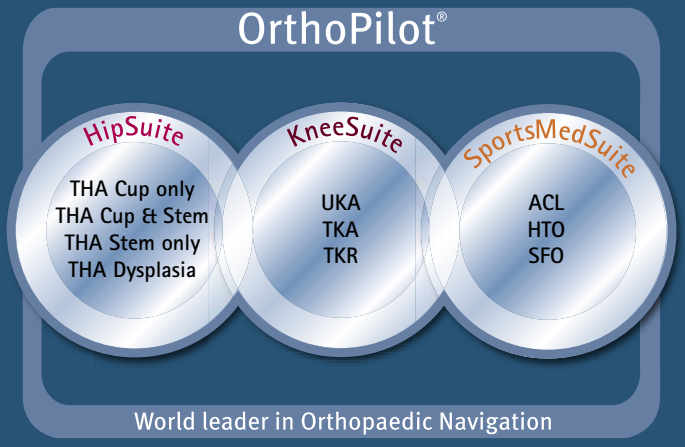
Aesculap® OrthoPilot®

OrthoPilot® KneeSuite – TKA
Total Knee Arthroplasty e.motion®, e.motion® Pro System, Columbus®, VEGA System®

Aesculap Orthopaedics

B BRAUN
SHARING EXPERTISE

OrthoPilot® TKA – Total Knee Arthroplasty



[1] Jenny JY, Clemens U, Kohler S, Kiefer H, Konermann W, Miehlke RK. Consistency of implantation of a total knee arthroplasty with a non-image-based navigation system: a case-control study of 235 cases compared with 235 conventionally implanted prostheses. J Arthroplasty. 2005 Oct;20(7):832-9.

[2] Jenny JY, Miehlke RK, Giurea A. Learning curve in navigated total knee replacement. A multi-centre study comparing experienced and beginner centres. Knee. 2008 Mar;15(2):80-4. Epub 2008 Feb 11.

[3] Bäthis H, Shafizadeh S, Paffrath T, Simanski C, Grifka J, Lüring C. Are computer assisted total knee replacements more accurately placed? A metaanalysis of comparative studies. Orthopäde. 2006 Oct;35(10):1056-65.

[4] Bauwens K, Matthes G, Wich M, Gebhard F, Hanson B, Ekkernkamp A, Stengel D. Navigated total knee replacement. A meta-analysis. J Bone Joint Surg Am. 2007 Feb;89(2):261-9.

[5] Mason JB, Fehring TK, Estok R, Banel D, Fahrbach K. Meta-analysis of alignment outcomes in computer-assisted total knee arthroplasty surgery. J Arthroplasty. 2007 Dec;22(8):1097-106.

[6] Novicoff WM, Saleh KJ, Mihalko WM, Wang XQ, Knaebel HP. Primary total knee arthroplasty: a comparison of computer-assisted and manual techniques. Instr Course Lect. 2010;59:109-17.

[7] Decking R, Markmann Y, Fuchs J, Puhl W, Scharf HP. Leg axis after computer-navigated total knee arthroplasty: a prospective randomized trial comparing computer-navigated and manual implantation. J Arthroplasty. 2005 Apr;20(3):282-8.

[8] Seon JK, Song EK. Navigation-assisted less invasive total knee arthroplasty compared with conventional total knee arthroplasty: a randomized prospective trial. J Arthroplasty. 2006 Sep;21(6):777-82.

OrthoPilot®

The OrthoPilot® system assists in the precise implantation of knee and hip endoprostheses.[1] Integration in the surgical workflow as well as minimal prolongation of operation time were essential criteria in the development of the OrthoPilot® system[2]. At the same time, we focussed on a navigation system that is non-traumatic for the patient. From the beginning, a method was developed that dispenses with CTs and MRIs exposure or expenses that these entail, and requires only very little extra operation time.

