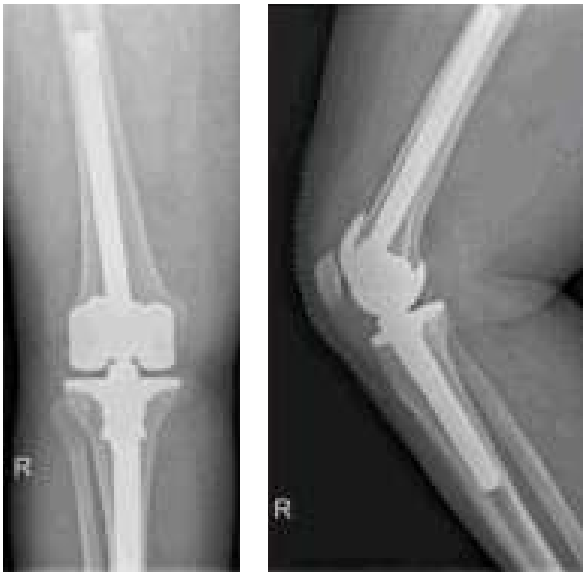
The mixing of different manufacturer implant components is not recommended due to metallurgical, mechanical and functional reasons. Dissimilar metals in contact with each other can accelerate the corrosion process due to galvanic corrosion effects. Do not use implants or instruments from other systems or manufacturers, and do not mix cobalt-chromium and titanium implant components together in a total knee system.

The implants can become loose or break if subjected to increased loading. Factors such as the patient's weight, activity level and adherence to weight-bearing or load-bearing instructions can affect the implant's longevity. Damage to the weight-bearing bone cement and/or bone structures caused by infection can give rise to loosening of the components and/or fracture of the bone.

These warnings do not include all adverse effects which could occur with surgery, but are important considerations specific to metallic devices. The risks associated with orthopedic surgery, general surgery and the use of general anesthesia should be explained to the patient prior to surgery. See the instructions for use for additional information, warnings, potential risks, precautions and possible adverse effects.

4. Preoperative Planning





If the primary prosthesis failed, it is imperative to identify the causes of failure in order to avoid repeat errors. It is recommended to consult the pre- and postoperative X-ray images.

Other parameters to ensure optimal results include:

- Restoration of the joint line
- Proper axis alignment
- Functionality of the extensor mechanism
- Functional stability
- Evaluation of soft tissue condition
- Preservation of bone

For the purposes of preoperative planning, EnduRo Hinge Knee System X-ray templates are available for X-ray image analysis to help determine the following:

- Angle between anatomic and mechanical femur axis
- Resection heights
- Size of the implants
- Entry points for intramedullary alignment
- Need for and dimensions of augments and stems

Extensive loss of bone can be compensated with the EnduRo Hinge Knee System:

- Maximum distal femur bone loss:
  - o F1 Distal: 19 mm, F2 Distal: 20.5 mm, F3 Distal: 22 mm
  - o F1 Posterior: 15 mm, F2 Posterior: 20.5 mm, F3 Posterior: 22 mm
- Maximum tibial bone loss:
  - o T1-T3: 40 mm

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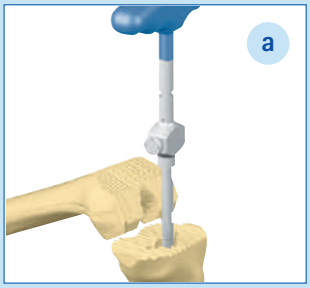
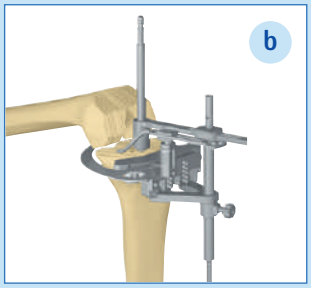
5. Workflow Guide

1





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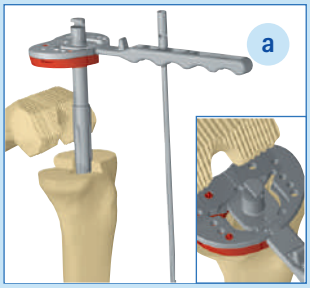

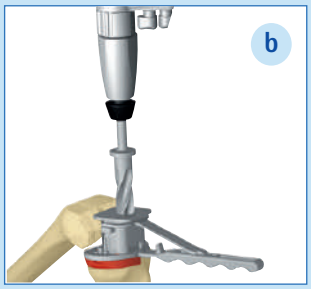

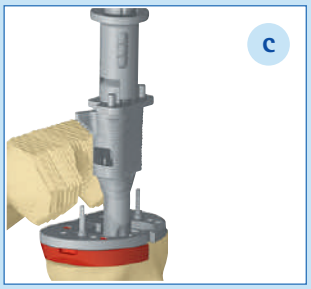

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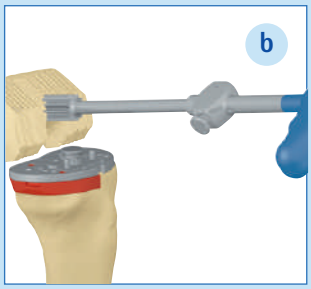

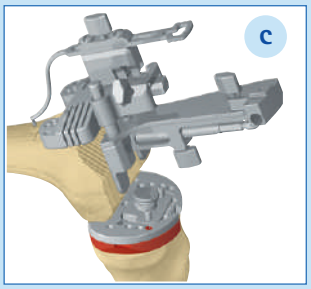

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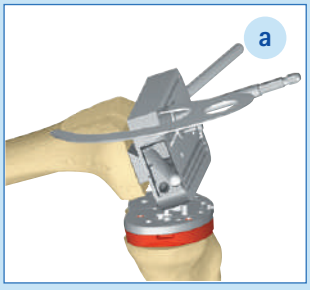

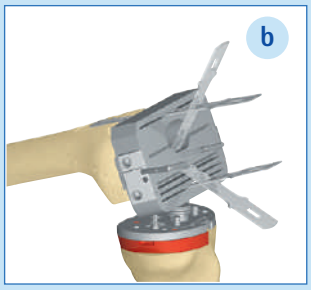

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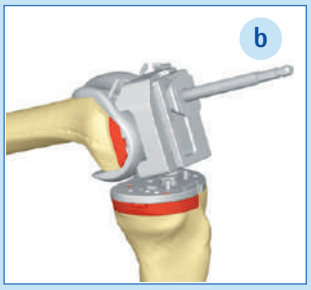

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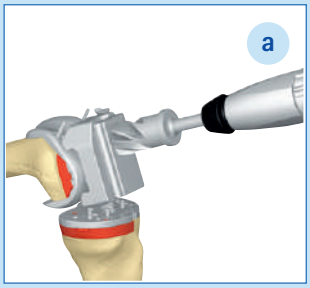

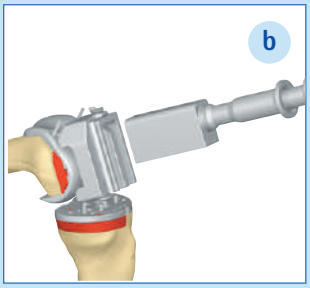

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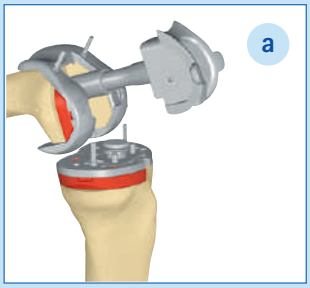

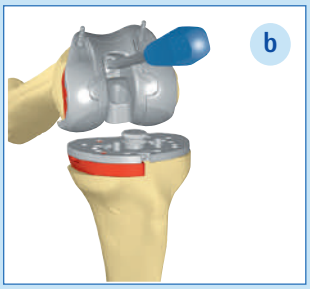

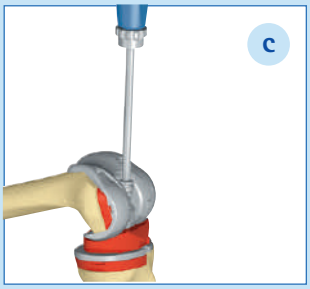

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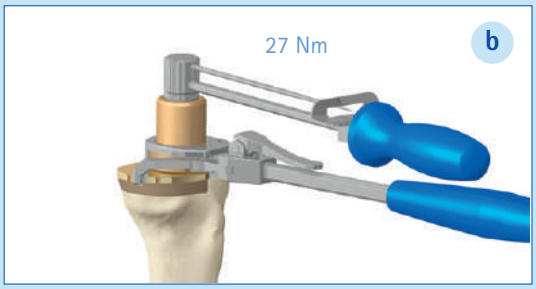

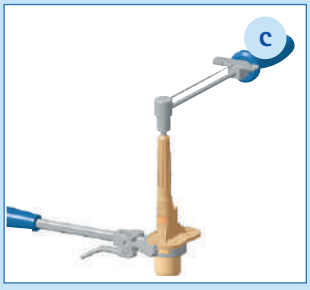

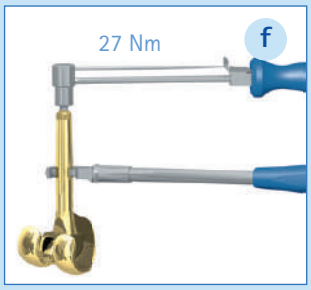

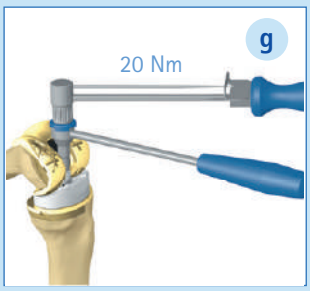

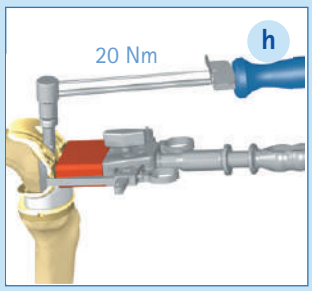

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6. Set Joint Line Reference

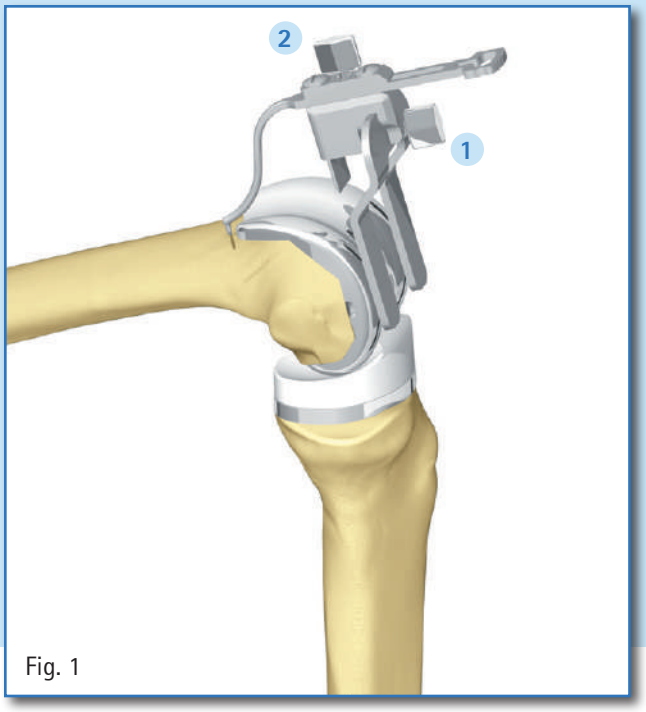

Fig. 1

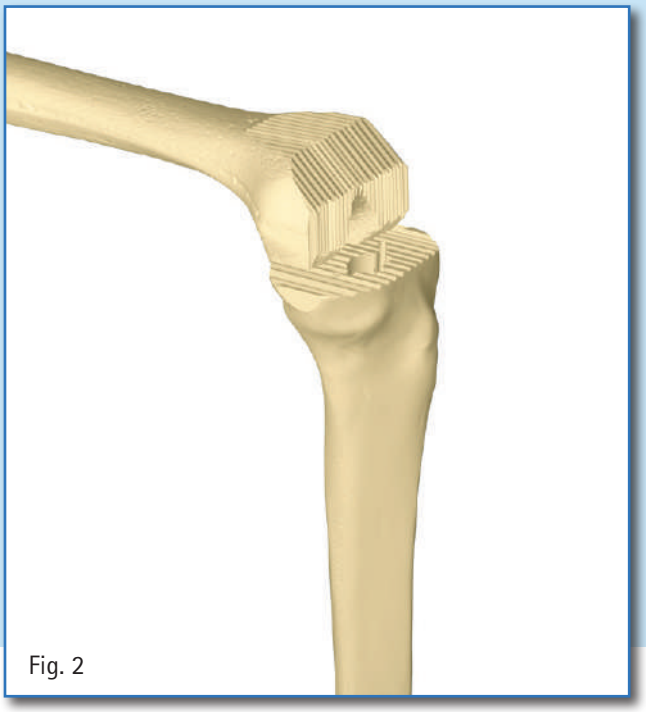
Fig. 2

Place the joint line positioner (NQ708R) on the distal femur contact plate (NQ709R) and secure with screw 1. On the anterior side of the femur, make a reference mark, for example, at the level where the primary femoral shield ends proximally. Lock in place the stylus on the joint line positioner using screw 2.

The stylus should remain in this locked position for the remainder of the surgery. It may be decoupled from the distal femur contact plate for use later during the procedure.

Remove all primary implants. Collateral ligaments may also be resected.

Note: *The implant matrix (see page 50-51) can be used to ensure availability of implants, as specified in preoperative planning.*

This surgical guide describes the **Tibia First** technique. However, if the **Femur First** technique is used, the step **Femur Preparation** on page 18 will be performed first.

7. Tibial Preparation

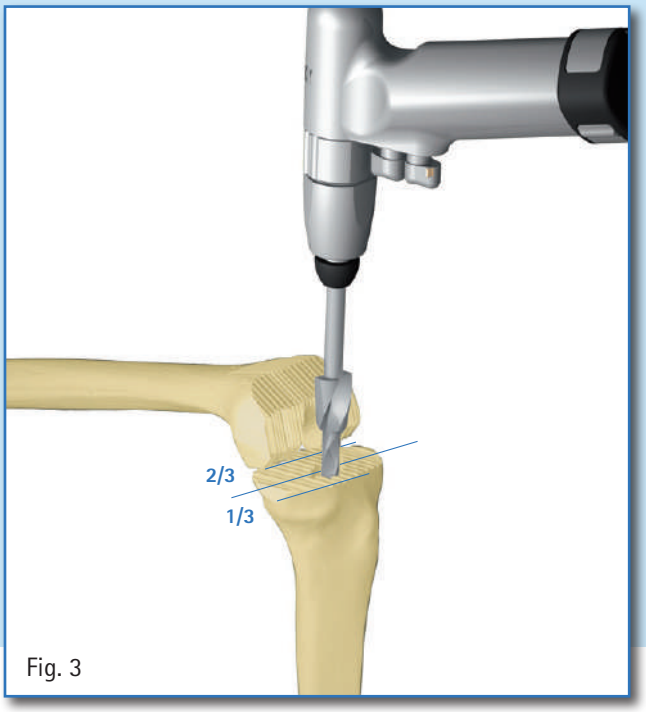

Fig. 3

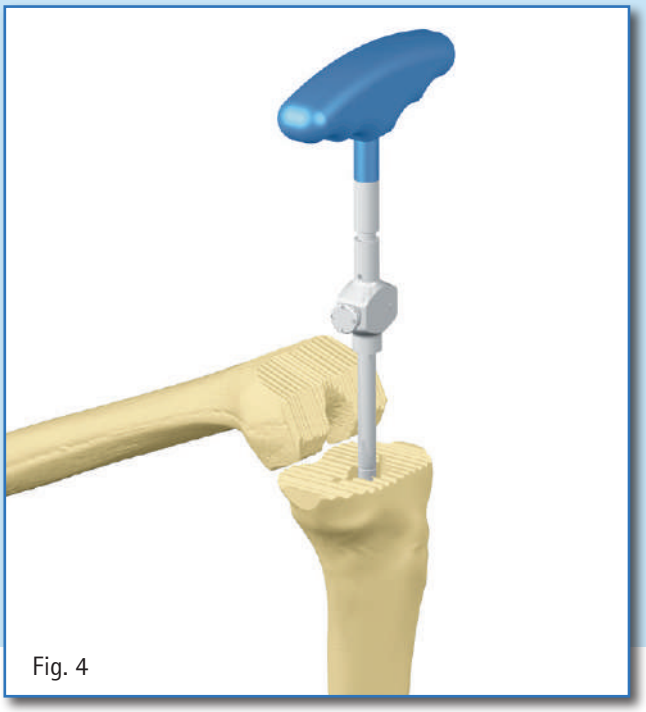
Fig. 4

7.1 Tibial Reaming

Determine the entry point for the drill (NP410R) and reamers, if necessary, with assistance from X-rays, the AP distance from 1/3 to 2/3 or via the trial tibia.

Note: *Pressfit tibial stem implants are 1 mm diameter larger than the corresponding reamer. Reamers and implants are conically shaped until 52 mm from the tip. Therefore, the depth of the preparation is crucial.*

For cemented stems, a cement mantle of at least 1 mm is required. It is necessary to ream with a larger diameter for the cement mantle. Alternatively, thinner stems can be used (-2 mm). Reamers with a diameter of 14, 15, 17, 18 and 20 mm are available.

Ream the intramedullary canal as deeply as possible using the reamer until stable anchorage is achieved for precise axle alignment.

Following the tibial resection, repeat reaming to the required depth, with the desired diameter, in order to achieve fixation preference: pressfit or cemented application. The reamers have markings for the different stem lengths. The depth reference is always the back side of the direct implant without augment. The markings on the reamer include the stem length and height of the tibial keel. Since bone is removed during proximal resection, it may be necessary to increase the depth so that the stem can be inserted correctly.

Warning: *Too aggressive of a pressfit fixation could lead to pain at the tip of the stem. Therefore, reaming by hand to achieve a less aggressive glide fit is recommended.*

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7. Tibial Preparation *(continued)*

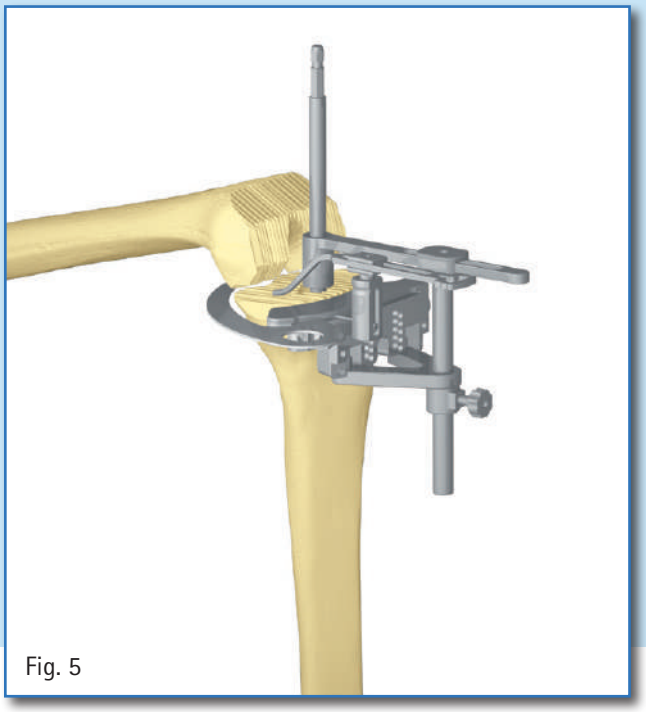


Fig. 5

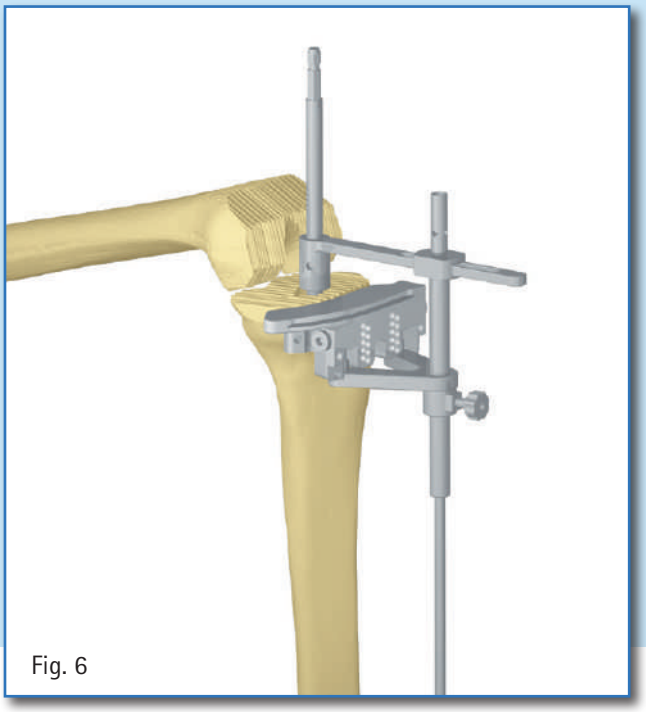
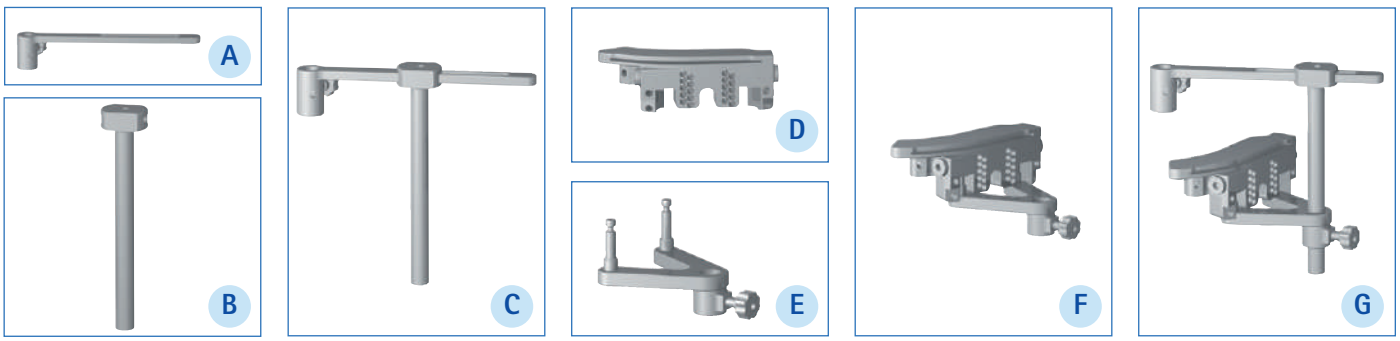


Fig. 6

7.2 Intramedullary Alignment

Assemble the alignment system, including tibial cutting guide, completely and fit onto the reamer. Determine the resection height by means of the tibial cutting guide stylus (NE425R) through the cutting guide, which has been adjusted to the desired resection height. Secure this position by tightening the lateral dial. The position of the cut can be checked using the resection check blade ("angel wing" – NM350R).

Optional: Review the position of the leg axis by inserting the alignment rod long (NP471R)/alignment rod short with sleeve (NE331R) into the borehole of the alignment system – body (NP678R).



A: Alignment System – Lever Arm (NP677R)
B: Alignment System – Body (NP678R)
C: Alignment System - Lever Arm and Body Assembled
D: Tibial Cutting Guide – Right, Left (NE196R, NE197R)
E: Alignment System – Base (NE195R)
F: Tibial Cutting Guide and Alignment System – Base Assembled
G: Alignment System and Tibial Cutting Guide Fully Assembled

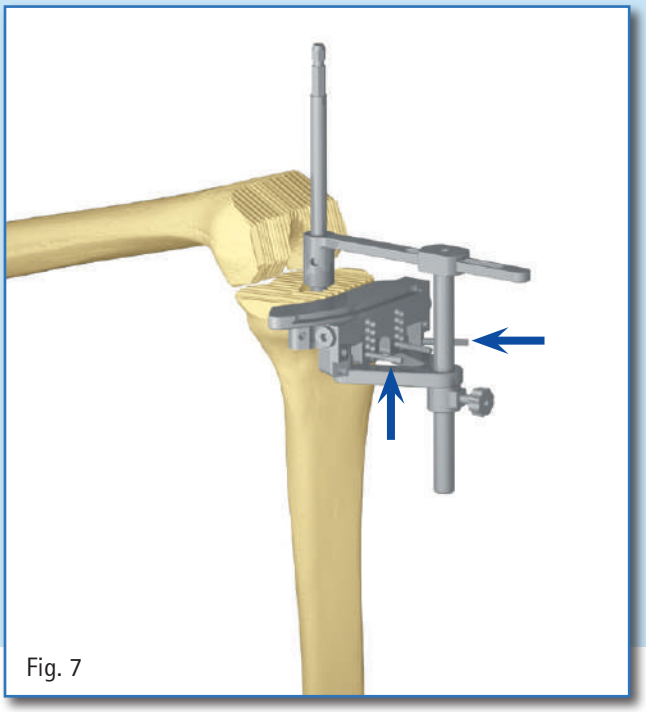


Fig. 7

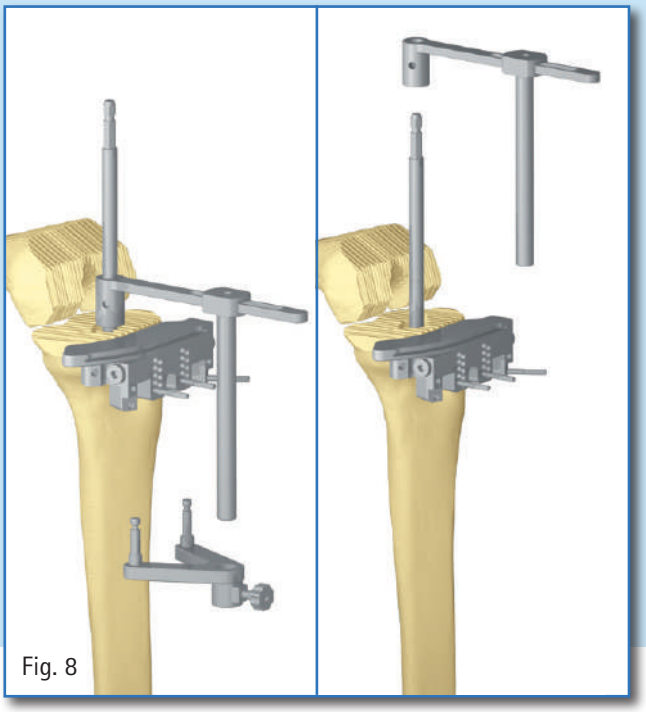


Fig. 8

Fix the tibial cutting guide in the desired position via two parallel headless pins and one convergent headed pin.