- CT Scan not required
- Ergonomic instruments precisely aligned to the surgery
- User-friendly navigational flow integrates itself easily into the operation
- Intraoperative documentation with OrthoPilot®
- Numerous international studies confirm better alignment using navigation[3,4,5,6]
- Routinely used in over 600 hospitals
- Over 300 OrthoPilot® publications worldwide[7,8]

OrthoPilot® TKA – Total Knee Arthroplasty

Content

OrthoPilot® TKA – Total Knee Arthroplasty

1 | Instrument overview

1.1 General instruments

Drill, drill sleeve, screw length gauge

Drill, D=3.2 mm	**NP615R**
Drill sleeve	**NP616R**
Screw length gauge	**NP281R**

Tissue protection sleeve, bicort. screws, RB adapter

MIOS® tissue protection sleeve	**NQ941R**
Bicortical screws	**NP620R – NP625R**
Rigid Body	**NP619R**

Passive transmitters

yellow	**FS633**
blue	**FS634**
red	**FS635**

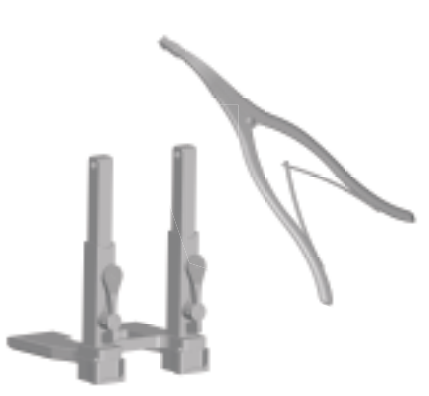
Pointer, straight

Pointer, straight	**FS604**

Tibia cut control plate

Tibia control plate	**NP617R**
Tibia control plate	**NP617RM**

Laminar spreader, spreading forceps



Laminar spreader	**NE750R**
Spreading forceps	**NP609R**

1.2 Standard and MIOS® Instruments*

Femoral alignment block with foot plates

e.motion®	**NE440R**
e.motion® MIOS®	**NQ955R**
e.motion® MIOS® short	**NQ945R**
Columbus®	**NE324T**
Columbus® MIOS®	**NQ954R**
Columbus® MIOS® short	**NQ944R**

Distal femoral sawing guide

Standard	**NP598R**
MIOS®	**NQ953R**

Tibial sawing guide

Standard right	**NP596R**
Standard left	**NP597R**
MIOS® right	**NQ952R**
MIOS® left	**NQ951R**

Note:
*** Not for VEGA System®.**

OrthoPilot® TKA – Total Knee Arthroplasty

1 | Instrument overview

1.3 IQ Instruments

Femoral alignment block with foot plates

Alignment block	**NS320R**
Y foot plate	**NQ958R**

Tibial/Distal femoral sawing guide and RB adapter, modular

Tibial/femoral sawing guide	**NS334R**
RB adapter, modular	**FS626R**

4-in-1 Femoral sawing guide and RB adapter, modular

e.motion® 4-in-1 Femoral sawing guide	
F2-F8	**NS582R - NS588R**
VEGA System® 4-in-1 Femoral sawing guide	
F1-F8	**NS321R - NS328R**
Columbus® 4-in-1 Femoral sawing guide	
F1-F8	**NQ1041R - NQ1048R**

2 | Preoperative planning using radiographic images

The OrthoPilot® system and the TKA software can be used in all cases where total knee arthroplasty with a total knee endoprosthesis is indicated. There must be sufficient bone quality and hip joint mobility.

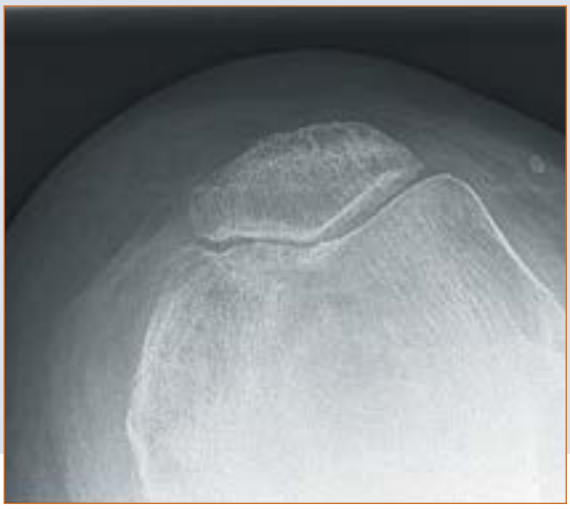
Note:

The corresponding notes in the respective surgical technique description, instruction for use and package inserts, in particular in the instruction for use for the OrthoPilot® application software TKA TA013595 must be observed.