Remove the alignment system and the reamer. Release the alignment system – base (NE195R) by simultaneously pressing the two side buttons of the tibial cutting guide, and then withdraw distally.

Next, remove the alignment system – lever arm (NP677R) and the alignment system – body (NP678R) in a proximal direction. Remove the reamer by first reattaching the T-handle (NE198R) and then turning the T-handle clockwise to withdraw proximally.

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7. Tibial Preparation *(continued)*

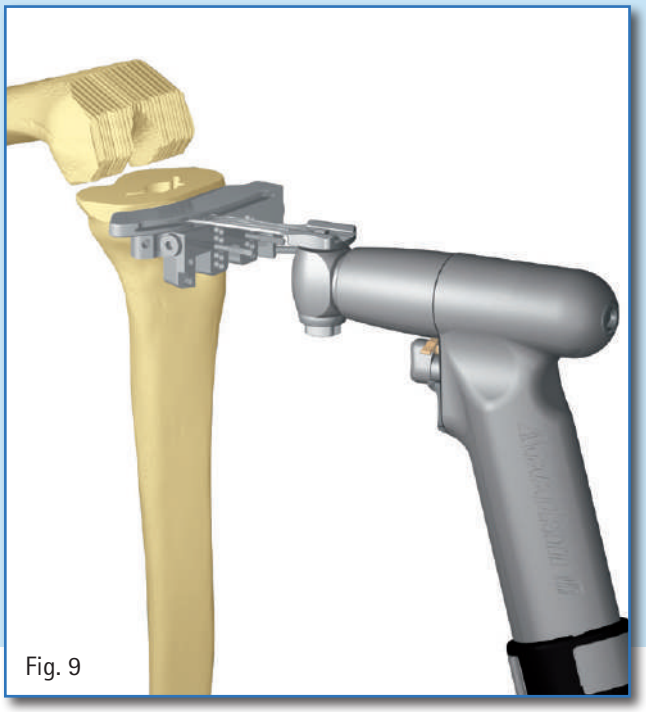


Fig. 9

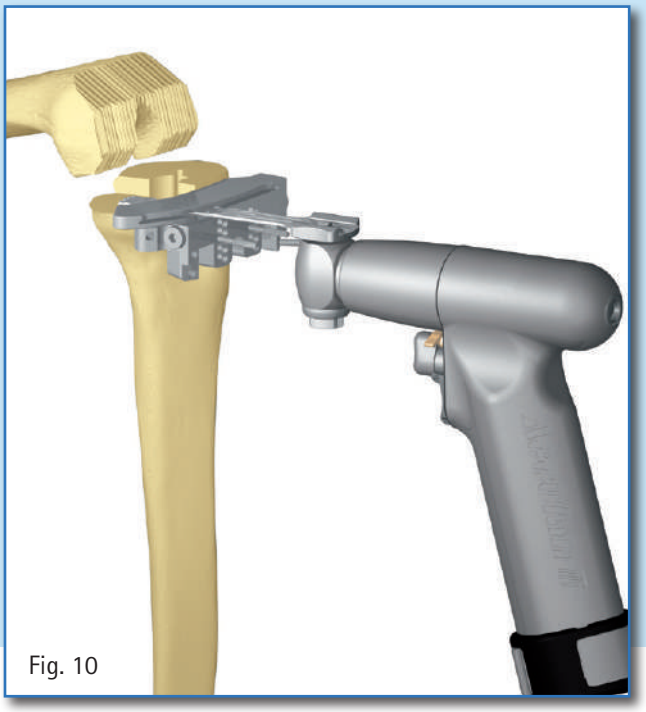


Fig. 10

7.3 Tibial Resection

Perform tibial resection using a 1.27 mm thick cutting blade.

By reconnecting the tibial cutting guide distally, it is also possible to make cuts for the 4, 8, 12 and 16 mm augments. The position at which the augment ends sagittally in the tibia center must be taken into account.

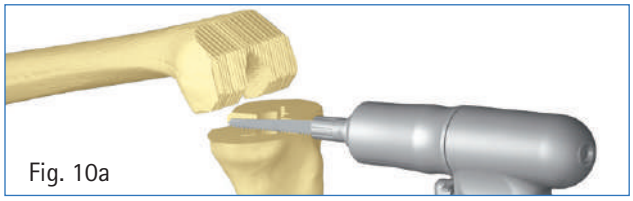


Fig. 10a

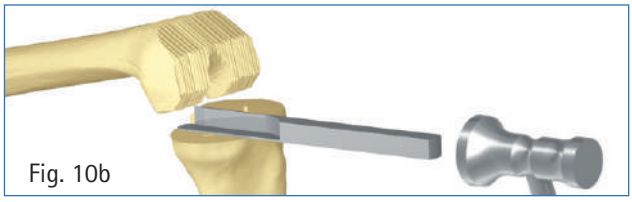


Fig. 10b

Depending upon the operative side, the chisel (RL/LM – NP024R, RM/LL – NP025R) or reciprocating saw is used for sagittal augment resection.

Note: *To minimize the risk of tibial fracture, the horizontal incision should be made before the sagittal incision. The sagittal incision should not be deeper than the horizontal resection surface.*

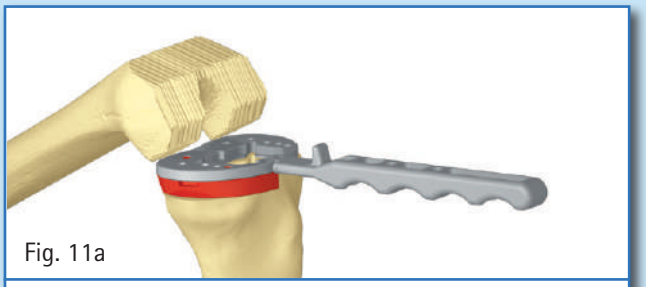


Fig. 11a

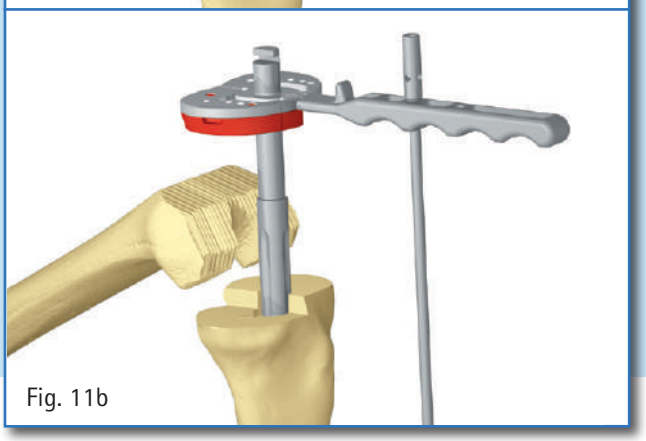


Fig. 11b

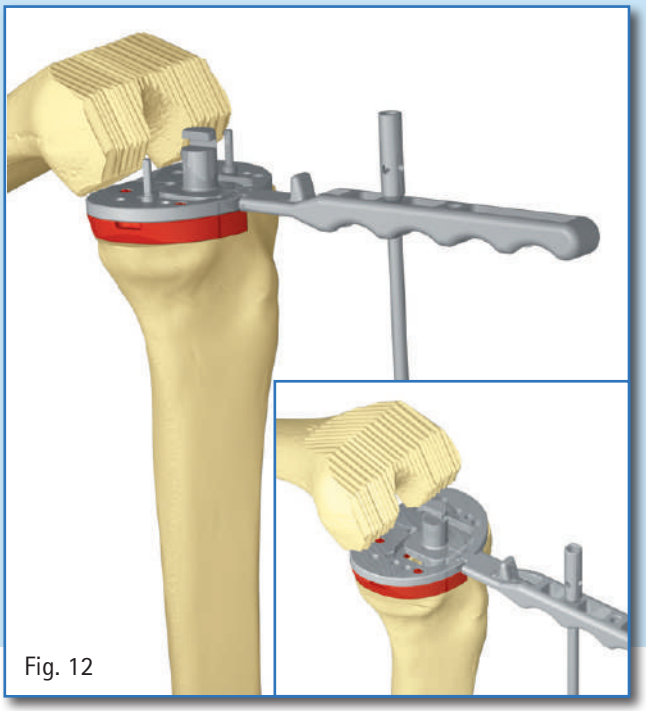


Fig. 12

7.4 Tibial Component Sizing and Position

Following the tibial resection, repeat reaming to the required depth, with the desired diameter, in order to achieve fixation preference: pressfit or cemented application. See page 11 for more reaming information.

Select the trial tibia which best covers the bone in ML and AP directions and attach the corresponding trial augment underneath the trial tibia, if applicable.

The optimal ML, AP and rotational position is determined by the ML positioner (NP466R). Connect the desired trial stem to the ML positioner and place it through the trial tibia and into the tibial canal until fully seated.

Note: *The ML value noted will be used to assemble the trial stem with the trial keel.*

Note the ML value by means of anterior markings. This value is determined by the location of the notch line on the ML positioner relative to the notch lines on the trial tibia. Secure the trial tibia in this position using two short headed pins.

Optional: The position of the leg axis can be reviewed by inserting the alignment rod long (NP471R)/ alignment rod short with sleeve (NE331R) into the borehole of the trial tibial handle (NE510R).

Note: *When preparing the tibia, the required buildup height (thickness of tibia + PE insert + optional augments) for reconstruction of the joint line should be taken into account at an early stage. In particular, the tibia should not end up too far distal; otherwise, there may not be sufficient space in the ML dimension to accommodate the tibial keel in the tibial metaphysis, which could result in fractures due to excessive strain. The joint line should therefore preferably be achieved by using augments on both sides rather than by a higher PE insert. This applies to both preparation and the final implant.*

EnduRo™ Hinge Knee System

Surgical Technique

7. Tibial Preparation *(continued)*

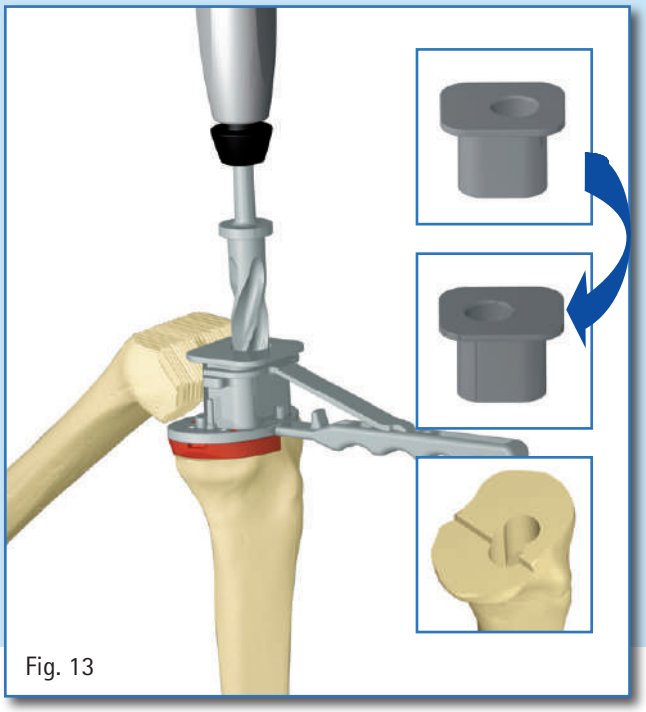


Fig. 13

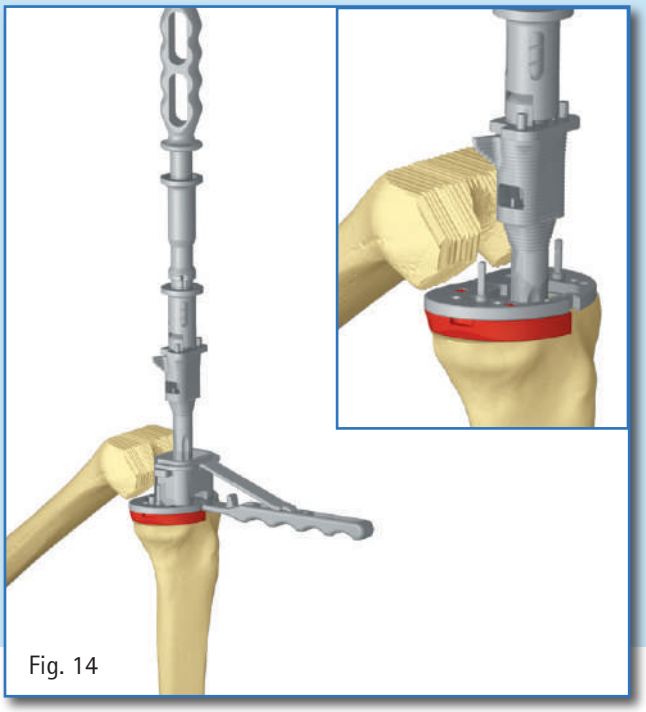


Fig. 14

7.5 Tibial Box Preparation

Remove the ML positioner (NP466R).

Place the tibial drill sleeve guide (NP463R) and the drill sleeve in the respective size (T1 – NP457R, T2/T3 – NP458R) onto the tibial trial. Position the locking holder (NP459R) on the tibial handle and the drill sleeve for assisted stabilization. Drill two overlapping holes – by reinserting the drill sleeve in a 180° rotated position – up to the depth limit using the 18 mm tibial box preparation drill (NP456R).

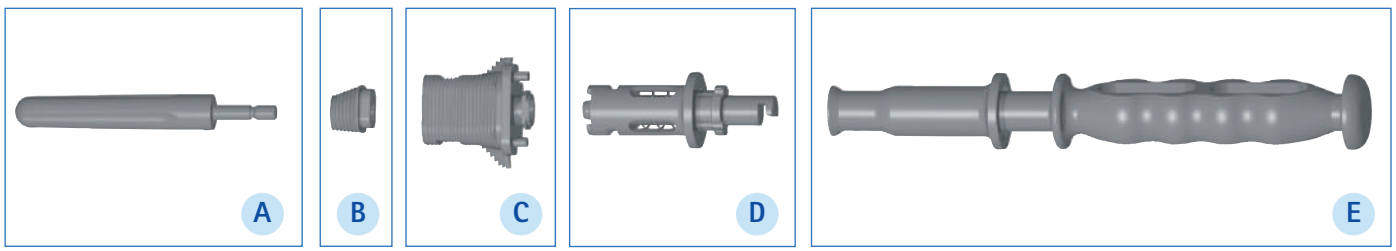
The result is a binocular-shaped cavity.

Complete the box shape as follows using the rasp:

Assemble the impactor handle (NP495R), adapter (NP467R), tibial trial keel in the respective size (T1 – NP464R, T2/T3 – NP465R), tibial stem collar trial (up to 14 mm – NQ846R, up to 17 mm – NQ843R, up to 20mm – NQ831R) and tibial trial stem in the desired size with the determined ML position.

Drive this rasp assembly into the tibial trial until fully seated, with or without the guide (NP463R).

The depth of the trial keel seating must be taken into account.



A: Tibial Trial Stem
B: Tibial Stem Collar Trial (up to 14 mm – NQ846R, up to 17 mm – NQ843R, up to 20 mm – NQ831R)
C: Tibial Trial Keel (T1 – NP464R, T2/T3 – NP465R)
D: Adapter (NP467R)
E: Impactor Handle (NP495R)

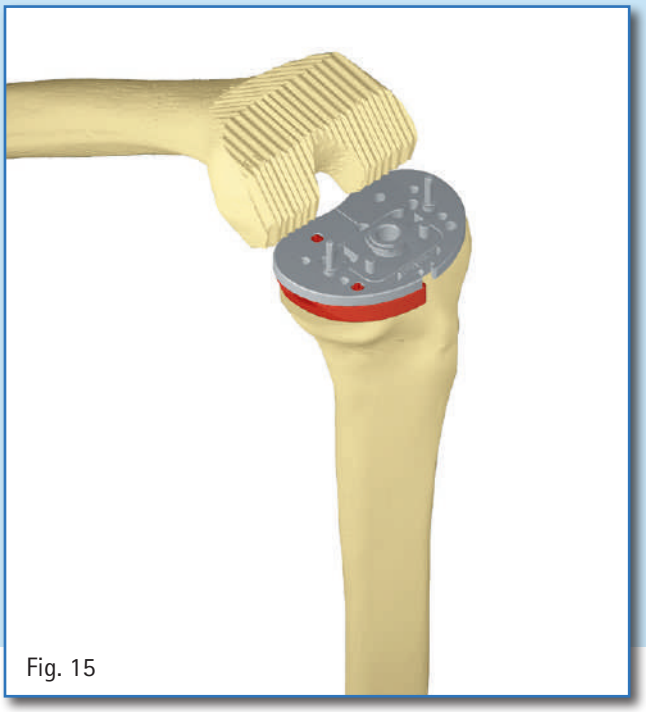


Fig. 15

Preparation of the tibia is now complete, and the tibia is fixed securely against rotation by the keel. Both pins can now be removed.

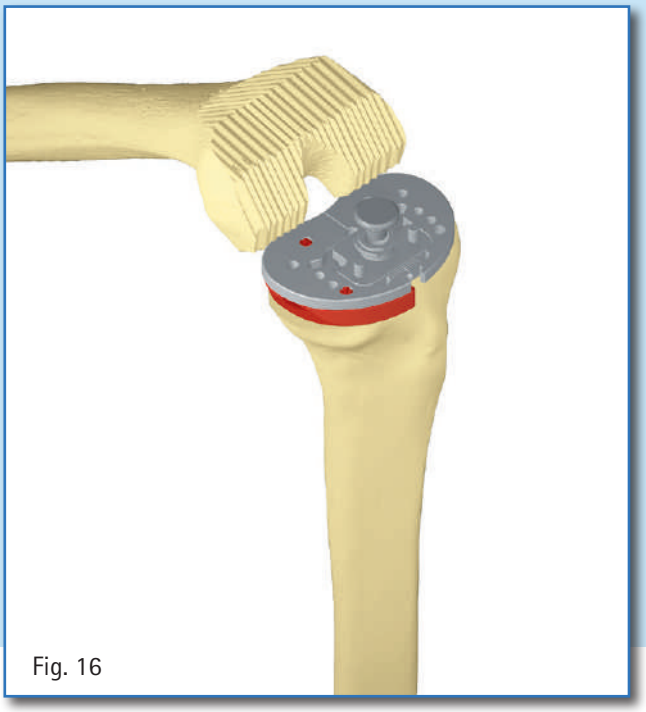


Fig. 16

Insert covering (NP479R) in order to prevent debris from entering the borehole for the tibial trial post, which provides the rotational axis.

EnduRo™ Hinge Knee System

Surgical Technique

8. Femoral Preparation

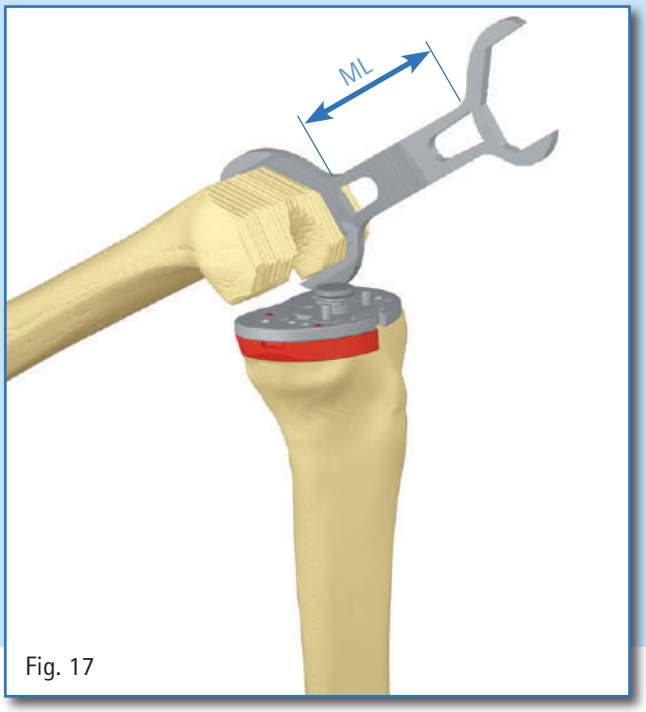


Fig. 17

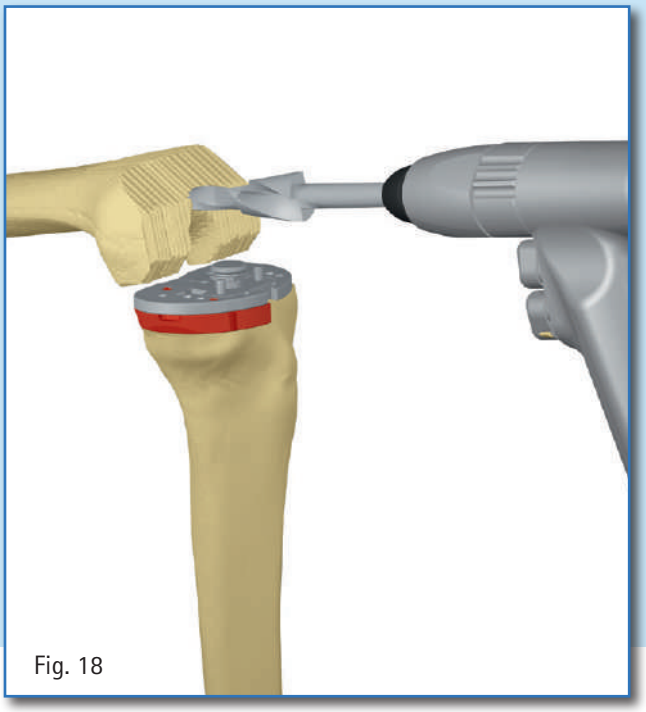


Fig. 18

8.1 Femoral Reaming

Determine the size of the femur using the femoral sizers (F1/F2 – NP441R, F3 – NP442R). The sizers indicate the respective AP and ML dimensions. Additional markings on the instrument indicate the available distal and posterior-distal femoral augments for each size.

Determine the entry point for the drill (NP410R) and reamers, if necessary, with assistance from X-ray images. Drilling is performed in the selected angle, taking into account the femoral curvature and other patient-specific aspects.

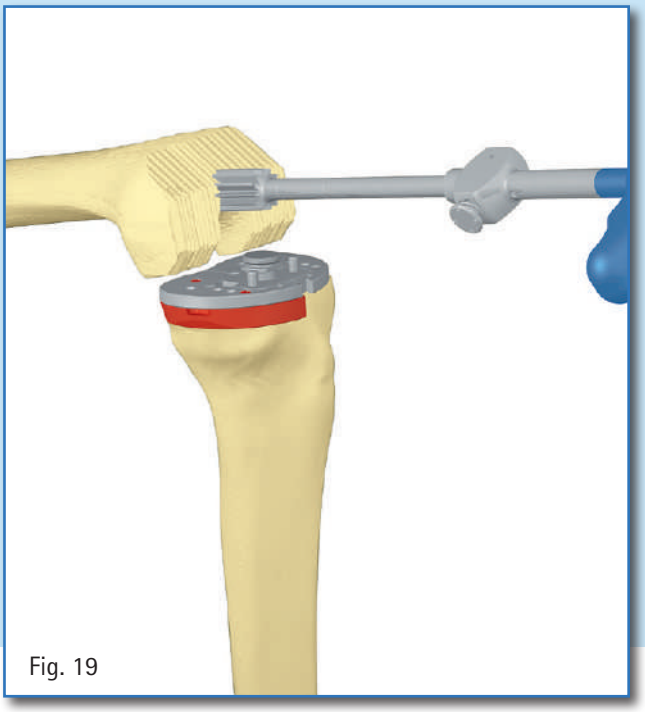


Fig. 19

Following the femoral resection, repeat reaming to the required depth, with the desired diameter, in order to achieve fixation preference: pressfit or cemented application. The reamers have markings for the different stem lengths. The depth reference is always the back side of the direct implant without augments. The markings on the reamer include the stem length and height of the femoral box. Since bone is removed during the distal resection, it may be necessary to increase the depth so that the stem can be inserted correctly.

Warning: *Too aggressive of a pressfit fixation could lead to pain at the tip of the stem. Therefore, reaming by hand to achieve a less aggressive glide fit is recommended.*

Note: *Pressfit femoral stem implants are 1 mm diameter larger than the corresponding reamer. Reamers and implants are conically shaped until 56 mm from the tip. Therefore, the depth of the preparation is crucial.*

For cemented stems, a cement mantle of at least 1mm is required. It is necessary to ream with a larger diameter for the cement mantle. Alternatively, thinner stems can be used (-2 mm). Reamers with a diameter of 14, 15, 17, 18 and 20 mm are available.