OrthoPilot® TKA – Total Knee Arthroplasty

3 | Preoperative planning

Aesculap considers it necessary to carry out an adequate preoperative planning based on the following X-ray images:	Selected information which can be obtained on the basis of the X-ray images:
■ Whole leg image in standing position	■ Axis deviation
■ Knee joint in an A/P projection	■ Implant alignment, joint gap, ML implant size
■ Knee joint in lateral projection	■ Slope, A/P implant size
■ Tangential image of the patella	■ Patella shape, joint gap



The analysis of the need for a full knee endoprosthesis is essential in the preoperative planning. In addition to the standard radiological examinations, the surgeon should take the following points into consideration before performing a knee endoprosthesis surgery:

- Soft tissue situation
- Functionality of the extensor mechanism
- Bone preservation
- Restoration of good axis orientation
- Functional stability
- Restoration of the joint line

The surgeon can obtain the following information when analysing the X-ray images with the help of the X-ray templates of the Aesculap prosthesis systems Columbus®, e.motion®, e.motion® Pro System and VEGA System®.

- Angle between anatomic and mechanical femur axis
- Resection height
- Implant size

OrthoPilot® TKA – Total Knee Arthroplasty

4 | Preparation of the patient

Positioning and sterile draping of the patient is carried out according to the standard procedures which are also applied in the conventional technique. Aesculap recommends using a leg holder, which facilitates leg control during the various phases of the operation.
In order to record the points to be registered and to carry out all the necessary bone cuts, it is necessary to change the leg position several times. The leg holder enables the knee position to be varied between full extension and full flexion.

TIP

To facilitate mobilisation of the quadriceps, the knee should be brought to 100° flexion prior to activating the tourniquet. If a pad is used, make sure that it does not hinder full circulation of the hip joint required for registering the femoral head centre.

5 | OrthoPilot® setup and transmitter position

5.1 OrthoPilot®-Positioning

When positioning the OrthoPilot®, ensure that the physician has an unobstructed view of the screen at all times. Unit or camera can be positioned either on the opposite side of the leg to be operated on (contralateral), or on the same side (ipsilateral).
In many cases, it has proven beneficial to position the camera at shoulder height on the opposite side of the patient and aligned at approx. 45° to the operating field.

TIP

Point the laser pointer integrated in the handle of the camera (does not apply to FS010) at the knee joint to be operated on while the leg is in approx. 90° flexion. The camera alignment can be adjusted at any stage of the operation, except during determination of the hip centre.

5.2 Femoral transmitter

TIP

The following applies in general: the transmitter should be positioned in such a way, that it is visible for the camera during the entire operation. The femur transmitter must be fixed on the femur with the help of 4.5 mm cortical screws and the Rigid Body (RB) NP619R at about 10 cm proximal to the joint line.
The bicortical screw is pre-drilled by using a 3.2 mm drill NP615R through the drill sleeve NP616R; then, the length of the necessary bicortical screw can be determined with the help of the scale on the drill or the measuring instrument NP281R by hooking on the opposite cortical and reading out the dial. The Rigid Body NP619R is pushed forward – with MIOS®- and IQ-Instruments optionally through the tissue protection sleeve NQ941R – and brought into contact with the bone. Then one of the bicortical screws NP620R - NP625R is introduced first mechanically the last turns are performed with the help of a manual screwdriver. The transmitter adapter should point to the head of the hip, inclined towards the camera. It is recommended to test the secure fit.

TIP

The tip of the pointer with a length of about 10 cm can serve as a guide for the distance to the joint.

OrthoPilot® TKA – Total Knee Arthroplasty

5 | OrthoPilot® setup and transmitter position

5.3 Tibial transmitter

Through a separate, approximate 1 cm long incision, about 10 cm distal to the joint line, a RB NP619R is fixed to the tibia after pre-drilling with the 3.2 mm drill NP615R through the drill sleeve NP616R and after determining the length of the bicortical screw as described in the previous chapter 5.2. The last turns of the screw are performed also with a manual screwdriver. The possibilities of transmitter fixation are various. Two selected examples are displayed in figure 1 and 2.