EnduRo™ Hinge Knee System

Surgical Technique

8. Femoral Preparation *(continued)*

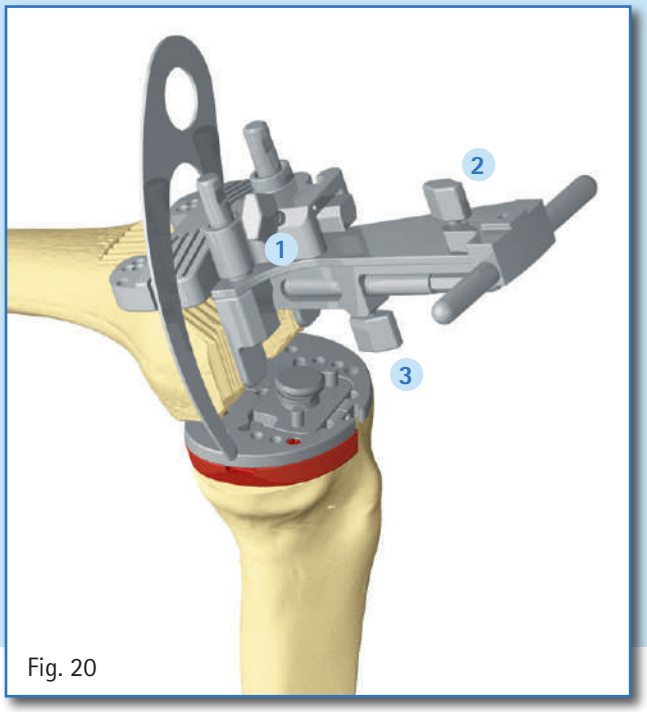


Fig. 20

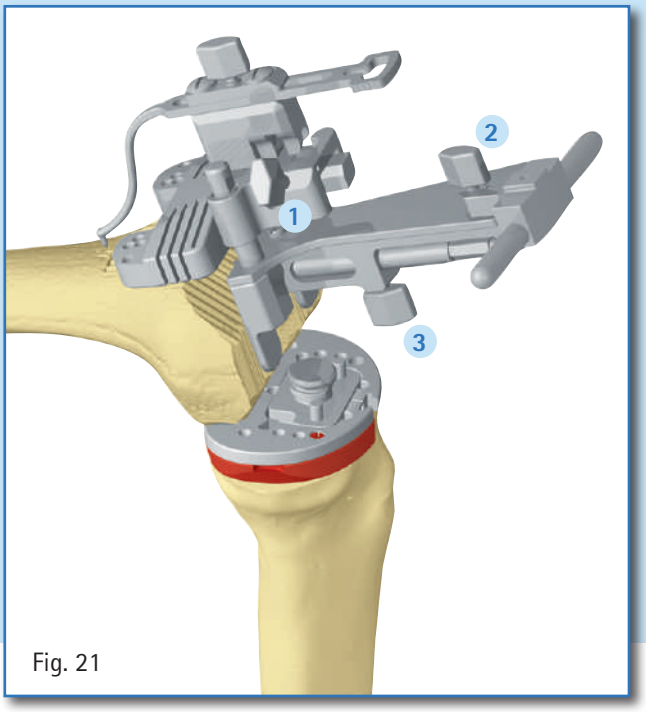


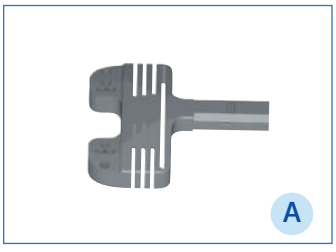
Fig. 21

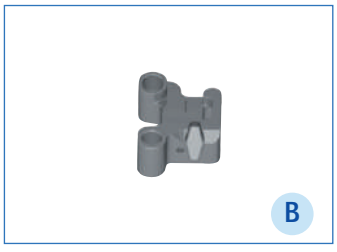
8.2 Distal Femoral Resection

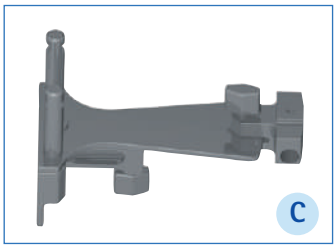
Completely assemble the alignment system, including the femoral cutting guide. The femoral cutting guide can be locked in place – a neutral position based on femur size or in a more proximal/distal position – by tightening screw 1. The desired angle between anatomic leg axis and mechanical axis (5° or 7° for pressfit and 6° for cemented applications) for the operative leg (left or right) is set and secured by tightening screw 2. Slide alignment system onto the reamer until contact with the bone and secure in place by tightening screw 3.

Version 1:
The cuts can be checked using the resection check blade ("angel wing" - NM350R) in the continuous cutting slot.

Version 2:
Attach the joint line positioner (NQ708R) to the continuous cutting slot of the distal femoral cutting guide (NP411R). The cutting guide is adjusted until the stylus tip coincides with the anterior mark, previously made using the primary femoral implant. If necessary, this mark is used as a reference for distal or proximal position. The resection position is locked by tightening screw 1.







A: Distal Femoral Cutting Guide (NP411R)
B: Alignment System – Body (NQ703R)
C: Alignment System – Base (NQ702R)
D: Alignment System – Handle Bar (NQ474R).

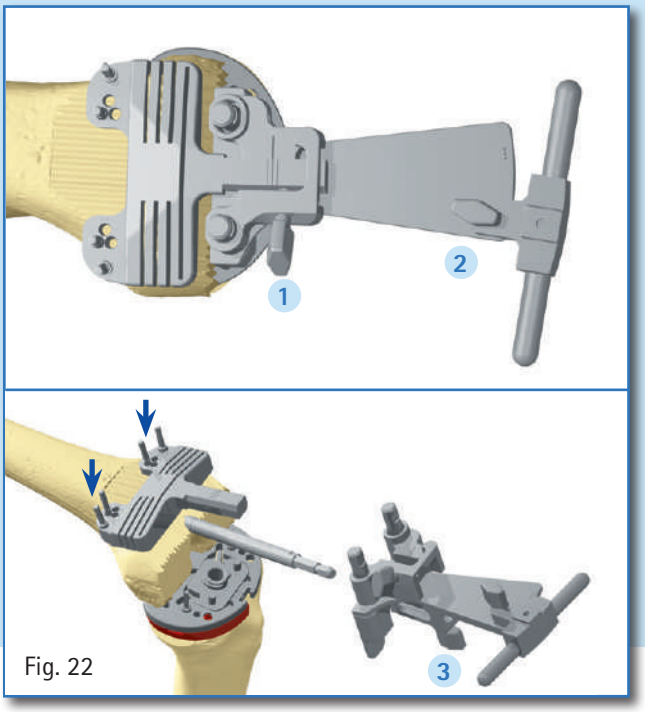


Fig. 22

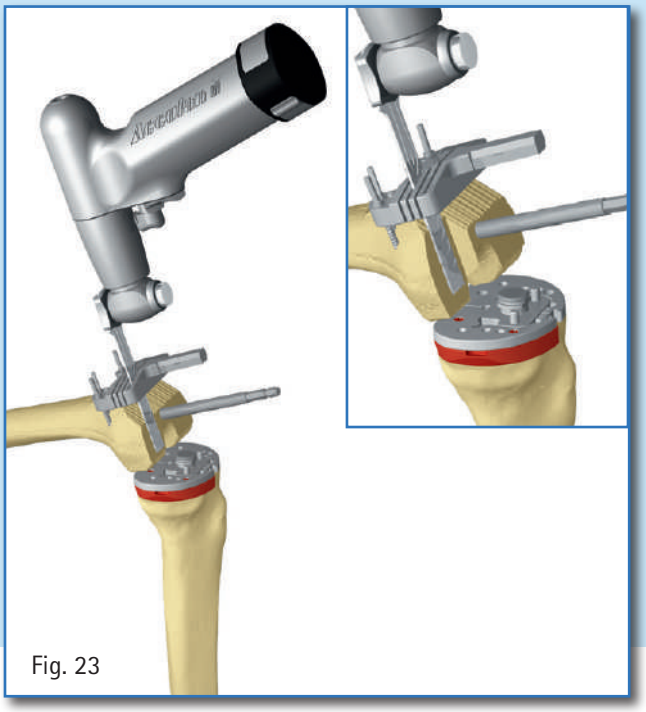


Fig. 23

Fixate the cutting guide to the anterior femur with two parallel headless pins and one/two convergent headed pins. Remove the resection check blade, the joint line positioner and the alignment system by untightening screw 1 and untightening screw 3.

The reamer can remain in the femoral canal for the distal cuts.

The distal femoral cut is performed in the selected plane of resection. If required, additional bone resection can be made for the distal or postero-distal femoral augments using the appropriate cutting slot.

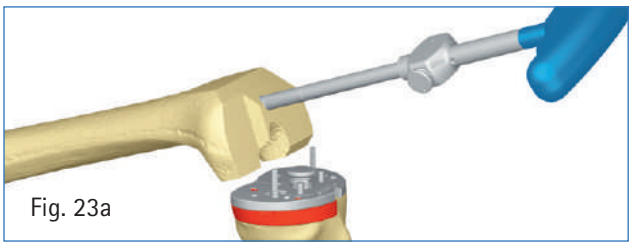


Fig. 23a

Following the femur resection, repeat reaming to the required depth, with the desired diameter, in order to achieve fixation preference: pressfit or cemented application. See page 19 for more reaming information.

EnduRo™ Hinge Knee System

Surgical Technique

8. Femoral Preparation *(continued)*

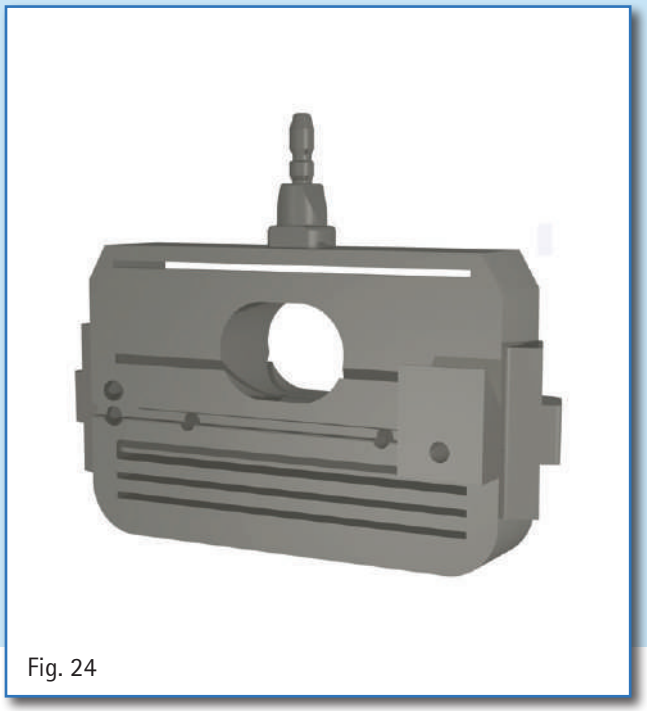


Fig. 24

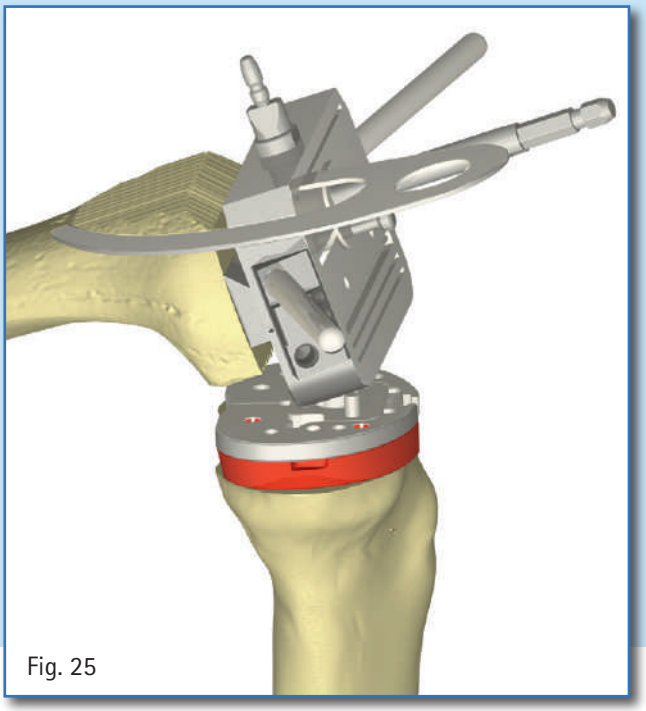


Fig. 25

8.3 AP and Rotational Alignment

If resection was performed for distal femoral augments, analogously dimensional distal trial augments must be attached to the back side of the 4-in-1 cutting guide.

Slide the required 4-in-1 cutting guide into position on the reamer with the AP orientation sleeve (available in neutral – NE172R and ±2 mm – NE172R). In order to avoid anterior undercutting/notching of the femoral cortex, the resection check blade ("angel wing" – NM350R) is set through the anterior cutting slot for review.

Optional: Two handles (NE730R) can be attached to the cutting guide to assist with rotational alignment.

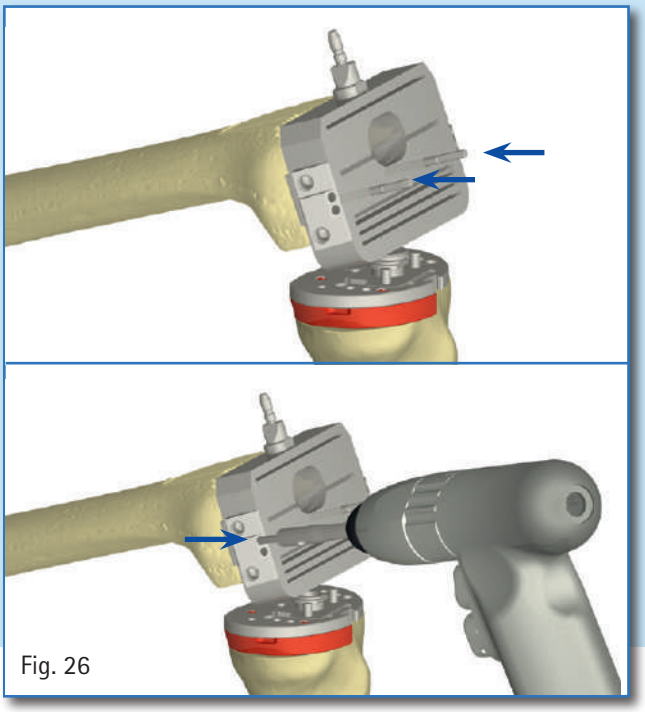


Fig. 26

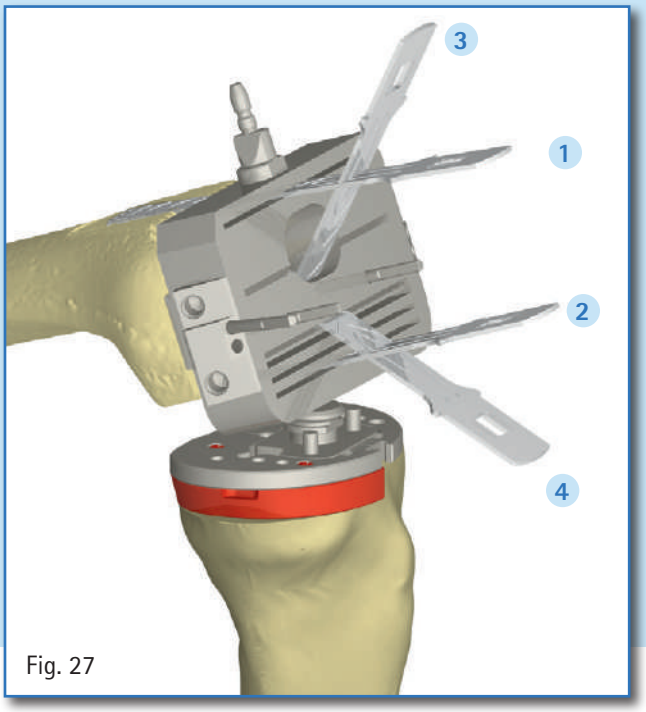


Fig. 27

8.4 Femoral Resection

Fixate the cutting guide in the defined rotational position using two long headless pins through the two parallel anterior center holes on the guide. Remove the handles, orientation sleeve, resection check blade and reamer. For large reamer diameters, the cutting guide must be removed and subsequently reattached.

Additionally, fixate using one or two long headless pins through the convergent anchoring holes. The two parallel headless pins may be removed.

The four femoral resection cuts are performed in the following sequence:

1. Anterior Cut
2. Posterior Cut (including augment cut if required)
3. Posterior Chamfer Cut
4. Anterior Chamfer Cut

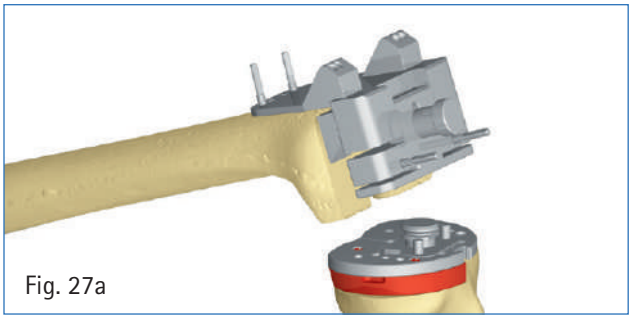


Fig. 27a

If a 12 mm posterior femoral augment is required, use the designated 12 mm cutting guide (NP431R). Fixate to the bone with pins, and then perform resection using the appropriate cutting slot.

EnduRo™ Hinge Knee System

Surgical Technique

8. Femoral Preparation *(continued)*

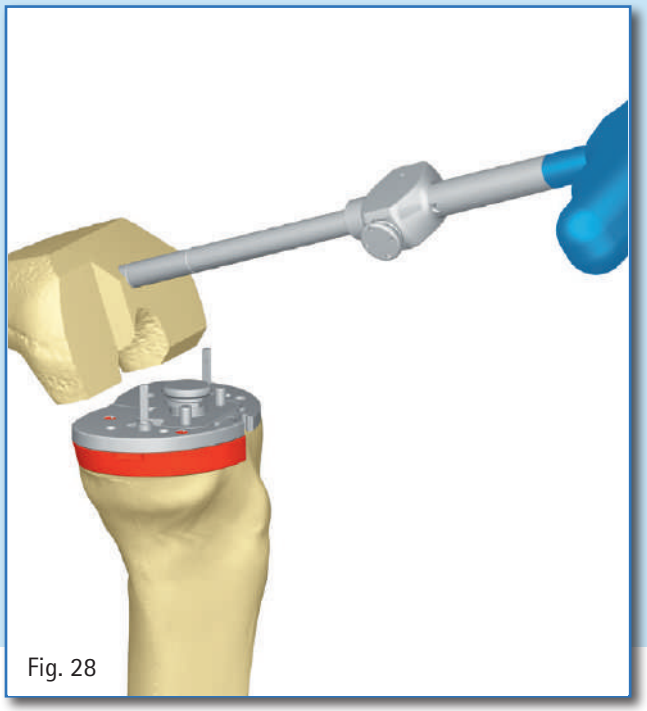


Fig. 28

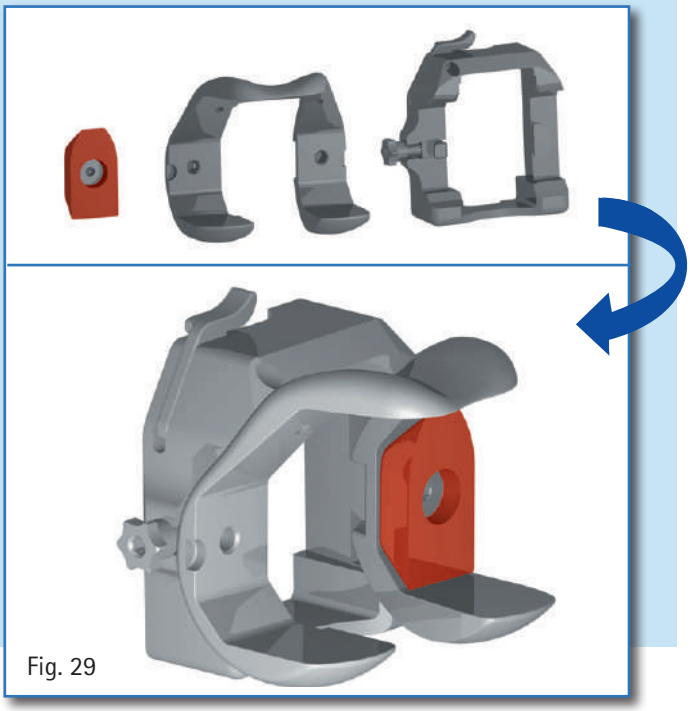


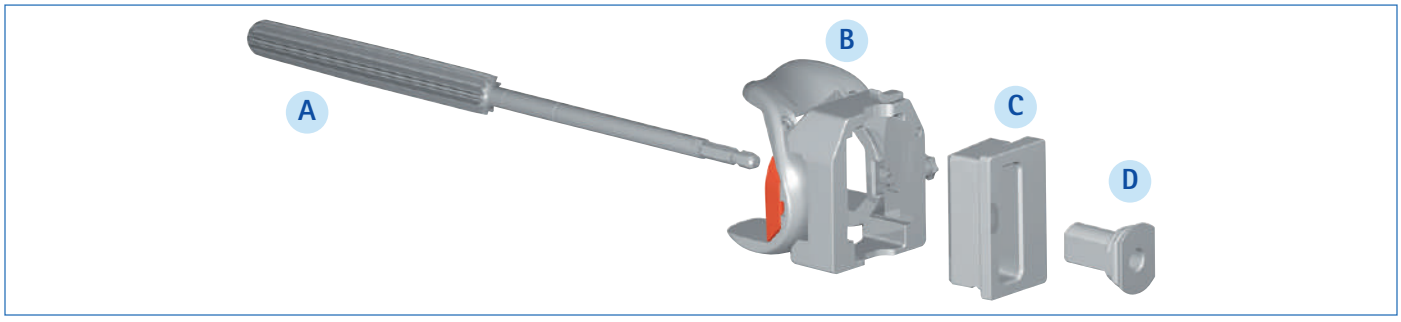
Fig. 29

8.5 Femoral Box Preparation

Reinsert the appropriate diameter reamer into the medullary canal to the desired depth in order to achieve fixation preference: pressfit or cemented application. The reamer will remain in place for the next step of femur box preparation.

Select the trial femur for the appropriate size and operative leg (left or right). Use the screwdriver (NE181R) to attach distal or posterior augments that correspond to the femur size, if applicable.

Select the frame for alignment of the trial femur and for femoral box preparation in the required size (F1 – NP421R, F2 – NP422R, F3 – NP423R) and fit it onto the distal part of the trial femur. Secure in place using the side dial. If necessary, the screwdriver (NE181R) can assist with turning the dial.



A: Reamer
B: Trial femur with optional trial augments and preparation frame (F1 – NP421R, F2 – NP422R, F3 – NP423R)
C: Femoral trial box alignment guide (F1 – NP415R, F2/F3 – NP416R)
D: Femoral trial box alignment sleeve (neutral for 6° cemented stem – NP417R, ±1° for 5°/7° pressfit stems – NP418R)

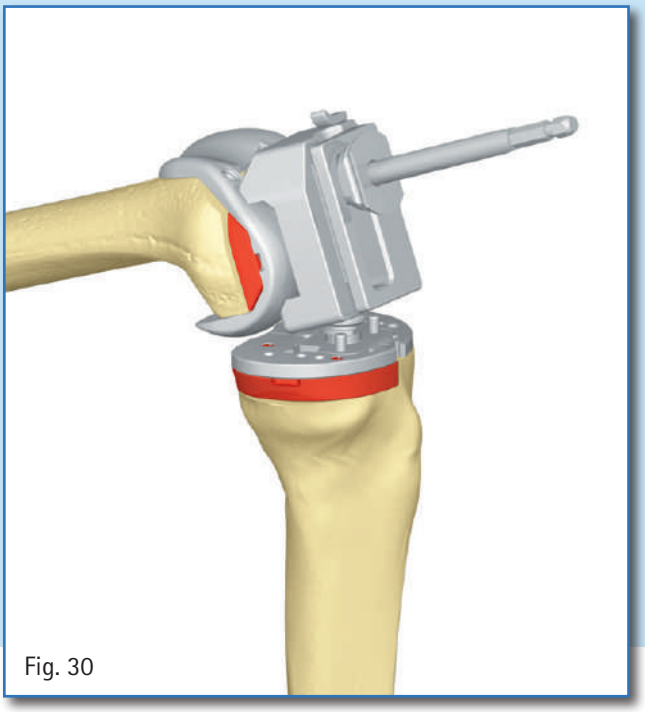


Fig. 30

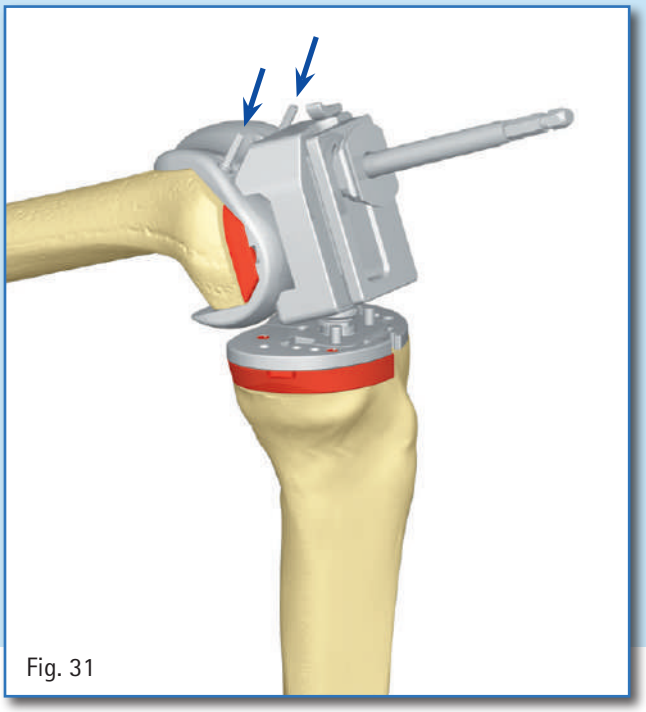


Fig. 31

Insert the femoral trial box alignment guide (F1 – NP415R, F2/F3 – NP416R) into the femoral box preparation frame, which has previously been locked to the trial femur. The anterior latch on the frame should be in an open position to insert the alignment guide, then closed to lock the alignment guide in place.