1

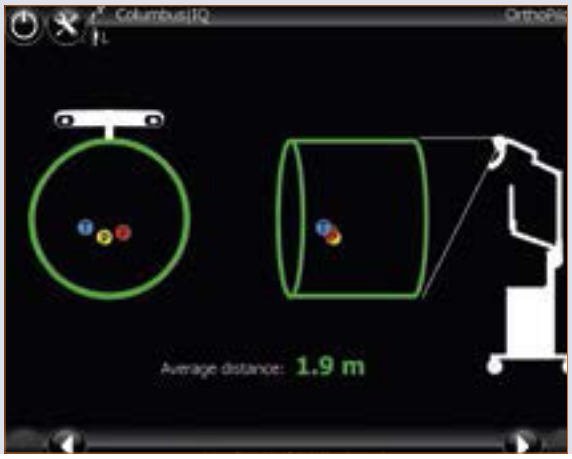
2

5.4 Camera adjustment

The field of view of the camera is shown on the screen as a cylindrical volume. The transmitters within the field of view of the camera are displayed in this cylinder capacity as coloured balls (corresponding to the colour coding), with their respective identification letters:

- Transmitter on the femur:
  red ball with identification letter "F"
- Transmitter on the instrument:
  yellow ball with identification letter "P"
- Transmitter on the tibia:
  blue ball with identification letter "T"

When all three transmitters are at an optimal distance from the camera, the camera's field of view is bordered in green on the screen. The distance from the camera to the transmitters is given in meters.

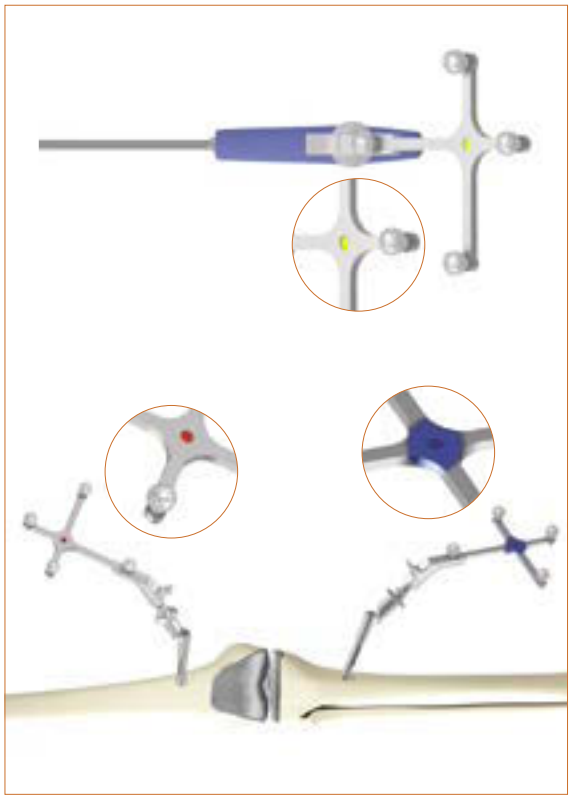


TIP

When aligning the camera, take into consideration that the leg is extended, abducted or adducted during the operation. The camera must be set up in such a way that it can register the transmitters in every position. The runner can readjust the camera to improve the visibility of the transmitters at any time of the operation – except during the step "Registration of the hip joint center".

OPTION

The screen for positioning the camera can be accessed at any time via the user-toolbox-menu in the upper left corner of the screen (default). As an option during the software installation, the camera adjustment screen can be set to occur always after the patient data screens in order to enforce the adjustment.



The passive transmitter (FS635) marked in red is attached to the femoral Rigid Body (RB) adapter, the passive transmitter (FS634) marked in blue on the tibial Rigid Body (RB) adapter. The yellow passive transmitter (FS633) is attached to the respective instruments required at each stage.

OrthoPilot® TKA – Total Knee Arthroplasty

6 | Entering patient-related information

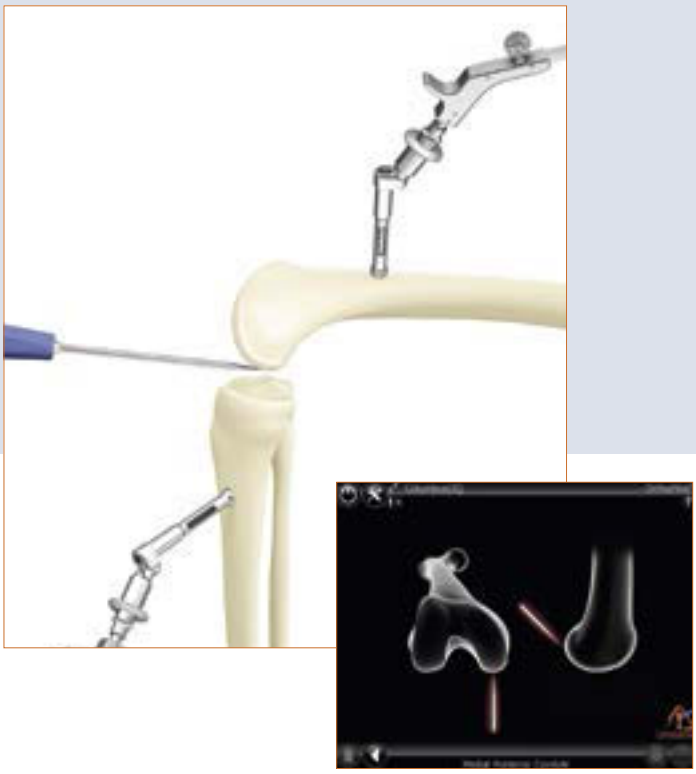
Entering hospital-related data
Name of the surgeon
Name of the hospital/department
Entering patient data
First name
Surname
Date of birth
Gender

Side
Left
Right
Implant
Columbus®
e.motion®
e.motion® Pro
VEGA System®
Tool set
Standard
IQ
MIOS®
Tracking technology
Passive

7 | Anterior cortex point and posterior condyle line

7.1 Recording the medial and lateral posterior condyle

The tip of the pointer is placed in the middle of the posterior medial condyle. The point selected is the one lying furthest posterior, i.e. the one with the greatest distance from the anterior femoral cortex. The recording on the lateral side is made in the same manner.

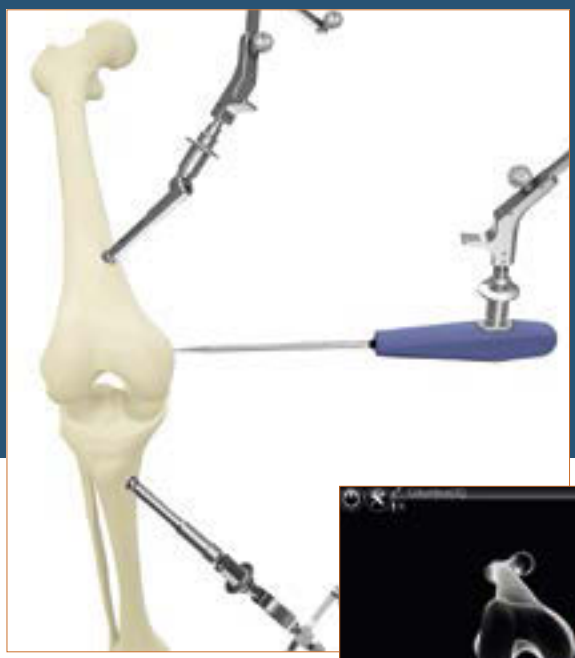


7.2 Recording the anterior cortex point

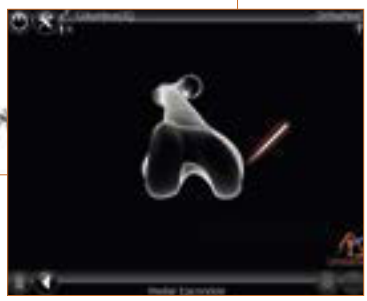
This piont is located at the place where the anterior shield of the prosthesis will end proximally. In the medio-lateral direction, the most anterior point should be palpated.
The proposal for the size of the femoral component is calculated on the basis of the distance between this point and the posterior condyle. This point is furthermore used later on to determine whether there is a danger of sawing into the anterior cortex (notching).

8 | Recording the epicondylar line – **option**

The epicondylar line is recorded via recording of the medial and lateral epicondyle. Therefore the corresponding option must be activated. In a later program step, the user can decide whether to use the epicondylar line or the connecting line between the palpated posterior condyles as reference line for rotational alignment of the femoral component.



The tip of the pointer is placed first on the medial, then on the lateral epicondyle. The recording is made in each instance by pressing the right pedal.