Care must be taken to ensure the alignment guide has the correct size and marking corresponding to the operative leg (left or right). Insert the femoral trial box alignment sleeve neutral L6°/R6° - NP417R, ±1° L7°R5°/L5°R7° - NP418R) into the femoral box alignment guide at the correct angle. Slide this assembly of the femoral box alignment guide onto the reamer shaft or drive into position using the femoral impactor (NP414) connected to the handle (NP495R) until the internal femoral geometry of the trial femur makes full contact with the bone.

Secure the trial femur in place with two anterior headed pins. Remove the sleeve, the femoral box alignment guide and the reamer. The femoral box alignment frame should remain in place.

Note: *In order to avoid injury of the dorsal soft tissues, it is advisable to detach these beforehand and protect them with a suitable instrument.*

EnduRo™ Hinge Knee System

Surgical Technique

8. Femoral Preparation *(continued)*

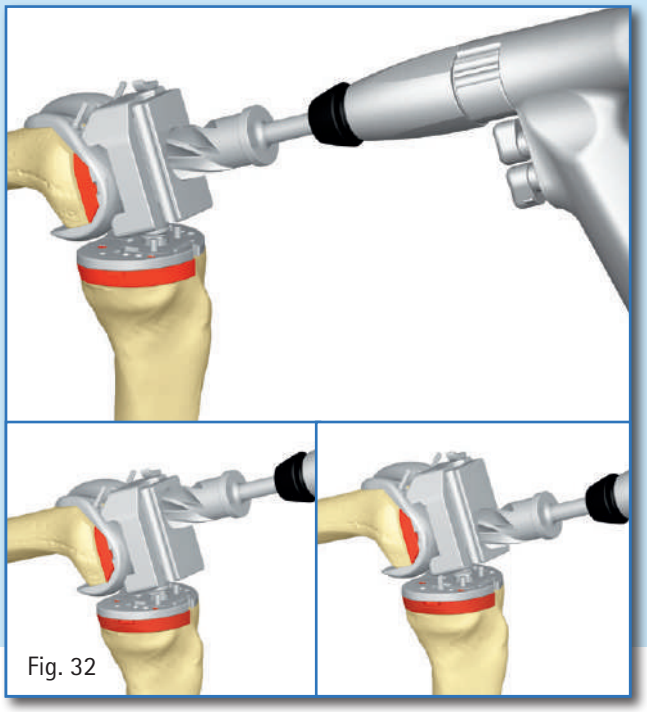


Fig. 32

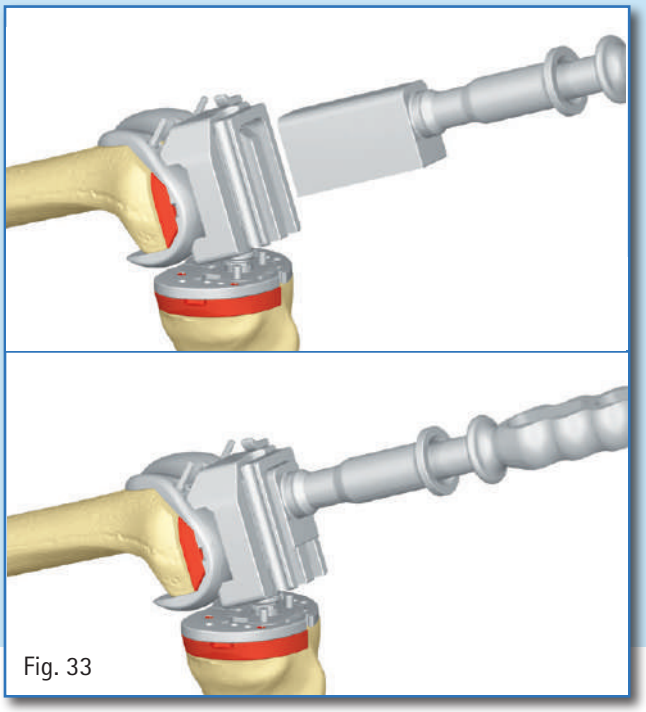


Fig. 33

8.5 Femoral Box Preparation *(continued)*

Insert the center drill guide for femoral box preparation (F1 – NP436R, F2/F3 – NP437R) with the correct size into the femoral box preparation frame. Lock it in place. Milling is then performed with the femoral box preparation drill (NP435R) until the stop position. Remove the center drill guide.

Next, insert the offset drill guide for femoral box preparation (F1 – NP438R, F2/F3 – NP439R) with the correct size into the femoral box preparation frame. Drill two overlapping holes – by reinserting the drill guide in a 180° rotated position – with the femoral box preparation drill (NP435R) until the stop position. Remove the offset drill guide. The femoral box alignment frame should remain in place.

Insert the chisel guide for femoral box preparation (F1 – NP433R, F2/F3 – NP434R) into the femoral box preparation frame and lock in place. Connect the U-shaped chisel (NP443R) to the handle (NP495R) until assembly is secure. Hammer the U-shaped chisel into the chisel guide to the stop position. Remove the U-shaped chisel and the chisel guide. The femoral box preparation frame should remain in place.

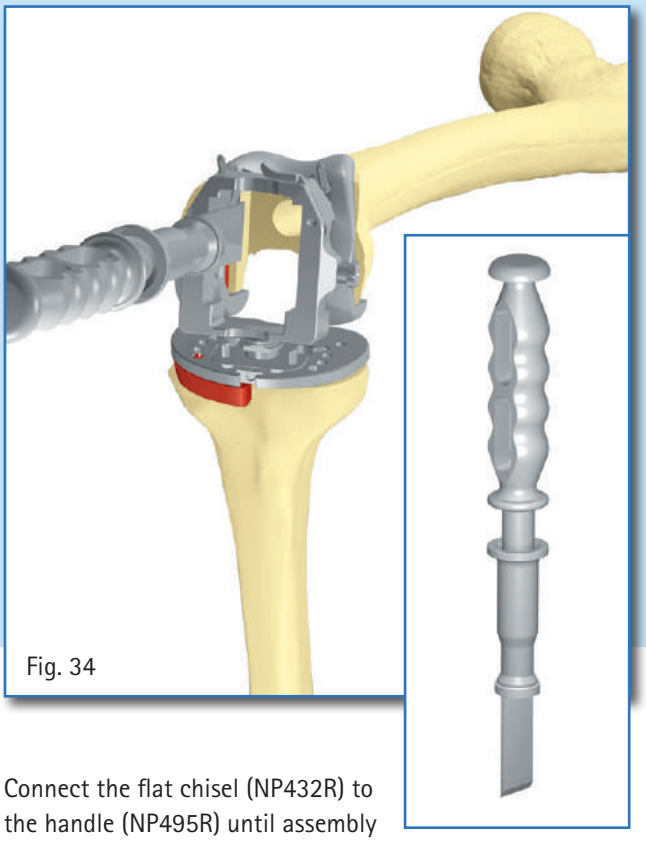


Fig. 34

Connect the flat chisel (NP432R) to the handle (NP495R) until assembly is secure. In order to remove any remaining bone, carve out the femoral box on the medial side up to the stop position with the long side of the blade touching the inner, medial side of the femoral box frame. Remove the flat chisel and femoral box preparation frame.

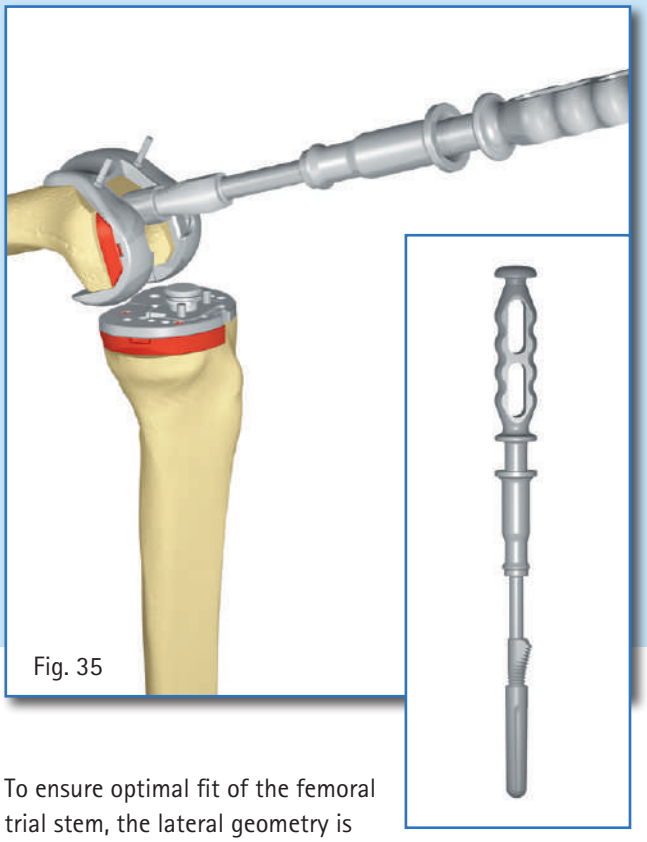


Fig. 35

To ensure optimal fit of the femoral trial stem, the lateral geometry is prepared with the rasp (NQ832R). Connect the rasp (NQ832R) to the handle (NP495R) and the trial stem until assembly is secure. Drive the rasp into the femoral cavity twice (by rotating it 180°) up to and including the last wide tooth at the proximal end.

EnduRo™ Hinge Knee System

Surgical Technique

8. Femoral Preparation *(continued)*

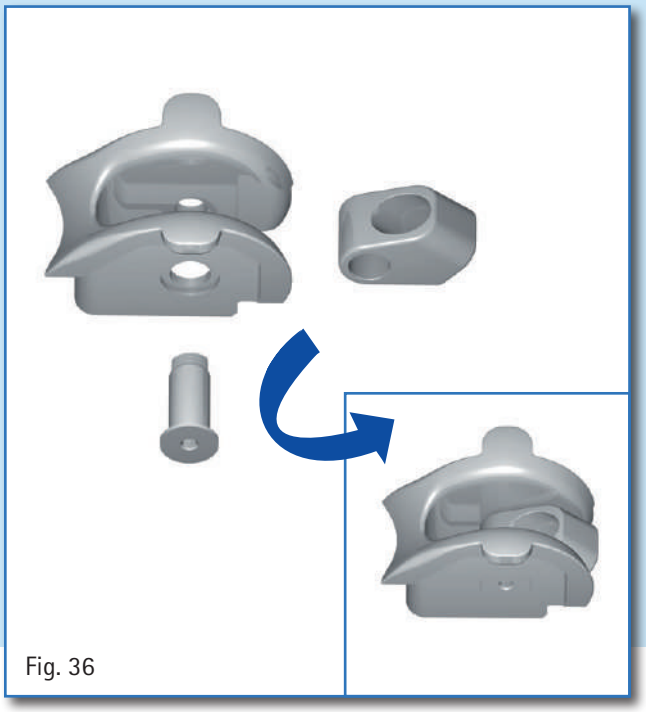


Fig. 36

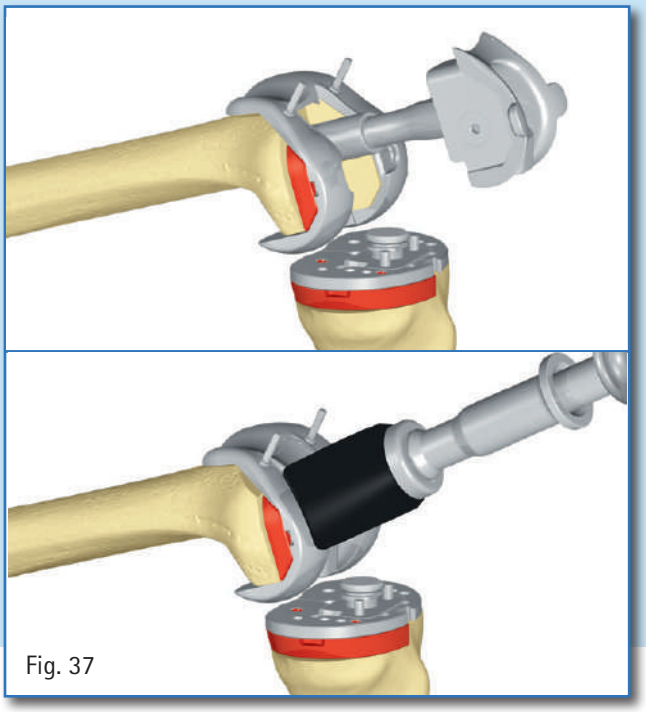


Fig. 37

8.6 Femoral Trial Box Assembly

Insert the corresponding trial hinge hood (F1 – NP445R, F2/F3 – NP446R) into the femoral trial box, and secure in place via the trial hinge pin (NP444R).

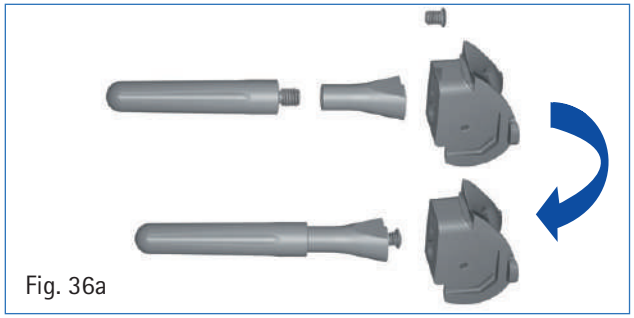


Fig. 36a

Thread the selected femoral trial stem into the femoral trial stem adapter having the desired angle and length. Femoral pressfit stem trial adapter is available in 5° and 7° (NS008R, NS014R). Femoral cemented stem trial adapter and stem are one unit with a 6° angle (instead of the two components, i.e. stem and adapter). Then thread the attachment screw (NS001R) into the adapter for one or two turns of the thread. Insert the stem into the proximal guide of the femoral trial box and loosely fixate from the distal side. There should be some play in the AP direction to allow for self-centering.

This trial femoral box assembly is inserted manually into the femur and then impacted until fully seated using the femoral impactor (NP414) connected to the handle (NP495R).

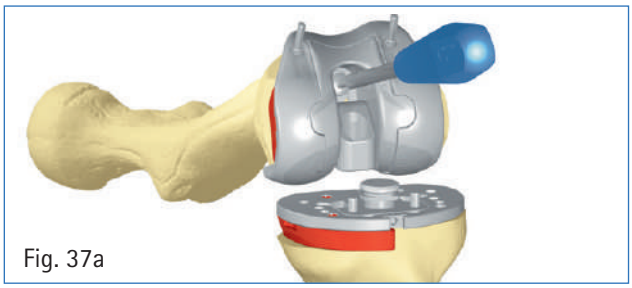


Fig. 37a

Use the screwdriver (NE181R) to tighten the intercondylar attachment screw in order to maintain the self-aligned AP position of the femoral stem.

The two pins in the femoral trial can now be removed.

9. Stability Review

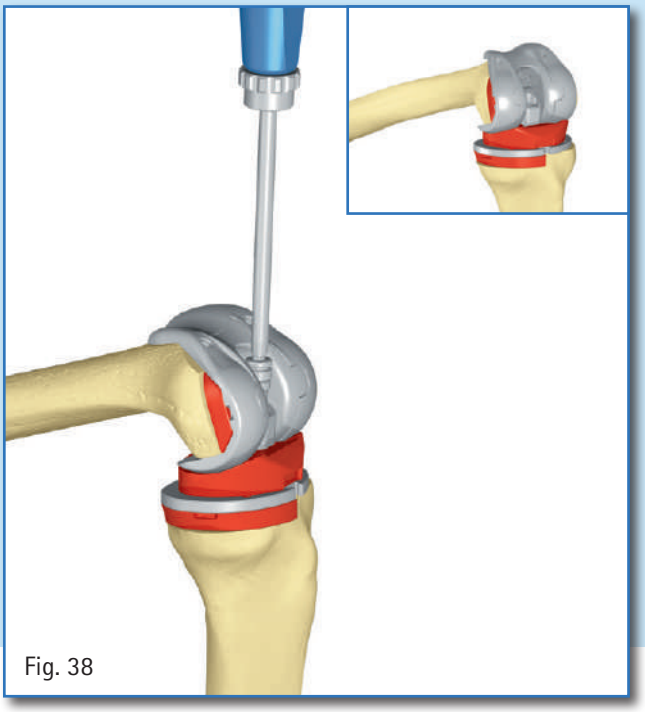


Fig. 38

Remove the covering of the tibial borehole in order to assemble the tibial trial post, which will connect with the femoral trial hinge hood, thereby joining the femur with the tibia.

The trial insert can now be selected and inserted onto the trial tibia. Heights 16 and 18 mm can be created by combining the 10 and 12 mm trial insert with the 6 mm supplementary insert.

Close the trial hinge hood over the trial insert and thread the trial tibial post into it using the screwdriver (NP440R). The trial post is available in two lengths (short up to 16 mm trial insert height – NP447R, long 18 mm trial insert height – NP449R).

Joint stability in flexion and extension can now be reviewed and a thicker/thinner insert is selected in accordance with the result. It is recommended to perform this review with the patella. When selecting the height of the insert, care should be taken to ensure the system is sufficiently under tension despite the protection from dislocation immanent in the system.

Note: *A hyperextension of ≥3° should be avoided.*

Fig. 38a

Note: *The size of the polyethylene insert corresponds with the femur size, as the system is mobile-bearing. This applies to the trial components and final implant.*

EnduRo™ Hinge Knee System

Surgical Technique

10. Patella Preparation and Implantation

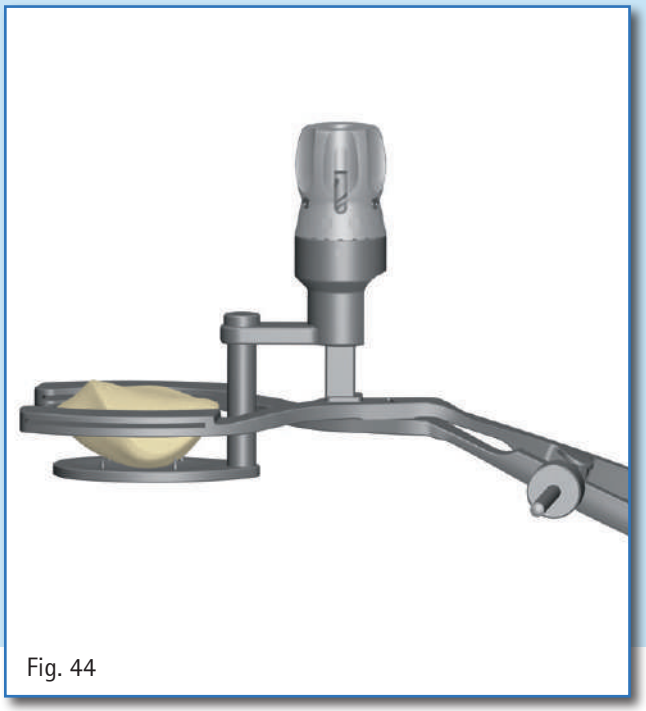


Fig. 44

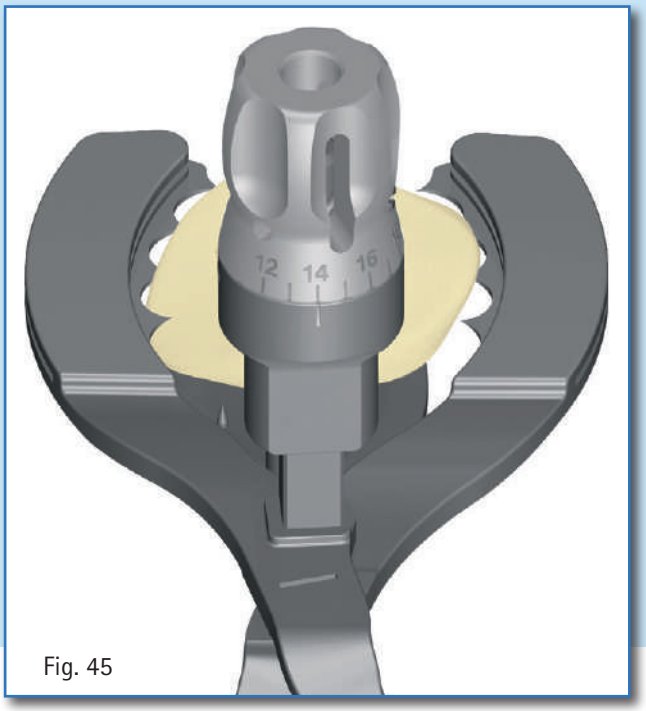


Fig. 45

10.1 Patella Preparation

The thickness of the patella is measured using the caliper (AA847R). This thickness should not be exceeded after implantation of the patella implant. Calculate bone resection.

Note: *The minimum thickness of the remaining patellar bone should be 12 mm.*

Using the patella resection clamp (NS840R), clamp the patella and adjust the level of resection by turning the depth wheel to the planned level of remaining patellar bone thickness.

Perform the resection through the cutting slot with a 1.27 mm thick saw blade.

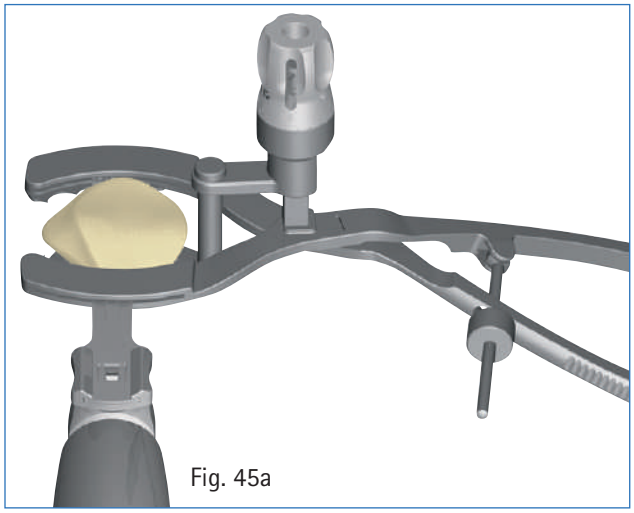
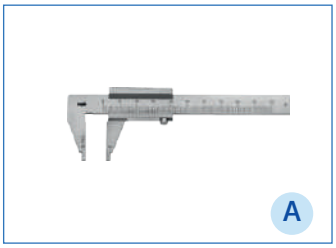


Fig. 45a



A: Caliper (AA847R)
B: Patella resection clamp (NS840R)
C: Acculan® oscillating saw

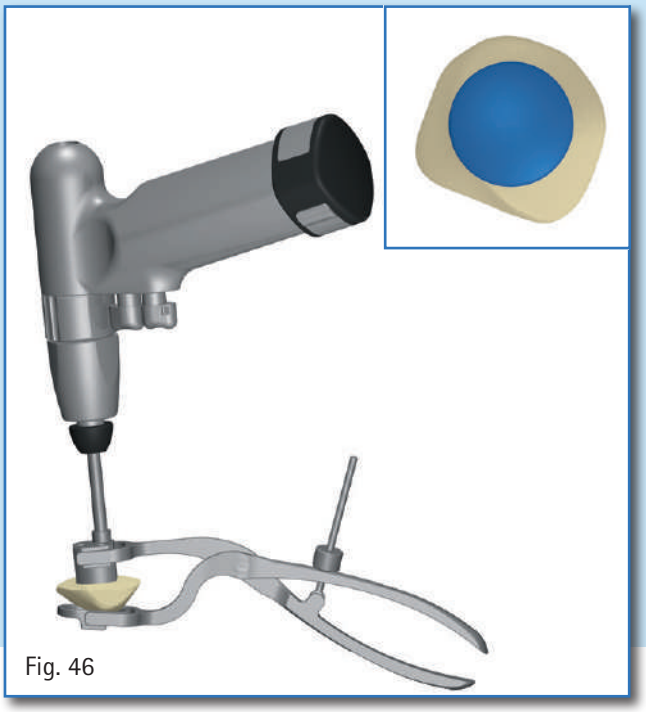


Fig. 46

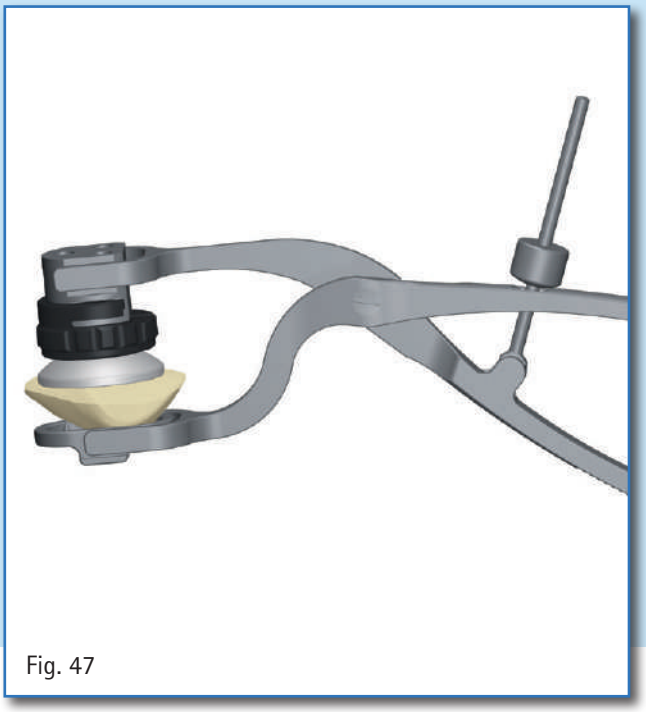


Fig. 47

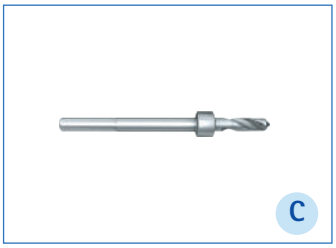
Remove the patella resection clamp. Attach the patella drilling/cementing clamp (NS841R) to the osteomized patellar surface choosing a medialized position to recreate the resected apex of the articular surface. The trial patella can be placed on top of the drill guide to check its position relative to the medial rim as well as in the superior and inferior direction.

Drill the pegs of the implant through the holes with the 6 mm drill (NQ449R) until the stop is reached. The size of the patella is established with the corresponding trial patellar implant.

10.2 Patella Implantation

Attach the cementing adapter (NS842) to the patella drilling/cementing clamp (NS841R). Place the patella onto the bone with the pegs in the corresponding holes and use the patella drilling/cementing clamp to assist with force transmission during cement hardening.

Note: *All cement residue must be removed carefully in order to avoid third body wear.*



A: Patella drilling/cementing clamp (NS841R)
B: Acculan® drill

C: Drill with stop 6 mm (NQ449R)
D: Trial patella (NQ281-NQ285)

EnduRo™ Hinge Knee System

Surgical Technique

11. Assembly and Implantation

Fig. 48

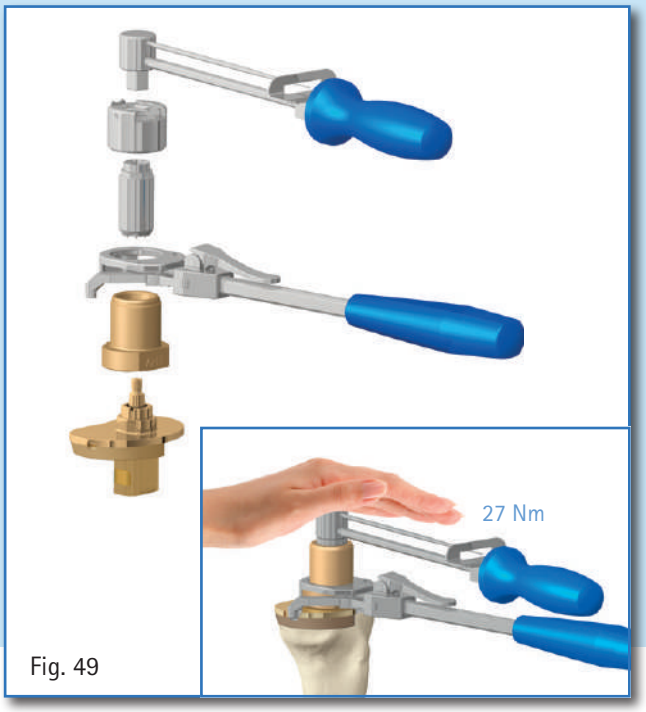


Fig. 49

11.1 Tibial Assembly

Select the required final implants and prepare based on the result of the trial reduction.

Insert the tibial post 1 into the black bearing sleeve 2. Then place them together into the borehole of the tibia. Thread the locking ring 3 into the tibia borehole by hand.

Note: *The tibial post 1, black bearing sleeve 2 and locking ring 3 are packaged with the PE insert. The size of the PE insert is based on the femur size due to the rotating platform.*

Note: *To apply the required torque, all implants that are tightened with a defined torque (tibial locking ring, tibial/femoral stem, hinge hood and locking nut) must be subjected to the torque three times.*

To create a secure connection of the tibial post and locking ring within the tibial borehole, first place the key guide for tibial post ring (NP144PM) over the tibial post. Next, place the tibial implant holder (NQ839R) over the key guide for tibial post ring and connect it to the tibia. Thread the safety clamp (NP141R) onto the key guide for tibial post ring. Next, insert the key for tibial post ring according to size (F1 insert height 10/12 mm – NP462RM; F1/F2/F3 – NP454R). Tighten the key using the torque wrench (NE184RM) to 27 Nm.

Note: *To assist with tightening to the appropriate torque, pressure should be applied to the torque wrench from above. For this reason, it is an advantage to have two people perform the implant assembly and coupling.*

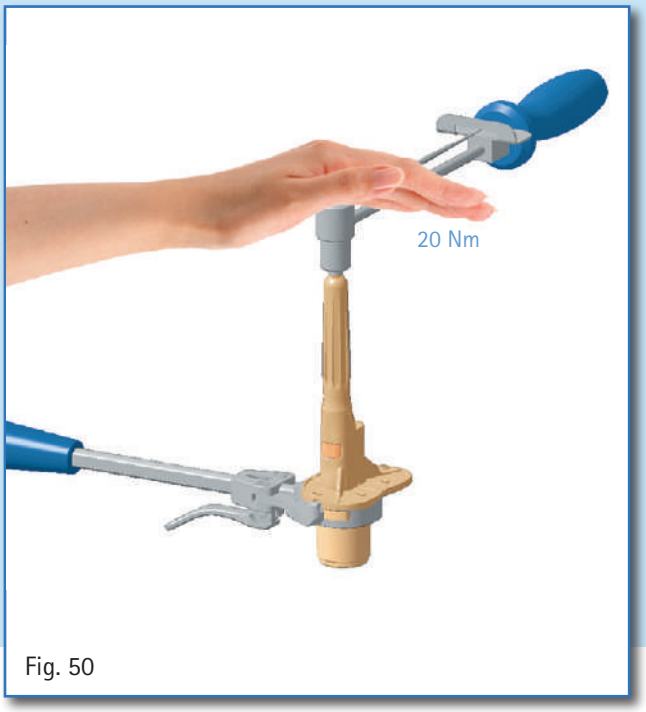


Fig. 50

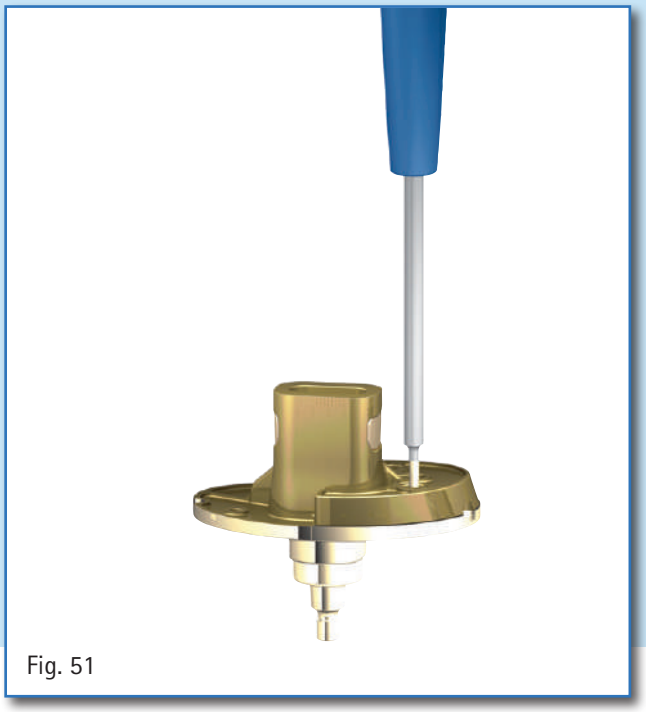


Fig. 51

Flip over the tibial implant using the attached tibial implant holder (NQ839R). The defined tibial stem is first threaded into the tibia by hand based on the medial/lateral offset position noted on the tibial trial implants. Next, attach the stem key for torque wrench (NE185R) onto the torque wrench (NE184RM) and tighten the stem to 20 Nm.

Note: *The ML stem position of the tibial trial stem serves as a reference for the assembly of the final tibial stem.*

If required, attach the tibial augments to the underside of the tibia using the screws packaged with the augments and screwdriver (NE181R).

EnduRo™ Hinge Knee System

Surgical Technique

11. Assembly and Implantation *(continued)*

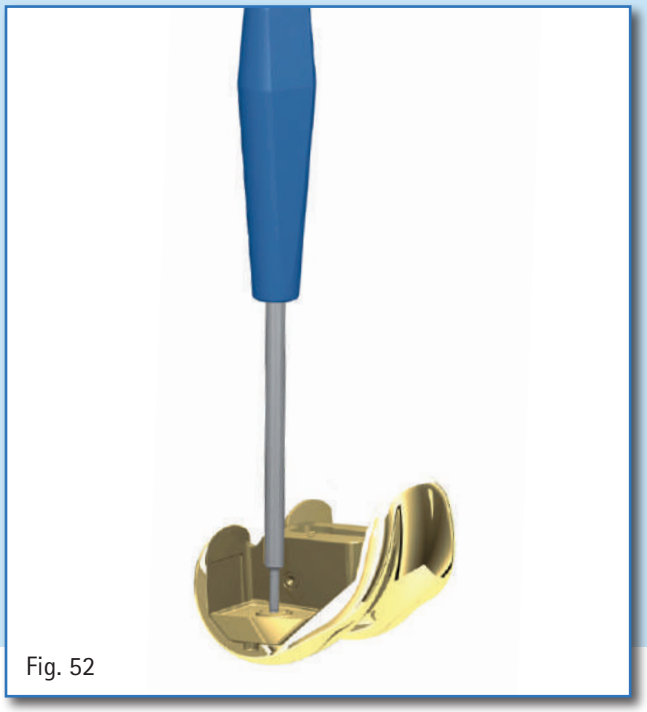


Fig. 52

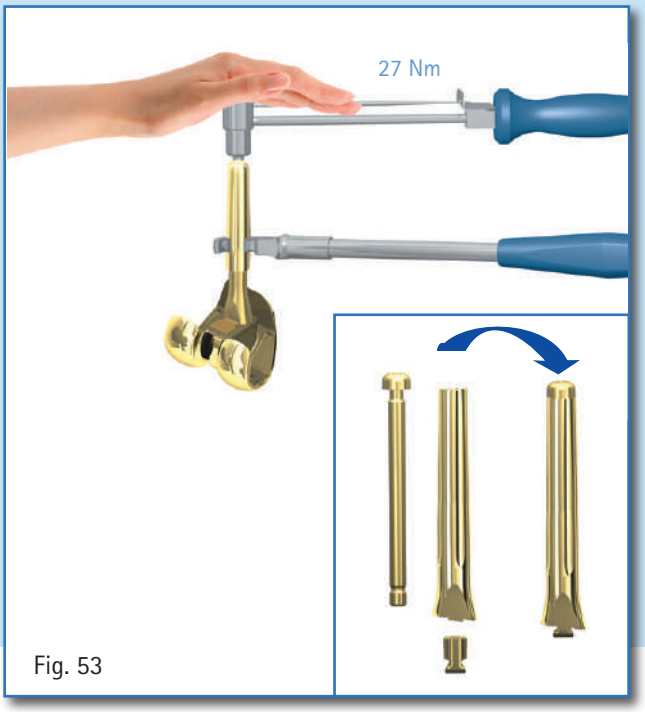


Fig. 53

11.2 Femoral Assembly

If required, attach the femoral augments to the backside of the femur using the screws packaged with the augments and screwdriver (NE181R).

Insert the separately packaged femoral stem nut into the backside of the femur. Then, with the tension bolt inside the defined femoral stem, thread the tension bolt into the femoral stem nut by hand based on the anterior/posterior offset position noted on the femoral trial implants. Next, attach femoral stem implant holder (NQ834R) to the femoral stem to act as a counter-holder. Lastly, attach the stem key for torque wrench (NE185R) onto the torque wrench (NE184RM) and tighten the stem to 27 Nm.

Note: *The AP stem position of the femoral trial stem serves as a reference for the assembly of the final femoral stem.*

Fig. 53a

Fig. 53b

Insert the femoral box door, which can be cut to size for the remaining AP length, into the femur box opening in order to prevent entry of cement. This femoral box door is packaged with the femur implant.

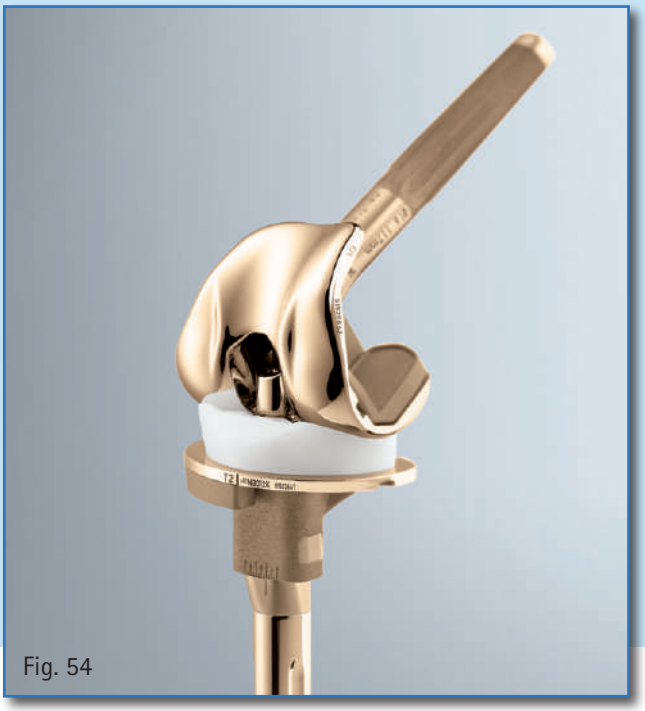


Fig. 54

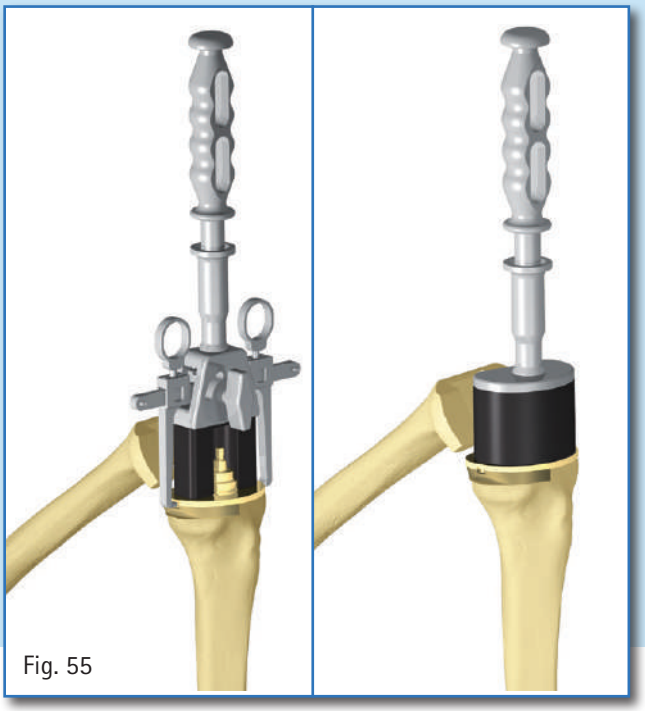


Fig. 55

11.3 Tibial Implantation

Note: *Tibial and femoral implants must be cemented. The stem can be used either with cement or pressfit applications depending upon the fixation need.*

Note: *Ensure that the bone preparation, in terms of sizes, diameters, heights and lengths, matches the final implant. Verify this information with the trial components prior to final implant assembly and implantation.*

Implantation sequence:

- Tibia
- Femur
- PE Insert
- Patella

OR

- Tibia
- PE Insert
- Femur
- Patella

Connect the tibial insert for implant holder (NQ569) to the implant holder (NQ570R) and attach this to the impactor handle (NP495R). Attach the tibia to the implant holder by the L-shaped hooks and secure using the tightening knob. Then, hammer this construct perpendicularly into the bone in the correct rotational position.

Optional: Connect the tibia impactor (NP468) to the impactor handle (NP495R). Insert the tibia by hand in the correct rotational position and then hammer it perpendicularly into the bone.

EnduRo™ Hinge Knee System

Surgical Technique

11. Assembly and Implantation *(continued)*

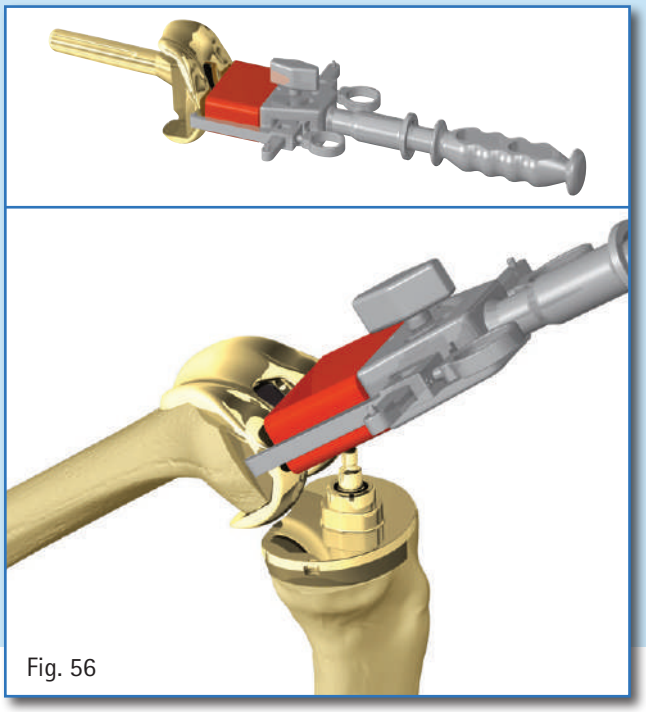


Fig. 56

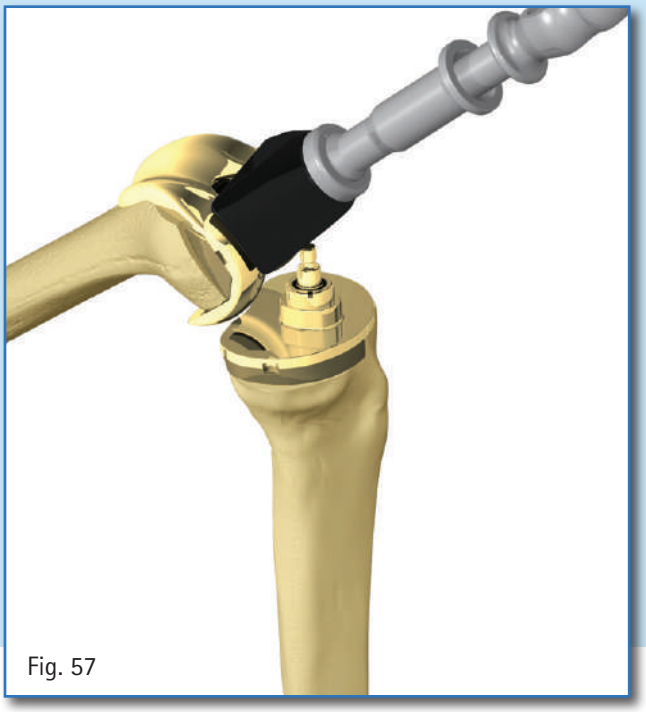


Fig. 57

11.4 Femoral Implantation

Connect the femoral insert for implant holder in the required size (F1 – NQ566, F2 – NQ567, F3 – NQ568) to the implant holder (NQ570R) and attach this to the impactor handle (NP495R). Attach the femur to the implant holder by the L-shaped hooks and secure using the tightening knob. Then, hammer this construct into the bone in the correct position.

Optional: Connect the femur impactor (NP414R, NQ459) to the impactor handle (NP495R). Insert the femur by hand in the correct position and then hammer it into the bone.

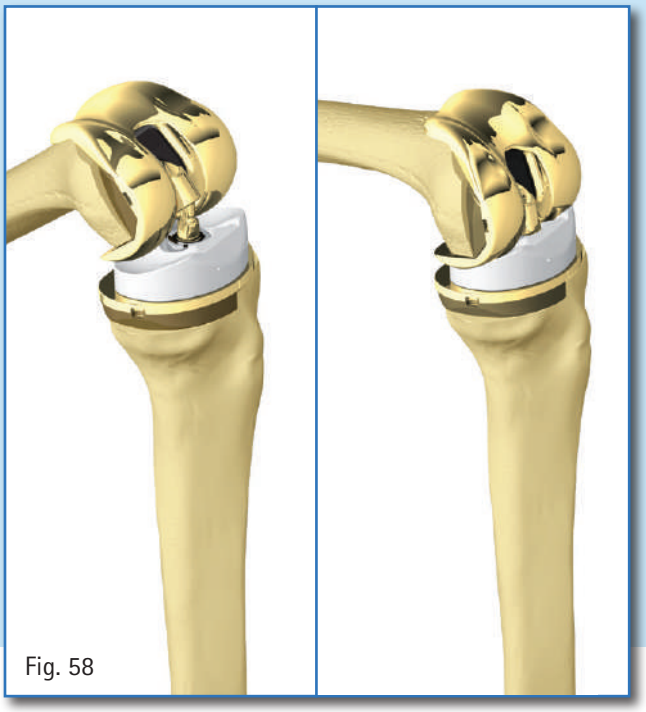


Fig. 58

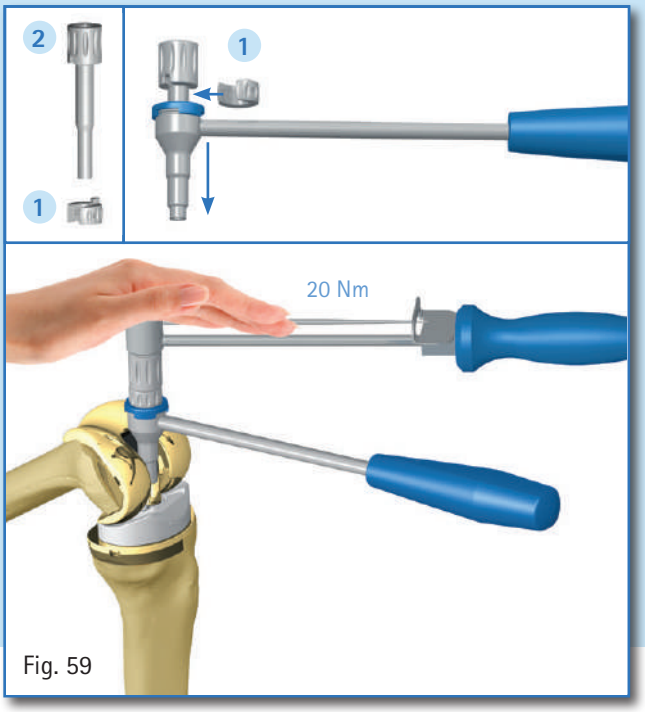


Fig. 59

11.5 Joining the Femur and Tibia

With the knee in ≥90° flexion, place the PE insert over the tibial post and onto the tibia. Close the hinge hood over the tibial post. Allow the hinge hood to center.

Note: *The size of the polyethylene insert corresponds to the femur size, as the system is mobile-bearing. This applies to the trial components and final implant.*

Note: *All cement residue must be removed carefully in order to avoid third body wear. The tibial post and hinge hood must be free of cement residue in order to avoid contact corrosion.*

Since cement residue may have accumulated in the dorsal area, especially in the case of cemented stems, the hinge hood must be lifted and the PE insert removed to completely eliminate all cement residue.

Note: *It is recommended to allow the cement to harden with the operative leg in extension, with the PE insert on the tibia and the hinge hood closed over the tibial post. As a result, the yield stress is achieved and the femoral implant centers itself on the hinge line.*

Insert the guide for threaded tibial post grip and washer (NP419R) into the hinge hood until fully seated. Then, insert the threaded tibial post grip (NP420R) 2 into the guide. By hand, first push down with the threaded tibial post grip to connect it to the tibial post, and then pull up and rotate it to ensure the components thread together. Once a firm connection is maintained, place the washer 1 between the guide and the tibial post grip. Lastly, insert the torque wrench (NE184RM) into the tibial post grip and tighten to 20 Nm. Since the thread of the tibial post is a small pitch, several rotations are necessary.

Turn the torque wrench counterclockwise to remove all instruments.

Note: *Should connecting the tibial post and tibial post grip be a challenge through the guide, you may attempt connection without the guide first. Once a connection has been made and stabilized, remove the tibial post grip and continue with the guide as stated above.*

EnduRo™ Hinge Knee System

Surgical Technique

11. Assembly and Implantation *(continued)*

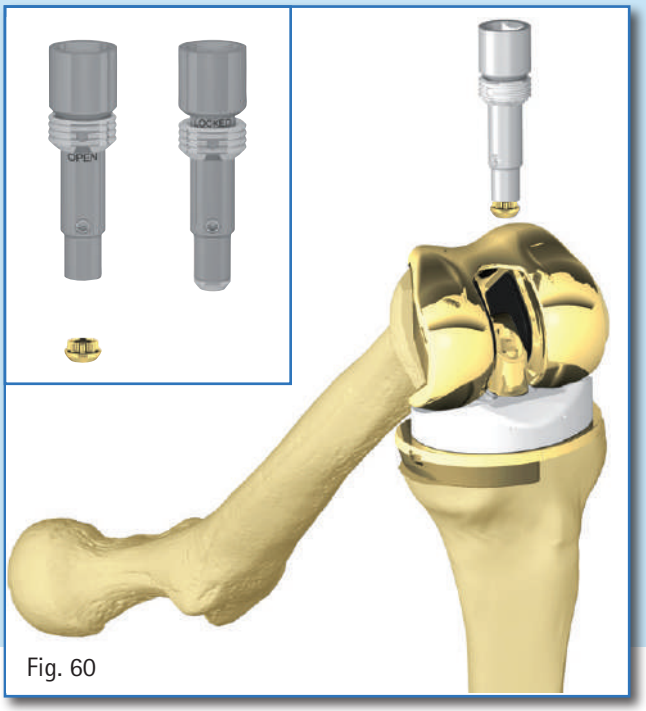


Fig. 60

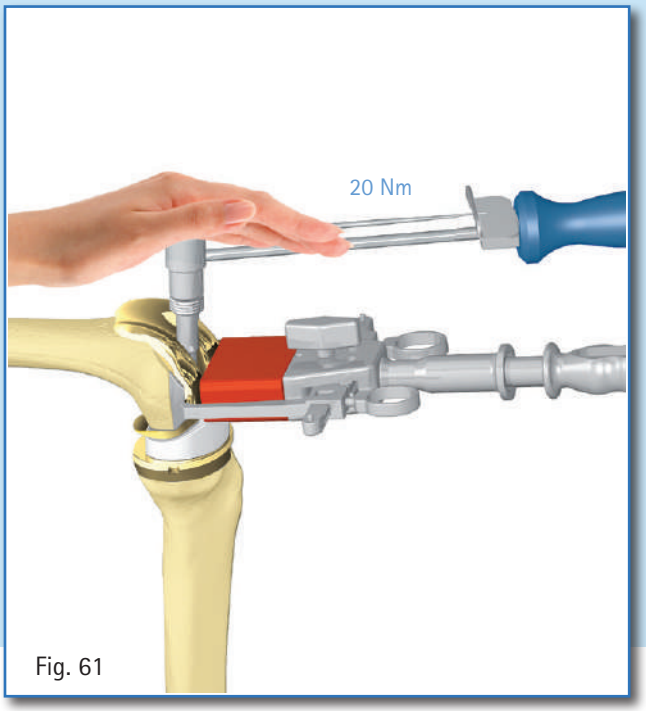


Fig. 61

10.5 Joining the Femur and Tibia *(continued)*

Attach the locking nut, which is packaged with the femur, to the holder for tibial post locking nut (NP455R) and secure it by pushing the collar to the locked position.

Place the locking nut onto the tibial post and push the collar of the holder to the unlocked position, so that the nut is able to be threaded by hand onto the tibial post.

Connect the femoral insert for implant holder in the required size (F1 – NQ566, F2 – NQ567, F3 – NQ568) to the implant holder (NQ570R) and attach this to the impactor handle (NP495R). Attach the femur to the implant holder by the L-shaped hooks and secure using the tightening knob.

Insert the torque wrench (NE185R) into the holder for tibial post locking nut (NP455R) and tighten to 20 Nm.

Note: *To assist with tightening to the appropriate torque, pressure should be applied to the torque wrench from above. For this reason, it is an advantage to have two people perform the implant assembly and coupling.*

12. Explantation

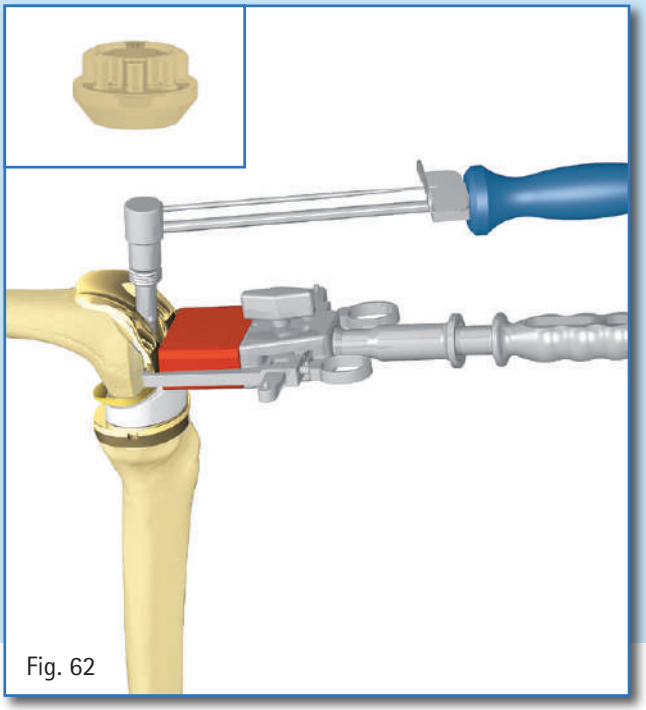


Fig. 62

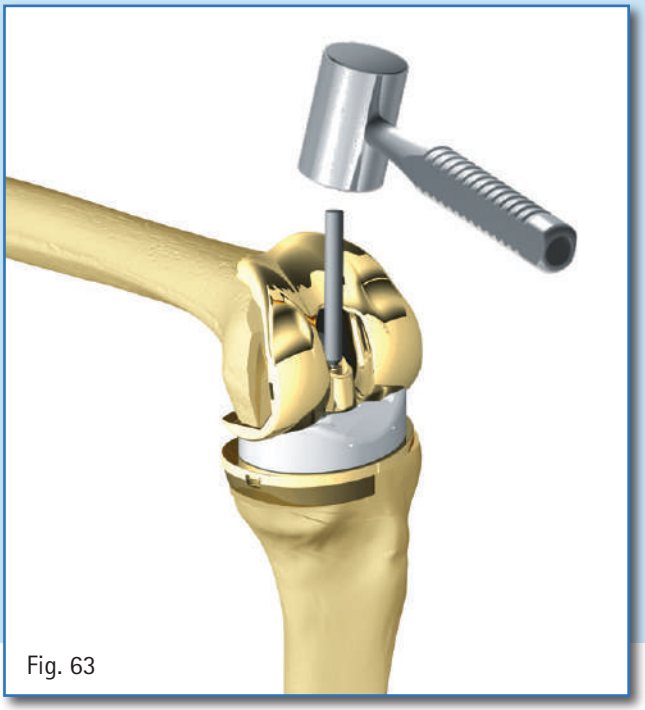


Fig. 63

12.1 Decoupling the Femur and Tibia

Connect the femoral insert for implant holder in the required size (F1 – NQ566, F2 – NQ567, F3 – NQ568) to the implant holder (NQ570R) and attach this to the impactor handle (NP495R). Attach the femur to the implant holder by the L-shaped hooks and secure using the tightening knob.

Then, place the holder for tibial post locking nut (NP455R) onto the locking nut within the hinge hood. Next, insert the torque wrench (NE185R) into the holder for tibial post locking nut and turn counterclockwise.

Note: *To assist with decoupling, it is recommended that pressure should be applied to the torque wrench from above. For this reason, it is an advantage to have two people perform the implant decoupling.*

The hinge hood and tibial post may be loosened or decoupled by applying an impulse shock in the distal direction. Use a suitable instrument (not included with EnduRo instrument set) with a tip to knock the tibial post distally out of the hinge hood.

EnduRo™ Hinge Knee System

Surgical Technique

12. Explantation *(continued)*

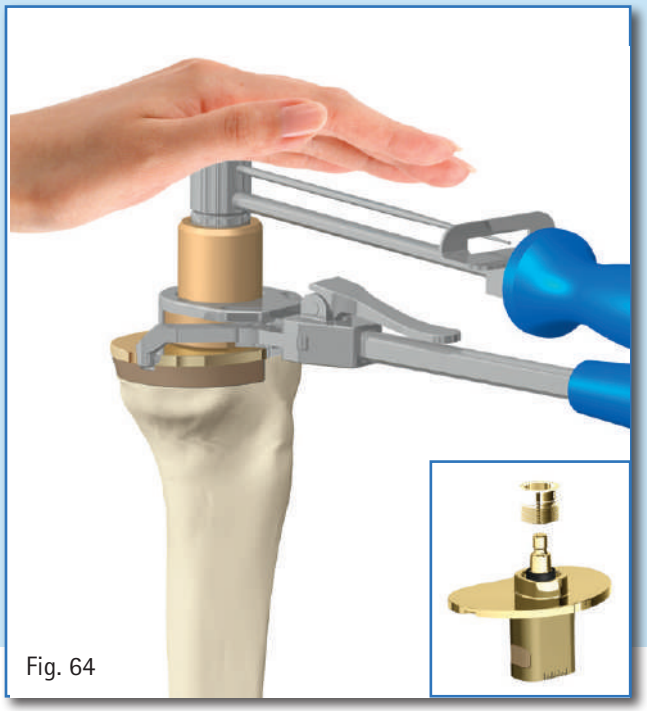


Fig. 64

Fig. 65

12.2 PE Insert Exchange

Remove the PE insert to be exchanged from the tibia.

Place the key guide for tibial post ring (NP144PM) over the tibial post. Next, place the tibial implant holder (NQ839R) over the key guide for tibial post ring and connect it to the tibia. Then, insert the key for tibial post ring according to size (F1 insert height 10/12 mm – NP462RM, F1/F2/F3 – NP454R). Connect the torque wrench (NE184RM) to the key and turn counterclockwise until the tibial post ring is loosened and can be removed. Remove the tibial post ring, the tibial post and the black bearing sleeve.

Note: *To assist with decoupling, it is recommended that pressure should be applied to the torque wrench from above. For this reason, it is an advantage to have two people perform the implant decoupling.*

Note: *Should the tibial implant holder (NQ839R) not be able to attach to the tibia as a counterholder, hold the tibia by hand to perform this action.*

Select a new PE insert which fits to the femur size and desired height. Replace the removed components, which can be found within the new sterile package (PE insert, tibial post, black bearing sleeve and tibial post ring). Complete step *"Tibial Assembly"* on page 32 and step *"Joining the Femur and Tibia"* on page 37-38 to complete assembly.

Note: *In the case of PE insert exchange only, the respective femoral and tibial components must remain undamaged. It is recommended to replace all components to avoid damage.*

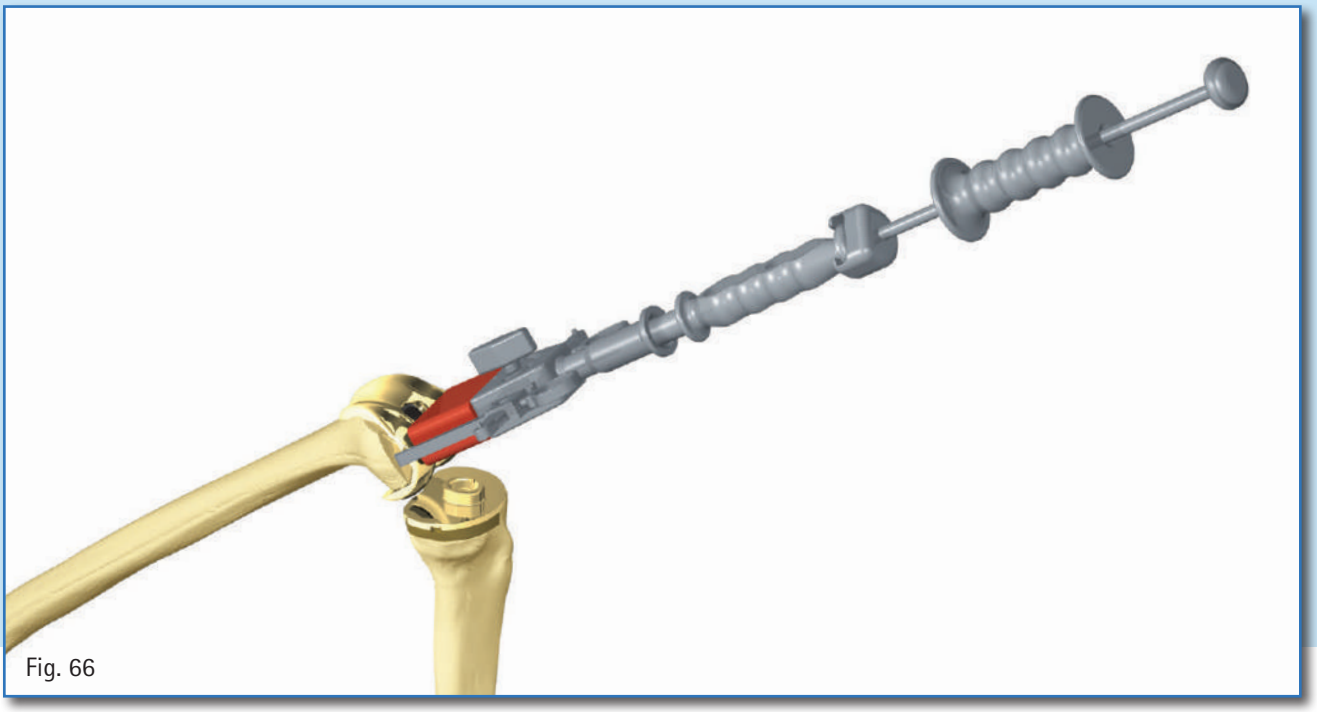


Fig. 66

12.3 Femur Exchange

Decouple the femur from the tibia as described in the step *"Decoupling the Femur and Tibia"* on page 39. Remove the PE insert and decouple/remove the tibial post, black bearing sleeve and tibial post ring as described in the step *"PE Insert Exchange"* on page 40.

Connect the femoral insert for implant holder in the required size (F1 – NQ566, F2 – NQ567, F3 – NQ568) to the implant holder (NQ570R) and attach this to the impactor handle (NP495R). Attach the impactor handle to the slap hammer (NP684R). Attach the femur to the implant holder by the L-shaped hooks and secure using the tightening knob. Use the sliding handle on the slap hammer to remove the femur.

Note: *Should the femoral implant holder (NQ570R) not be able to attach to the femur, use standard practice to remove the femur.*

Select a new femur, femoral stem and augments (if desired). Implant femoral components according to steps *"Femur Assembly"* on page 34 and *"Femur Implantation"* on page 36. Complete step *"Tibial Assembly"* on page 32 and step *"Joining the Femur and Tibia"* on page 37-38 to complete assembly.

12. Explantation *(continued)*

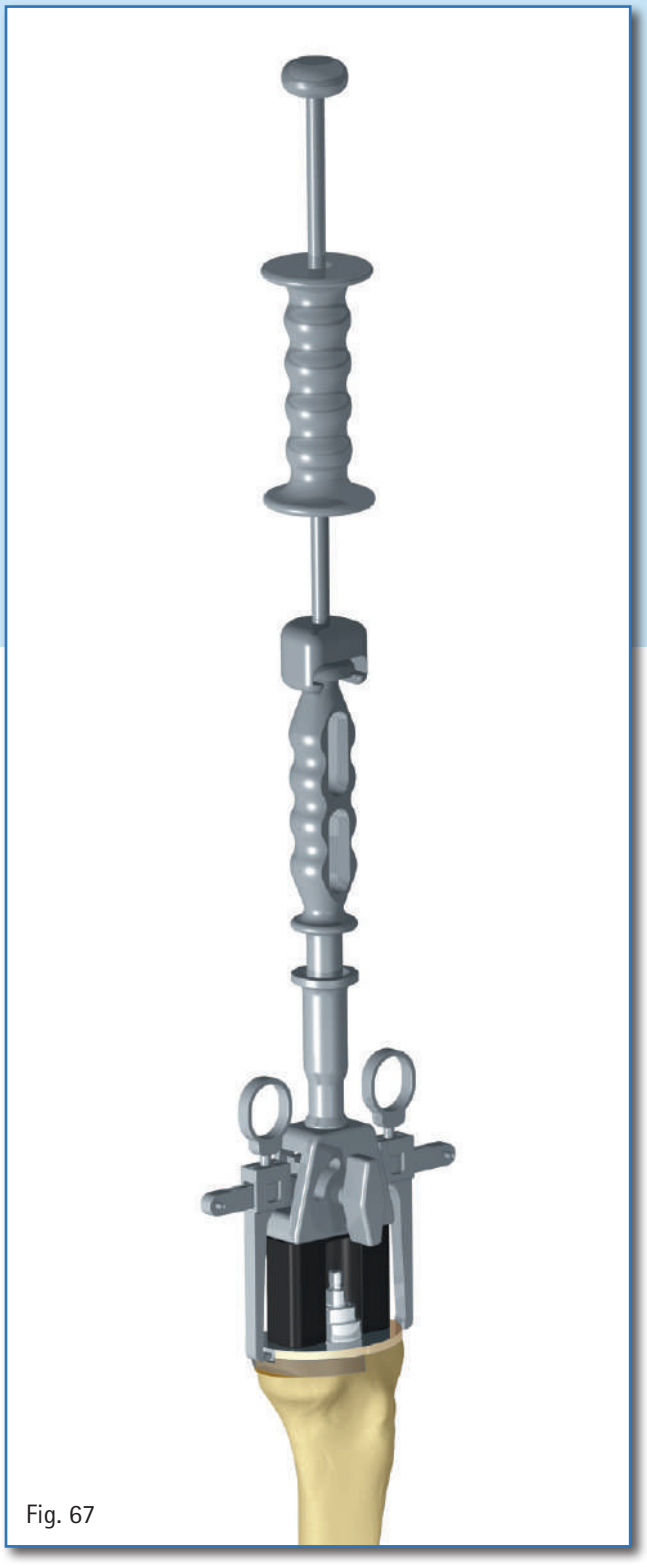


Fig. 67

12.4 Tibia Exchange

Decouple the femur from the tibia as described in the step *"Decoupling the Femur and Tibia"* on page 39. Remove the PE insert and decouple/remove the tibial post, black bearing sleeve and tibial post ring as described in the step *"PE Insert Exchange"* on page 40.

Connect the tibial insert for implant holder (NQ569) to the implant holder (NQ570R) and attach this to the impactor handle (NP495R). Attach the impactor handle to the slap hammer (NP684R). Attach the tibia to the implant holder by the L-shaped hooks and secure using the tightening knob. Use the sliding handle on the slap hammer to remove the tibia.

Note: *Should the tibia implant holder (NQ570R) not be able to attach to the tibia, use standard practice to remove the tibia.*

Select a new tibia, tibial stem and augments (if desired). Implant tibial components according to steps *"Tibial Assembly"* on page 32-33 and *"Tibial Implantation"* on page 35. Complete step *"Joining the Femur and Tibia"* on page 37-38 to complete assembly.

13. Implant Specifications

Femur/Tibia Compatibility Chart

Sizes	F1	F2	F3
T1			
T2			
T3			

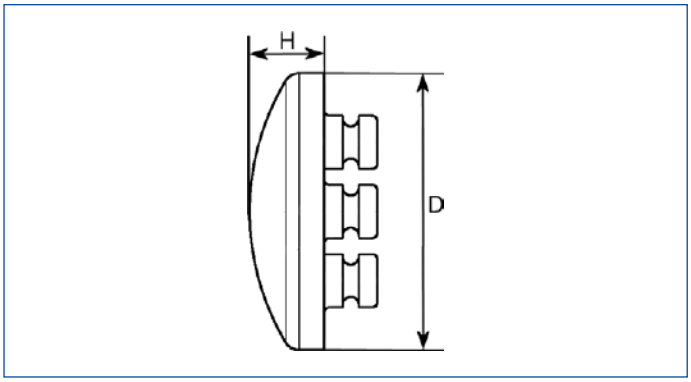
Ideal combination for optimum performance

Not compatible

PE Insert Measurements

Rotation	±12°
Hyperextension	3°
Flexion	140°
PE Design	Rotating Platform
No Slope Built Into PE	

Note: *PE Insert based on femur size*



Patella Measurements in (mm)

Size	Diameter	Height
P1	26	7
P2	29	8
P3	32	9
P4	35	10

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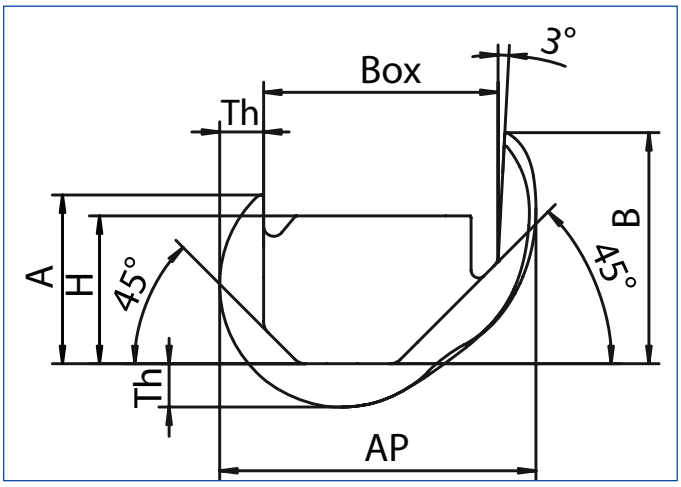
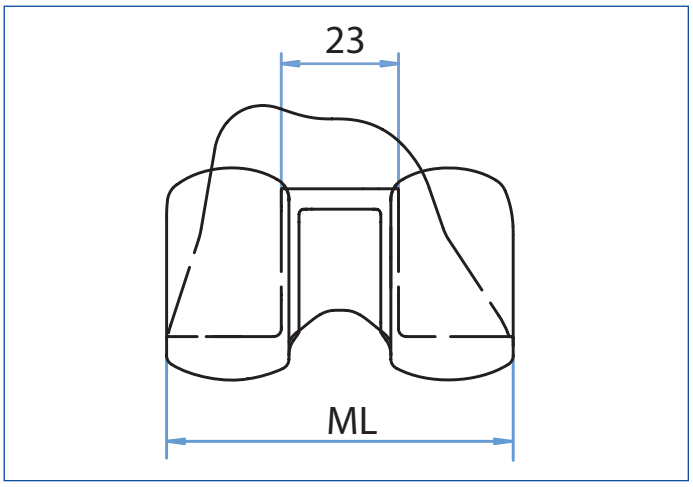
13. Implant Specifications *(continued)*





Femoral Measurements in (mm)

Size	ML	AP	Box	H	Trochlear Depth	Th
F1	60.0	54.0	37.0	26.5	4.0	7.0
F2	68.0	62.1	40.7	29.0	5.0	8.5
F3	76.0	70.3	46.0	31.5	5.5	10.0

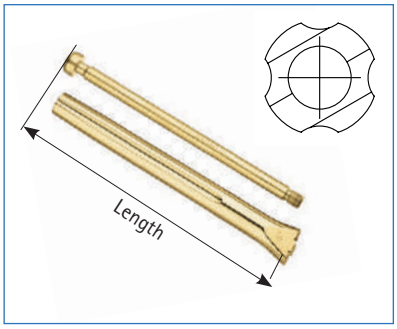
Note: *Max bone loss at distal femur:*
- *F1: 19 mm*
- *F2: 20.5 mm*
- *F3: 22 mm*

Note: *Max bone loss at posterior femur:*
- *F1: 15 mm*
- *F2: 20.5 mm*
- *F3: 22 mm*

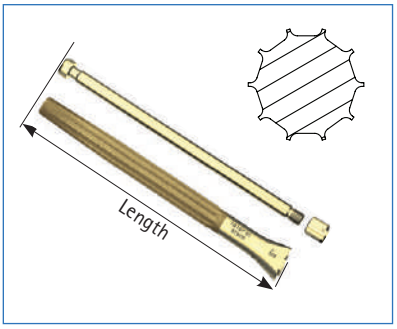
Femur Details

- Anatomic design - left/right
- 3 sizes
- Single-radius design
- Cement pockets 1 mm deep
- Hyperextension limit of 3° for all sizes
- AP offset ± 2 mm through femoral stems

Femoral Stem Details



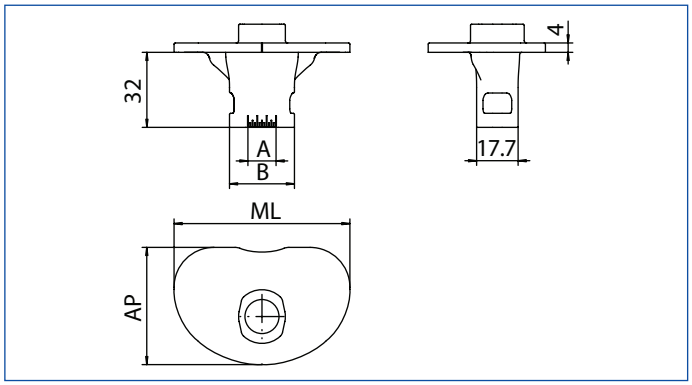
Cemented
- Cemented: 6° angle
- Length: 77, 157 mm
- Diameter: 12, 15, 18 mm
- Cylindrical and polished
- Four fluted grooves to reduce the risk of embolism



Pressfit
- Pressfit 5°, 7° angle
- Length: 117, 177 mm
- Diameter: 12 – 20 mm (1 mm increments)
- Slightly tapered
- 10 fluted grooves (Wagner profile)

Femoral Augment Details

- Cemented pockets 1 mm deep
- Fixated with a distal screw on the backside of the femur
- Distal augment heights: 4, 8, 12 mm
- Posterior/distal augment heights: 4, 8, 12 mm
  - Must have 4 mm posterior height and 4 mm distal height to use the posterior/distal augments



Tibia Details

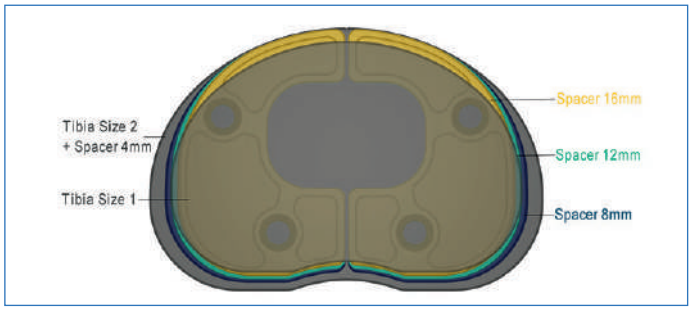
- Symmetric design
- 3 sizes
- Cement pockets 1 mm deep
- AP offset ± 6 mm through tibial stems
  - Size T1 ± 4 mm

Tibial Measurements in (mm)

Size	ML	AP	AP/ML	B
T1	67	44	2/3	23.7
T2	75	50	2/3	27.7
T3	83	56	2/3	27.7

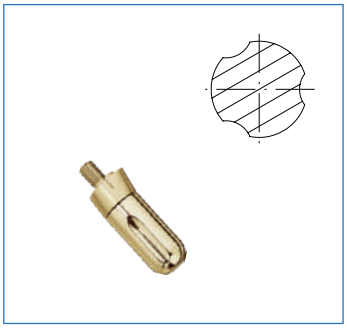
Note: *Max bone loss at tibia:*

- *T0-T3: 40 mm*



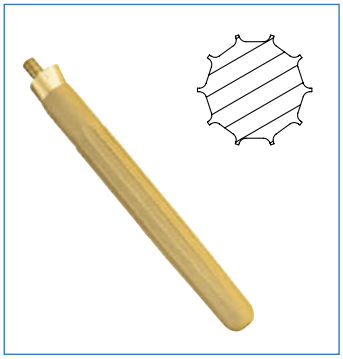
		Tibia 1	Tibia 2	Tibia 3
	Original ML	67	75	83
	Original AP	44	50	56
with 2 tibial spacers	4 mm ML	67	75	83
with 2 tibial spacers	4 mm AP	44	50	56
with 2 tibial spacers	8 mm ML	61	69	77
with 2 tibial spacers	8 mm AP	42	48	54
with 2 tibial spacers	12 mm ML	58.5	66.5	74.5
with 2 tibial spacers	12 mm AP	41.5	47.5	53.5
with 2 tibial spacers	16 mm ML	55.5	63.5	71.5
with 2 tibial spacers	16 mm AP	40.5	46.5	52.5

Tibial Stem Details



Cemented

- Cemented: no angle
- Length: 52, 92 mm
- Diameter: 12, 15, 18 mm
- Cylindrical and polished
- Three fluted grooves to reduce the risk of embolism
- Asymmetric "collar" for increased stability



Pressfit

- Pressfit: no angle
- Length: 92, 172 mm
- Diameter: 11-20 mm (1 mm increments)
- Slightly tapered
- 10 fluted grooves (Wagner Profile)
- Asymmetric "collar" for increased stability

Tibial Augment Details

- Cement pockets 1 mm deep
- Fixated with a screw on the underside of the tibia
- Tibial augment heights: 4, 8, 12, 16 mm
- Anatomical medial or lateral design

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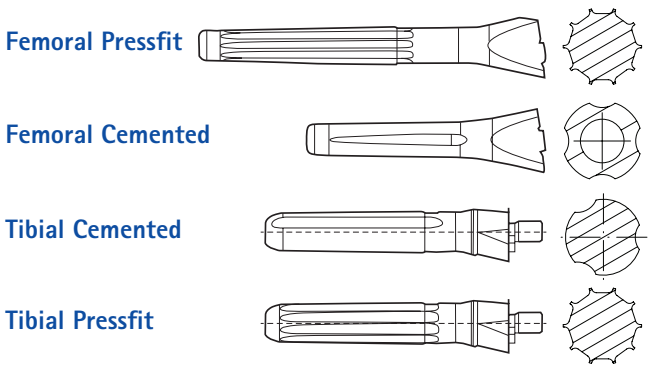
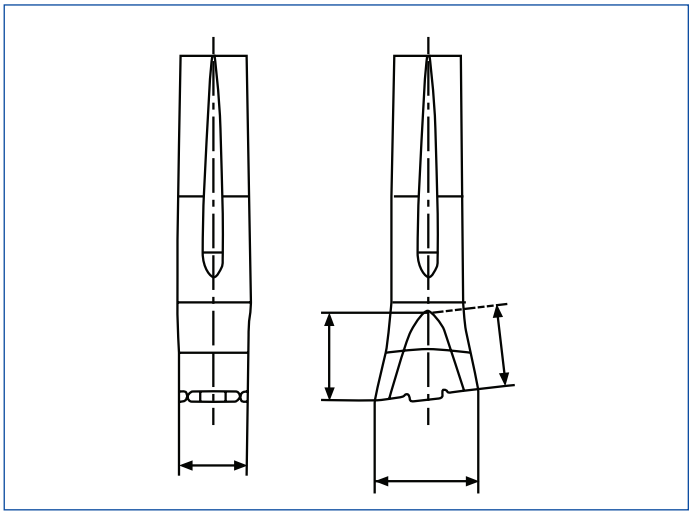
13. Implant Specifications *(continued)*

Stem Measurements in (mm)



Cemented Stems:
- Polished
- 3° conically shaped up to 3.6 cm from the stem tip

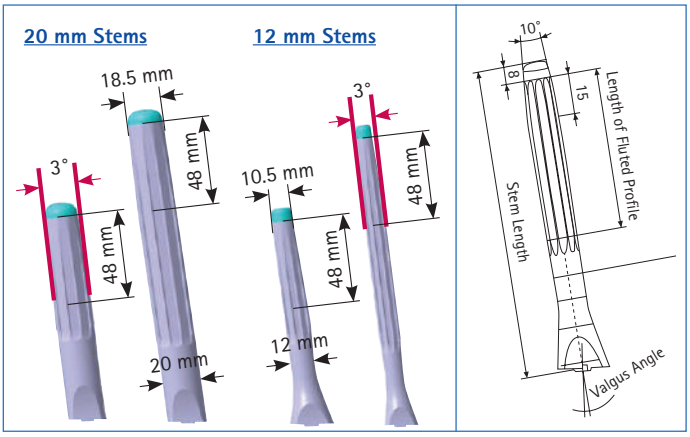
Pressfit Stems:
- Corrundum radiated
- 3° conically shaped up to 5.6 cm from the stem tip



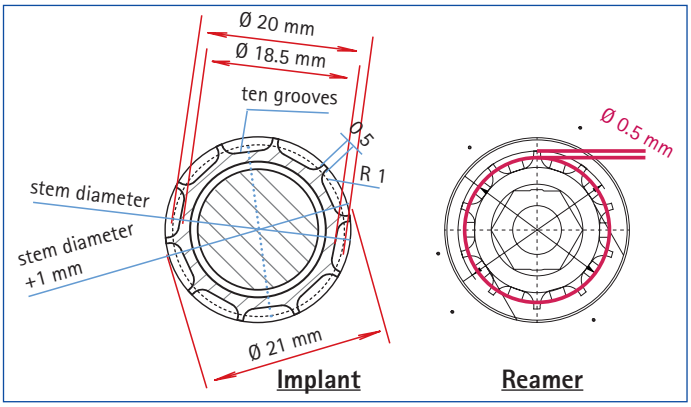
Connection Hub Measurements in (mm) for Femoral Stem

	D. 12 x L. 77	D. 15 x L. 77	D. 18 x L. 77	D. 12 x L. 157	D. 15 x L. 157	D. 18 x L. 157
A	14	14	14	14	14	14
B	20.9	20.9	20.9	20.9	20.9	20.9
C	17.3	17.8	17.1	17.3	17.8	17.1
D	16.1	16.6	15.9	16.1	16.6	15.9

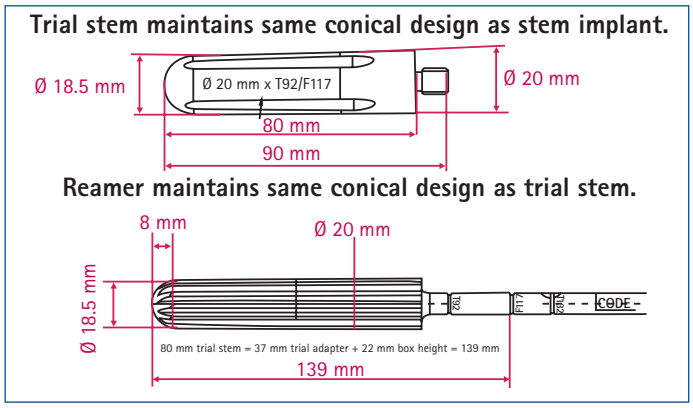
**It is recommended that you check the patient x-ray template of manufactured cone and place it on top with EnduRo template to ensure all implants fit together.*



The pressfit stem offers a 1 mm pressfit.



Size 20 mm is used as an example.

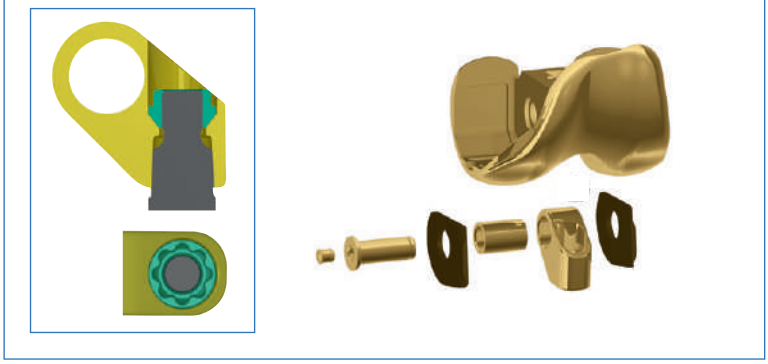


Size 20 mm is used as an example.

Cemented Stem Measurements in (mm)

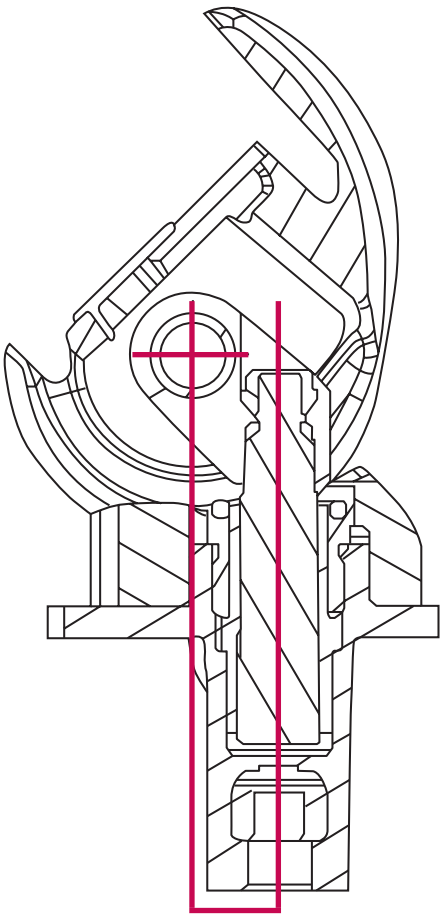
	D. 12 Stem		D. 15 Stem		D. 18 Stem	
Reamer	12	14	15	17	18	20
Trial Stem	12	14	15	17	18	20
Cement Mantle	Minimal	2	Minimal	2	Minimal	2

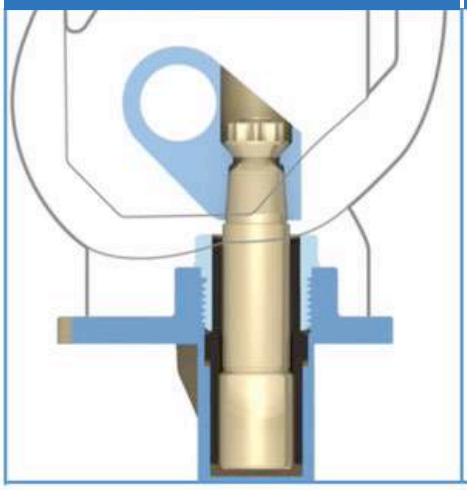
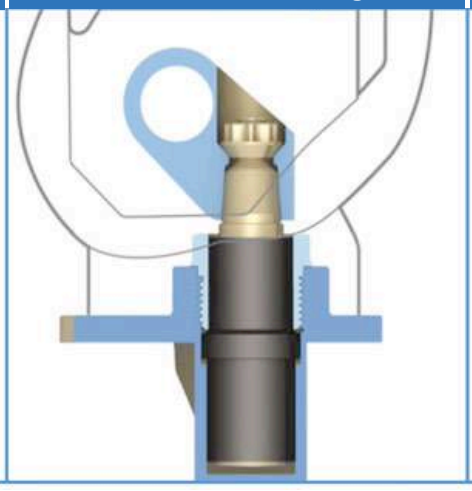
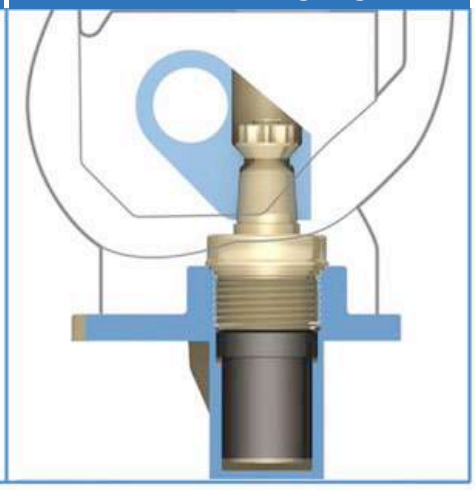
Hinge and Tibial Post/Hinge Hood Mechanism Details



Up to 3 mm of distraction

Highly-Congruent Condylar Loading*



Tibial Post	CFR-PEEK Axle Bushing	Tibial Post Locking Ring
		

* The results of in vitro wear simulation testing have not been proven to predict clinical performance. Data on file with Aesculap.

EnduRo™ Hinge Knee System

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13. Implant Specifications *(continued)*

Compatibility of Rotation Axis Elements

In case of unsterile or damaged tibial post, bearing sleeve or nut, you`ll find replacement options for proper treatment in the matrix below.

Components to replace	Replaceable by post/nut or bearing sleeve of PE insert		
	F1	F2	F3
F1 10 mm	-	-	-
F1 12 mm	-	-	-
F1 14 mm	-	10 mm	-
F1 16 mm	-	12 mm	10 mm
F1 18 mm	-	14 mm	12 mm

Components to replace	Replaceable by post/nut or bearing sleeve of PE insert		
	F1	F2	F3
F2 10 mm	14 mm	-	-
F2 12 mm	16 mm	-	10 mm
F2 14 mm	18 mm	-	12 mm
F2 16 mm	20 mm	-	14 mm
F2 18 mm	22 mm	-	16 mm

Components to replace	Replaceable by post/nut or bearing sleeve of PE insert		
	F1	F2	F3
F3 10 mm	16 mm	12 mm	-
F3 12 mm	18 mm	14 mm	-
F3 14 mm	20 mm	16 mm	-
F3 16 mm	22 mm	18 mm	-
F3 18 mm	24 mm	20 mm	-

Example 1:

- Unsterile or damage to the bearing sleeve, PE F1 10 mm, post or tibial nut:

  According to the chart, there is a "-". The "-" means that there are NO parts from any other PE that can be used. As there are no options, you would have to use a completely different PE-height with all the corresponding parts.

Example 2:

- Unsterile or damage to the bearing sleeve, PE F1 10 mm, post or tibial nut:

  According to the chart, the F1 14 mm row is a red row; then you can see the possibility of using the PEEK of F2 10 mm which is also a row red.

Example 3:

- Unsterile or damage to the bearing sleeve, PE F3 12 mm, post or tibial nut:

  According to the chart, the PE F3 12 mm is an orange row; then you can see the possibility of using the PEEK of F1 18 mm or F2 14 mm.

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14. EnduRo Hinge Implants

EnduRo Femur

Femur	F1	F2	F3
Left	NB014Z	NB015Z	NB016Z
Right	NB017Z	NB018Z	NB019Z

EnduRo Femoral Augment Distal

Size	4 mm	8 mm	12 mm
F1	NR861Z	NR862Z	NR863Z
F2	NR864Z	NR865Z	NR866Z
F3	NR867Z	NR868Z	NR869Z

EnduRo Femoral Augment Posterior/Distal

Size	4 x 4 mm	4 x 8 mm	4 x 12 mm	8 x 4 mm	8 x 8 mm	8 x 12 mm	12 x 4 mm	12 x 8 mm	12 x 12 mm
F1	NR366Z	NR367Z	NR396Z	NR368Z	NR369Z	NR397Z	-	-	-
F2	NR376Z	NR377Z	NR590Z	NR378Z	NR379Z	NR591Z	NR592Z	NR593Z	NR594Z
F3	NR386Z	NR387Z	NR595Z	NR388Z	NR389Z	NR596Z	NR597Z	NR598Z	NR599Z

EnduRo Femoral Stem Nut

Size	Item No.
F1-F3	NR400Z

EnduRo Femoral Stem Cemented

Size (mm)	6°
D. 12 x L. 77	NR291Z
D. 15 x L. 77	NR292Z
D. 18 x L. 77	NR293Z
D. 12 x L. 157	NR294Z
D. 15 x L. 157	NR295Z
D. 18 x L. 157	NR296Z

EnduRo Femoral Stem Cementless 5°, 7°

Size (mm)	5°	7°
D. 12 x L. 117	NR402Z	NR502Z
D. 13 x L. 117	NR403Z	NR503Z
D. 14 x L. 117	NR404Z	NR504Z
D. 15 x L. 117	NR405Z	NR505Z
D. 16 x L. 117	NR406Z	NR506Z
D. 17 x L. 117	NR407Z	NR507Z
D. 18 x L. 117	NR408Z	NR508Z
D. 19 x L. 117	NR409Z	NR509Z
D. 20 x L. 117	NR410Z	NR510Z
D. 12 x L. 177	NR432Z	NR532Z
D. 13 x L. 177	NR433Z	NR533Z
D. 14 x L. 177	NR434Z	NR534Z
D. 15 x L. 177	NR435Z	NR535Z
D. 16 x L. 177	NR436Z	NR536Z
D. 17 x L. 177	NR437Z	NR537Z
D. 18 x L. 177	NR438Z	NR538Z
D. 19 x L. 177	NR439Z	NR539Z
D. 20 x L. 177	NR440Z	NR540Z

EnduRo PE Insert

Size	10 mm	12 mm	14 mm	16 mm	18 mm
F1	NR870Z	NR871Z	NR872Z	NR873Z	NR874Z
F2	NR880Z	NR881Z	NR882Z	NR883Z	NR884Z
F3	NR890Z	NR891Z	NR892Z	NR893Z	NR894Z

Note: *PE Insert is based off the femur size.*

EnduRo Tibial Hemi-Augment

Size	4 mm RM/LL	8 mm RM/LL	12 mm RM/LL	16 mm RM/LL	4 mm RL/LM	8 mm RL/LM	12 mm RL/LM	16 mm RL/LM
T1	NB025Z	NB026Z	NB027Z	NB028Z	NB035Z	NB036Z	NB037Z	NB038Z
T2	NB045Z	NB046Z	NB047Z	NB048Z	NB055Z	NB056Z	NB057Z	NB058Z
T3	NB065Z	NB066Z	NB067Z	NB068Z	NB075Z	NB076Z	NB077Z	NB078Z

EnduRo Tibia

T1	T2	T3
NB011Z	NB012Z	NB013Z

Patella

Size	Item No.
P1	NX041
P2	NX042
P3	NX043
P4	NX044
P5	NX045

EnduRo Tibial Stem Cemented

Size (mm)	Item No.
D. 12 x L. 52	NR191Z
D. 15 x L. 52	NR192Z
D. 18 x L. 52	NR193Z
D. 12 x L. 92	NR194Z
D. 15 x L. 92	NR195Z
D. 18 x L. 92	NR196Z

EnduRo Tibial Stem Cementless

Size (mm)	Item No.
D. 11 x L. 92	NR171Z
D. 12 x L. 92	NR172Z
D. 13 x L. 92	NR173Z
D. 14 x L. 92	NR174Z
D. 15 x L. 92	NR175Z
D. 16 x L. 92	NR176Z
D. 17 x L. 92	NR177Z
D. 18 x L. 92	NR178Z
D. 19 x L. 92	NR179Z
D. 20 x L. 92	NR180Z
D. 11 x L. 172	NR491Z
D. 12 x L. 172	NR492Z
D. 13 x L. 172	NR493Z
D. 14 x L. 172	NR494Z
D. 15 x L. 172	NR495Z
D. 16 x L. 172	NR496Z
D. 17 x L. 172	NR497Z
D. 18 x L. 172	NR498Z
D. 19 x L. 172	NR499Z
D. 20 x L. 172	NR500Z

EnduRo™ Hinge Knee System

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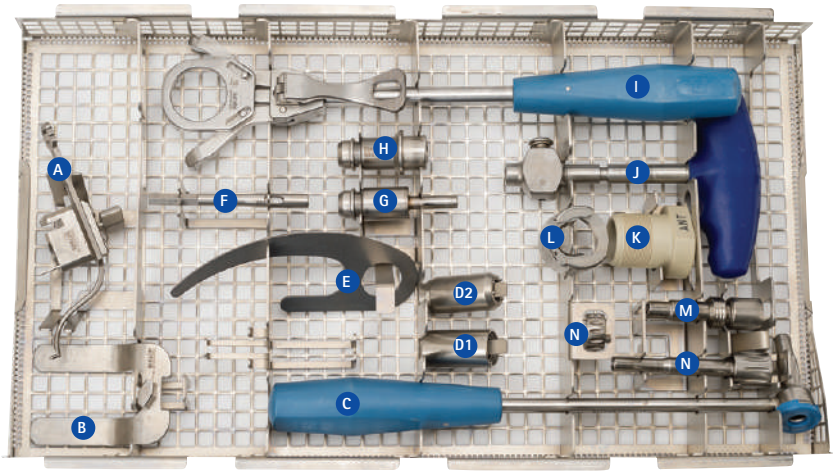
15. EnduRo Hinge Instruments – 10 Trays

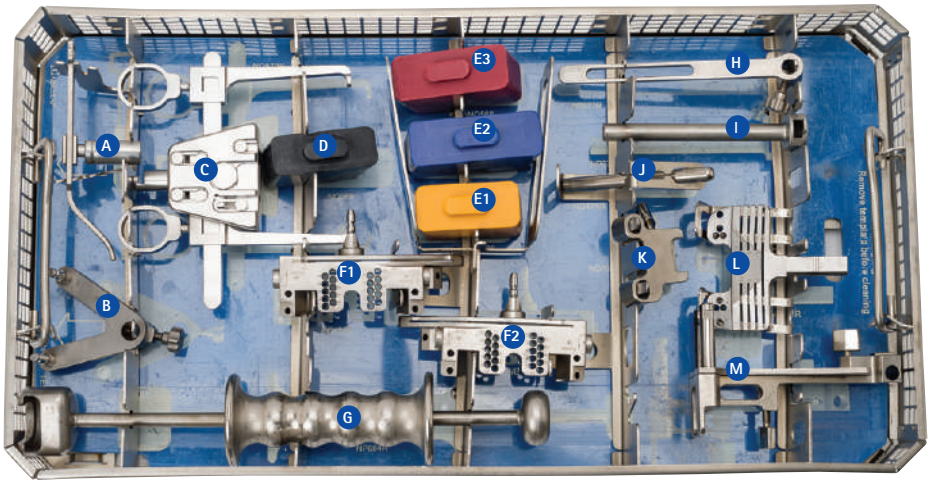


General Instruments Tray (NP301) – Top Tray

Index	Qty.	Item No.	Description	Index	Qty.	Item No.	Description
A	1	NQ708R	Jointline Positioner	H	1	GB413R	Hexagonal Quick Connect
B	1	NQ709R	Distal Femur Contact Plate	I	1	NQ839R	Tibial Implant Holder
C	1	NP419R	Guide for Threaded Tibial Post Grip and Washer (NP420R)	J	1	NE198R	T-handle
D1-2	2 ea.	NP454R, NP462RM	Key for Tibial Post Ring Size F1/F2/F3, Size F1 PE H. 10-12 mm	K	1	NP144PM	Key Guide for Tibial Post Ring
				L	1	NP141R	Safety Clamp for Key Guide (NP144PM)
E	1	NM350R	Resection Check Blade Th. 1.3 mm	M	2	NP455R	Holder/Inserter for Tibial Post Locking Nut
F	1	NP613R	Pin Driver	N	2	NP420R	Threaded Tibial Post Grip and Washer (two pieces)
G	2	GB414R	Hexagonal Quick Connect with Triangular Chuck Coupling				

General Instruments Tray (NP301) – Bottom Tray

Index	Qty.	Item No.	Description	Index	Qty.	Item No.	Description
A	6	NP583R	Threaded Headless Pin D. 3.2 mm x L. 63 mm	K	1	NE181R	Screwdriver HEX 3.0 mm
B	2	NP584R	Threaded Headless Pin D. 3.2 mm x L. 88 mm	L	1	NP471R	Alignment Rod Long
C	4	NP585R	Threaded Headed Pin D. 3.2 mm x L. 30 mm	M	1	NE331R	Alignment Rod Short with Sleeve
D	2	NP586R	Threaded Headed Pin D. 3.2 mm x L. 50 mm	N	2	NP495R	Impactor/Extractor Handle
E	2	NP587R	Threaded Headed Pin D. 3.2 mm x L. 75 mm	O	1	FL556R	Osteotome Fine Curved W. 20 mm L. 205 mm
F	1	NQ834R	Femoral Stem Implant Holder	P	1	NP410R	Drill D. 10 mm
G	1	NE185R	Stem Key for Torque Wrench (NE184RM)		1	NP311R	General Instruments Tray
H	1	NE184RM	Torque Wrench 20/27 Nm		1	TE977	Graphic Template for NP311R (NP301)
I	1	NQ643R	Cranked Wrench HEX 3.0 mm		1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm
J1-2	1 ea.	NP024R, NP025R	Tibia Chisel RL/LM, RM/LL				



Manual Instruments Tray (NP302)

Index	Qty.	Item No.	Description	Index	Qty.	Item No.	Description
A	1	NE425R	Tibial Cutting Guide Stylus without Notch	H	1	NP677R	Tibial Cutting Guide - Lever Arm
B	1	NE195R	Tibial Cutting Guide Base	I	1	NP678R	Tibial Cutting Guide - Body
C	1	NQ570R	Implant Holder	J	1	NQ474R	Distal Femoral Cutting Guide - Handle Bar
D	1	NQ569	Tibial Insert for Implant Holder (NQ570R)	K	1	NQ703R	Distal Femoral Cutting Guide - Body
E1-3	1 ea.	NQ566, NQ567, NQ568	Femoral F1, F2, F3 Insert for Implant Holder (NQ570R)	L	1	NP411R	Distal Femoral Cutting Guide
				M	1	NQ702R	Distal Femoral Cutting Guide - Base
F1-2	1 ea.	NE196R, NE197R	Tibial Cutting Guide - Right, Left		1	NP312R	Manual Instruments Tray
					1	TE978	Graphic Template for NP312R (NP302)
G	1	NP684R	Slap Hammer		1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm

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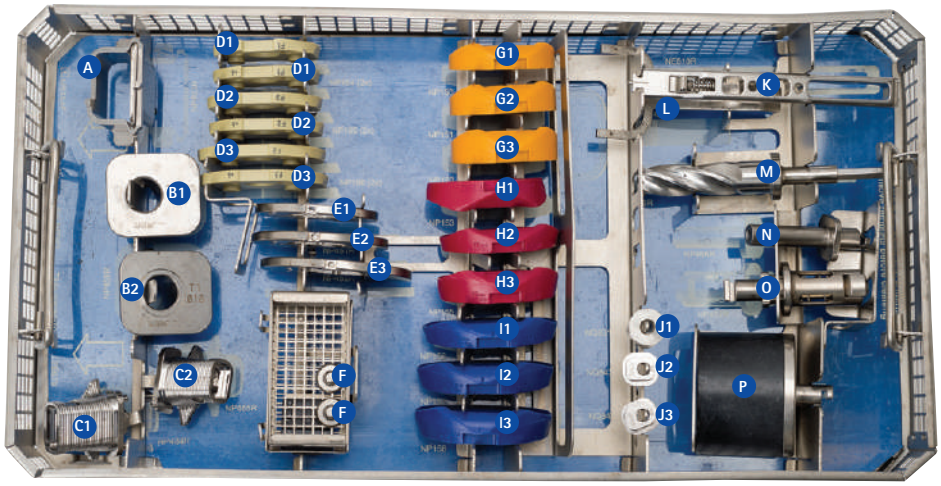
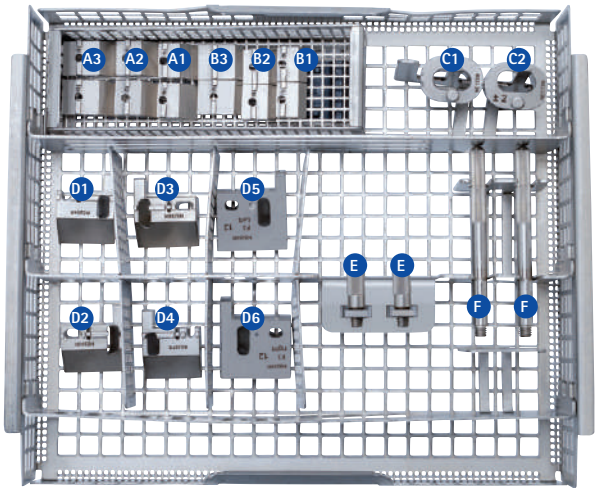
15. EnduRo Hinge Instruments – 10 Trays *(continued)*



Tibial Preparation Instruments Tray (NP303)

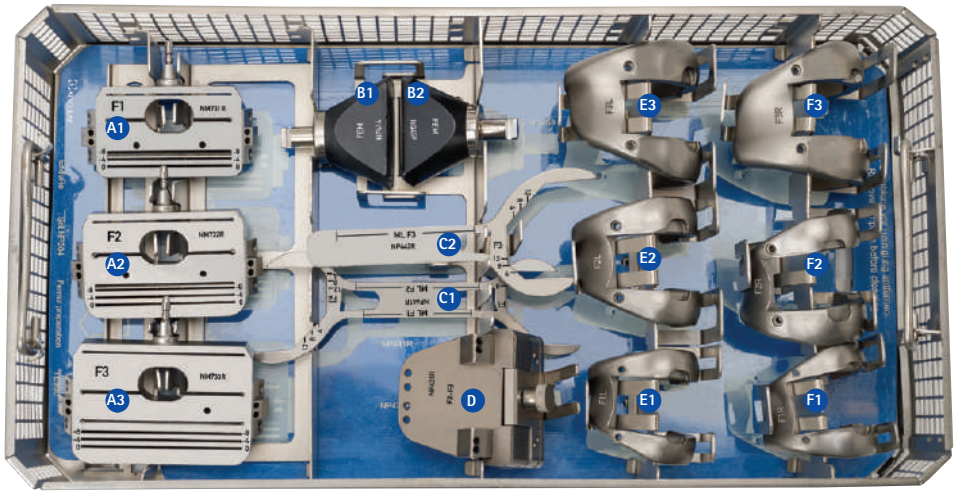
Index	Qty.	Item No.	Description
A	1	NP463R	Guide for Tibial Drill Sleeve and Keel Broach/Trial
B1-2	1 ea.	NP457R, NP458R	Tibial Keel Broach/Trial Drill Sleeve T1, T2/T3
C1-2	1 ea.	NP464R, NP465R	Tibial Keel Broach/Trial T1, T2/T3
D1-3	2 ea.	NP164, NP165, NP166	PE Insert Trial H. 6 mm F1, F2, F3
E1-3	1 ea.	NP451R, NP452R, NP453R	Trial Tibia T1, T2, T3
F	2	NP479R	Tibial Keel Broach/Trial Cover
G1-3	1 ea.	NP150, NP151, NP152	PE Insert Trial F1 H. 10, 12, 14 mm
H1-3	1 ea.	NP153, NP154, NP155	PE Insert Trial F2 H. 10, 12, 14 mm
I1-3	1 ea.	NP156, NP157, NP158	PE Insert Trial F3 H. 10, 12, 14 mm
J1-3	1 ea.	NQ831R, NQ843R, NQ846R	Tibial Stem Collar Trial Up to D. 20, Up to D. 17, Up to D. 14 mm

Index	Qty.	Item No.	Description
K	1	NE510R	Trial Tibia Handle
L	1	NP459R	Locking Holder for Tibial Keel Broach/Trial Guide (NP468)
M	1	NP456R	Drill D. 18 mm with Stop for Tibial Keel Preparation
N	1	NP466R	M/L Tibial Positioner
O	1	NP467R	Tibial Keel Broach/Trial Adapter
P	1	NP468	Tibia Impactor
	1	NP313R	Tibial Preparation Instruments Tray
	1	TE979	Graphic Template for NP313R (NP303)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm



Femoral Preparation Instruments Tray (NP304) – Top Tray

Index	Qty.	Item No.	Description
A1-3	2 ea.	NM737R, NM738R, NM739R	4-in-1 Cutting Guide Augment H. 8 mm F1, F2, F3
B1-3	2 ea.	NM734R, NM735R, NM736R	4-in-1 Cutting Guide Augment H. 4 mm F1, F2, F3
C1-2	1 ea.	NE172R, NE173R	Femoral Stem AP Orientation Sleeve Neutral, Offset
D1-6	1 ea.	NS264R, NS265R, NS266R, NS267R, NS268R, NS269R	4-in-1 Cutting Guide Augment H. 12 mm F1L, F1R, F2L, F2R, F3L, F3R
E	2	NE731R	Cutting Guide Fixation Tabs
F	2	NE730R	4-in-1 Cutting Guide Handles



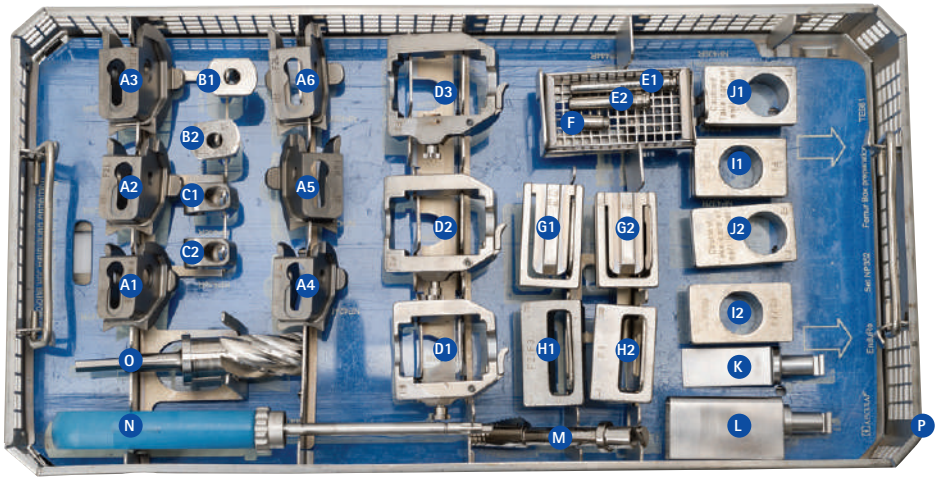
Femoral Preparation Instruments Tray (NP304) – Bottom Tray

Index	Qty.	Item No.	Description
A1-3	1 ea.	NM731R, NM732R, NM733R	4-in-1 Femoral Cutting Guide F1, F2, F3
B1-2	1 ea.	NP414, NQ459	Femur Impactor Straight, Curved
C1-2	1 ea.	NP441R, NP442R	Femoral Size F1/F2, F3
D	1	NP431R	Post. Augment Cutting Guide F2/F3 12 mm
E1-3	1 ea.	NP404R, NP405R, NP406R	Trial Femur Left F1, F2, F3
F1-3	1 ea.	NP407R, NP408R, NP409R	Trial Femur Right F1, F2, F3
	1	NP314R	Femoral Preparation Instruments Tray
	1	TE980	Graphic Template for NP314R (NP304)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm

EnduRo™ Hinge Knee System

Surgical Technique

15. EnduRo Hinge Instruments – 10 Trays *(continued)*



Femoral Box Preparation Instruments Tray (NP352)

Index	Qty.	Item No.	Description
A1-6	1 ea.	NP424R, NP425R, NP426R, NP427R, NP428R, NP429R	Femoral Trial Box F1L, F2L, F3L, F1R, F2R, F3R
B1-2	1 ea.	NP417R, NP418R	Femoral Trial Box Alignment Sleeve Neutral 6°, ±1° for 5°/7°
C1-2	1 ea.	NP445R, NP446R	Hinge Trial Hood F1/F2, F3
D1-3	1 ea.	NP421R, NP422R, NP423R	Femoral Box Preparation Frame F1, F2, F3
E1-2	2 ea.	NP447R, NP449R	Tibial Trial Post Short up to 16 mm, Long 18 mm
F	1	NP444R	Trial Hinge Pin
G1-2	1 ea.	NP433R, NP434R	Chisel Guide for Femoral Box Preparation F1, F2/F3
H1-2	1 ea.	NP415R, NP416R	Femoral Trial Box Alignment Guide F1, F2/F3
I1-2	1 ea.	NP436R, NP437R	Center Drill Guide for Femoral Box Preparation F1, F2/F3
J1-2	1 ea.	NP438R, NP439R	Offset Drill Guide for Femoral Box Preparation F1, F2/F3
K	1	NP432R	Chisel
L	1	NP443R	Chisel, U-shaped
M	1	NQ832R	Femoral Stem Starter Rasp
N	1	NP440R	Tibial Trial Post Screwdriver
O	1	NP435R	Drill for Femoral Box Preparation with Stop D. 24 mm
P	1	NP315R	Femoral Box Preparation Instruments Tray
	1	TE981	Graphic Template for NP315R (NP352)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm

Cementless Short Stem Reamers and Cementless Short Tibial Stem Trials Tray (NS134) – Top Tray

Index	Qty.	Item No.	Description
A1-10	1 ea.	NS081R, NS082R, NS083R, NS084R, NS085R, NS086R, NS087R, NS088R, NS089R, NS090R	Cementless Short L. 92/117 mm Stem Reamers D. 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 mm

Index	Qty.	Item No.	Description
B1-10	1 ea.	NS071T, NS072T, NS073T, NS074T, NS075T, NS076T, NS077T, NS078T, NS079T, NS080T	Cementless Short L. 92 mm Tibial Trial Stems D. 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 mm

Cementless Long Stem Reamers and Cementless Long Tibial Stem Trials Tray (NS134) – Bottom Tray

Index	Qty.	Item No.	Description
B1-10	1 ea.	NS051T, NS052T, NS053T, NS054T, NS055T, NS056T, NS057T, NS058T, NS059T, NS060T	Cementless Long L. 172 mm Tibial Trial Stems D. 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 mm
A1-10	1 ea.	NS061R, NS062R, NS063R, NS064R, NS065R, NS066R, NS067R, NS068R, NS069R, NS070R	Cementless Long L. 172/177 mm Stem Reamers D. 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 mm

Index	Qty.	Item No.	Description
	1	NS135R	Cementless Stem Preparation Instruments Tray
	1	TE982	Graphic Template for NS135R (NS134)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm

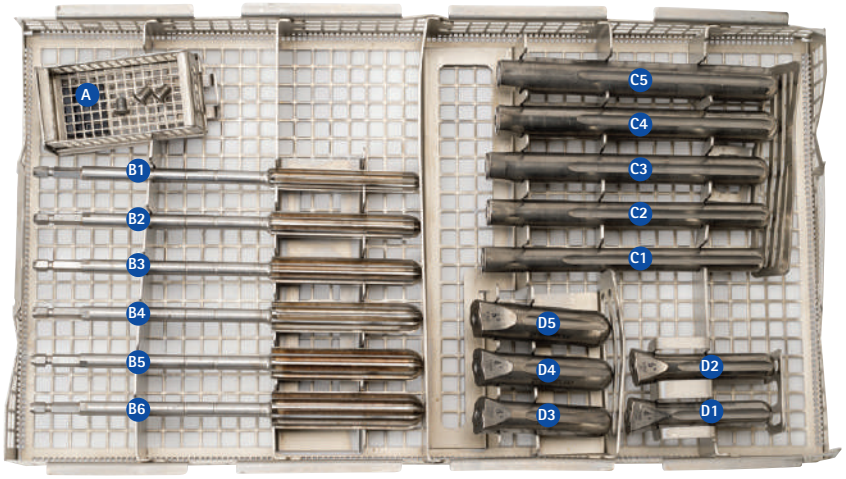
EnduRo™ Hinge Knee System

Surgical Technique

15. EnduRo Hinge Instruments – 10 Trays *(continued)*

Cementless Femoral Stem Trials Tray (NS136)

Index	Qty.	Item No.	Description
A1-9	1 ea.	NS242T, NS243T, NS244T, NS245T, NS246T, NS247T, NS248T, NS249T, NS250T	Cementless Long L. 177 mm Femoral Trial Stems D. 12, 13, 14, 15, 16, 17, 18, 19, 20 mm
B	3	NS001R	Femoral Trial Stem Screw Attachment HEX 3.0 mm
C	1	NS008R	Cementless Femoral Trial Stem Adapter 5° Neutral 37 mm
D	1	NS014R	Cementless Femoral Trial Stem Adapter 7° Neutral 37 mm
E1-9	1 ea.	NS232T, NS233T, NS234T, NS235T, NS236T, NS237T, NS238T, NS239T, NS240T	Cementless Short L. 117 mm Femoral Trial Stems D. 12, 13, 14, 15, 16, 17, 18, 19, 20 mm
	1	NS137R	Cementless Femoral Stem Trial Instruments Tray
	1	TE983	Graphic Template for NS137R (NS136)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm



Cemented Short Stem Reamers and Cemented Long and Short Femoral Trial Stems Tray (NS138) – Top Tray

Index	Qty.	Item No.	Description
A	3	NS001R	Femoral Trial Stem Screw Attachment HEX 3.0 mm
B1-6	1 ea.	NS104R, NS105R, NS106R, NS107R, NS108R, NS109R	Cemented Short L. 52/77 mm Stem Reamers D. 12, 14, 15, 17, 18, 20 mm
C1-5	1 ea.	NS225T, NS226T, NS227T, NS228T, NS229T	Cemented Long L. 157 mm Femoral Trial Stems D. 14, 15, 17, 18, 20 mm
D1-5	1 ea.	NS220T, NS221T, NS222T, NS223T, NS224T	Cemented Short L. 77 mm Femoral Trial Stems D. 14, 15, 17, 18, 20 mm

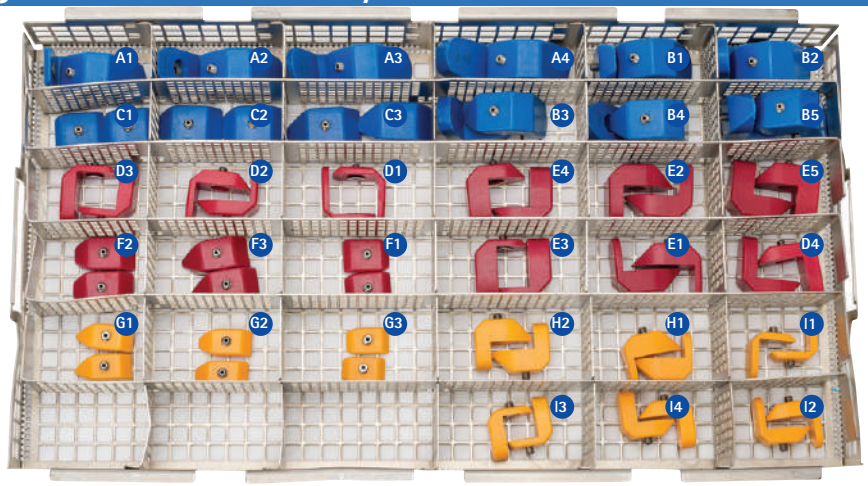
Cemented Long Stem Reamers and Cemented Long and Short Tibial Trial Stems Tray (NS138) – Bottom Tray

Index	Qty.	Item No.	Description
A1-5	1 ea.	NS217T, NS092T, NS218T, NS093T, NS219T	Cemented Long L. 92 mm Tibial Trial Stems D. 14, 15, 17, 18, 20 mm
B1-5	1 ea.	NS214T, NS102T, NS215T, NS103T, NS216T	Cemented Short L. 52 mm Tibial Trial Stems D. 14, 15, 17, 18, 20 mm
C1-6	1 ea.	NS094R, NS095R, NS096R, NS097R, NS098R, NS099R	Cemented Long L. 92/157 mm Stem Reamers D. 12, 14, 15, 17, 18, 20 mm
	1	NS139R	Cemented Stem Preparation Instruments Tray
	1	TE984	Graphic Template for NS139R (NS138)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm

EnduRo™ Hinge Knee System

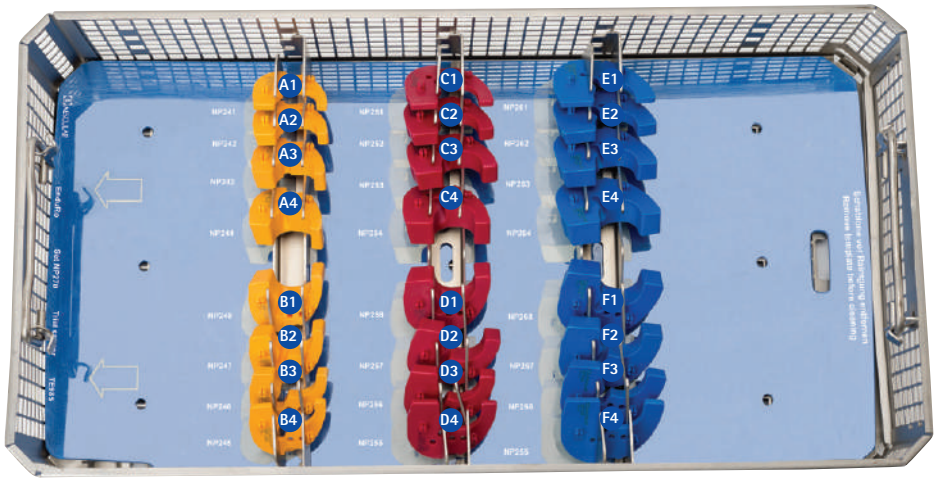
Surgical Technique

15. EnduRo Hinge Instruments – 10 Trays *(continued)*



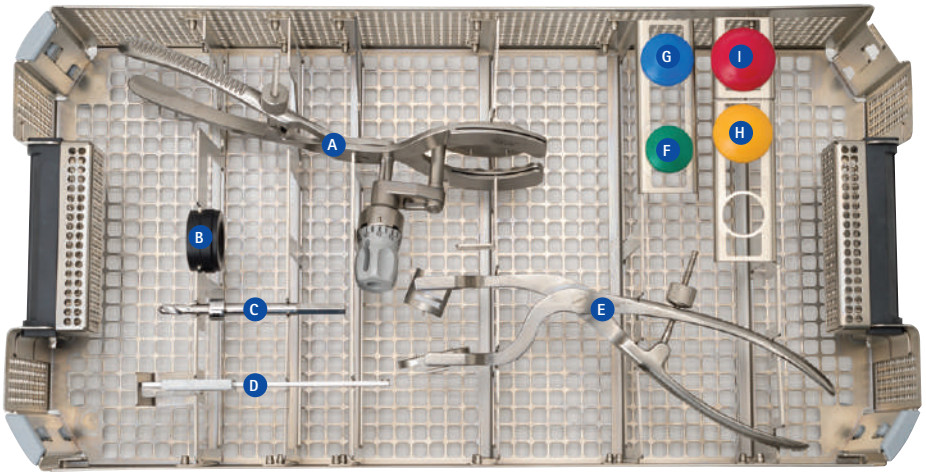
Trial Femoral Augments Instruments Tray (NP270) – Top Tray

Index	Qty.	Item No.	Description
A1-4	2 ea.	NP488, NP489, NP490, NP491	Trial Femoral Augment Posterior/Distal F3 H. 4 x 4, 4 x 8, 8 x 4, 8 x 8 mm
B1-5	2 ea.	NE234, NE235, NE237, NE238, NE239	Trial Femoral Augment Posterior/Distal F3 H. 4x12, 8x12, 12 x 4, 12 x 8, 12 x 12 mm
C1-3	2 ea.	NP474, NP477, NP494	Trial Femoral Augment Distal F3 H. 4, 8, 12 mm
D1-4	2 ea.	NP484, NP485, NP486, NP487	Trial Femoral Augment Posterior/Distal F2 H. 4 x 4, 4 x 8, 8 x 4, 8 x 8 mm
E1-5	2 ea.	NE229, NE230, NE231, NE232, NE233	Trial Femoral Augment Posterior/Distal F2 H. 4x12, 8x12, 12 x 4, 12 x 8, 12 x 12 mm
F1-3	2 ea.	NP473, NP476, NP493	Trial Femoral Augment Distal F2 H. 4, 8, 12 mm
G1-3	2 ea.	NP472, NP475, NP492	Trial Femoral Augment Distal F1 H. 4, 8, 12 mm
H1-2	2 ea.	NE226, NE227	Trial Femoral Augment Poserior/Distal F1 H. 4 x12, 8 x 12 mm
I1-4	2 ea.	NP480, NP481, NP482, NP483	Trial Femoral Augment Posterior/Distal F1 H. 4 x 4, 4 x 8, 8 x 4, 8 x 8 mm



Trial Tibial Hemi-Augments Instruments Tray (NP270) – Bottom Tray

Index	Qty.	Item No.	Description
A1-4	1 ea.	NP241, NP242, NP243, NP244	Trial Tibial Hemi-Augment T1 RM/LL H. 4, 8, 12, 16 mm
B1-4	1 ea.	NP245, NP246, NP247, NP248	Trial Tibial Hemi-Augment T1 RL/LM H. 4, 8, 12, 16 mm
C1-4	1 ea.	NP251, NP252, NP253, NP254	Trial Tibial Hemi-Augment T2 RM/LL H. 4, 8, 12, 16 mm
D1-4	1 ea.	NP255, NP256, NP257, NP258	Trial Tibial Hemi-Augment T2 RL/LM H. 4, 8, 12, 16 mm
E1-4	1 ea.	NP261, NP262, NP263, NP264	Trial Tibial Hemi-Augment T3 RM/LL H. 4, 8, 12, 16 mm
F1-4	1 ea.	NP265, NP266, NP267, NP268	Trial Tibial Hemi-Augment T3 RL/LM H. 4, 8, 12, 16 mm
	1	NP271R	Trial Augment Instruments Tray
	1	TE985	Graphic Template for NP271R (NP270)
	1	JH217R	1/1 Perf. Basket Lid 489 x 257 mm



Patella Instruments Tray (NS709)

Index	Qty.	Item No.	Description	Index	Qty.	Item No.	Description
A	1	NS840R	Patella Resection Clamp	G	1	NQ282	Patella Trial P2 D. 29 mm x H. 8 mm
B	1	NS842	Cementing Adapter	H	1	NQ283	Patella Trial P3 D. 32 mm x H. 9 mm
C	1	NQ449R	Drill with Stop D. 6 mm L. 28 mm	I	1	NQ284	Patella Trial P4 D. 35 mm x H. 10 mm
D	1	AA847R	Caliper Measures in D. 100 mm		1	NS719R	Patella Preparation Instruments Tray
E	1	NS841R	Patella Drilling and Cementing Clamp		1	TF069	Graphic Template for NS719R (NS709)
F	1	NQ281	Patella Trial P1 D. 26 mm x H. 7 mm		1	JA455R	Ortho Tray Lid without Handle

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