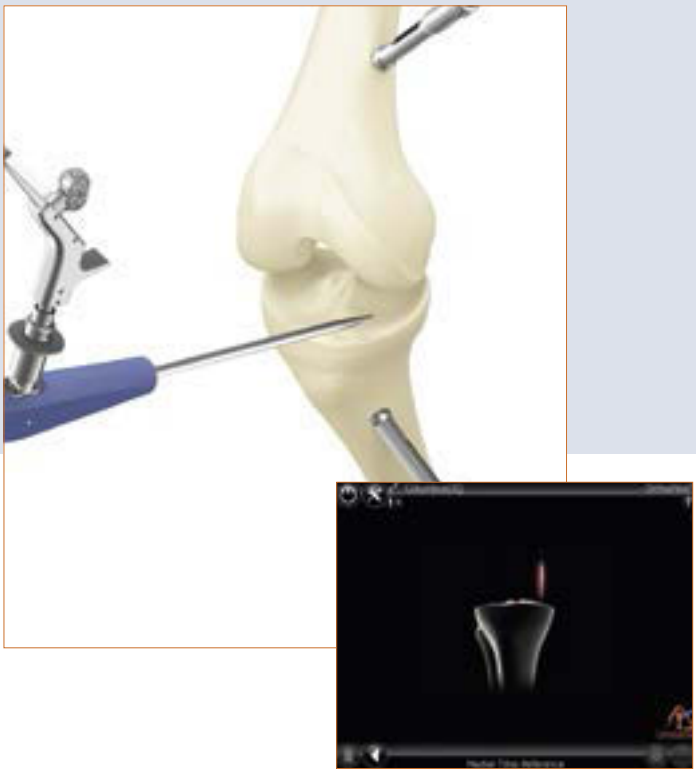
OPTION

By default, the palpation of the epicondyles is turned off. If needed, the palpation of the epicondyles in the tibia first workflows can be activated.

9 | Palpation of the tibial reference points

9.1 Reference for the medial cutting height indicator

In this step, the reference point for the medial cutting height indicator is recorded.
It is recommended to use significant landmarks for palpation such as, for example, the deepest points of the defects or the surface of the joint.

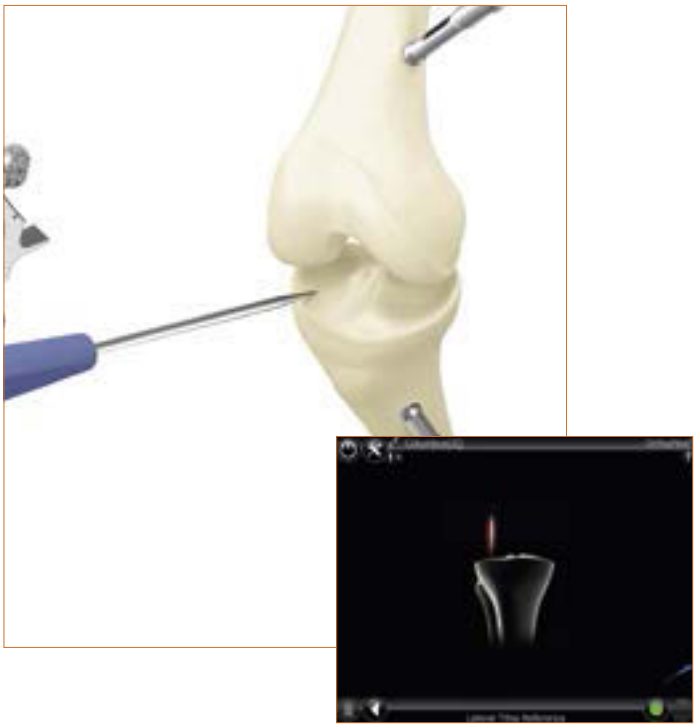


9.2 Reference for the lateral cutting height indicator

In this step, the reference point for the lateral cutting height indicator is recorded.
It is recommended to use significant landmarks for palpation such as, for example, the deepest points of the defects or the surface of the joint.

OPTION

By default, the palpation of both reference points is provided. Optionally the software can be triggered in such a way that only one reference point is requested. In consequence, only one reference point is recorded, and in the step "tibial resection" the cutting height for only this one reference point is shown.

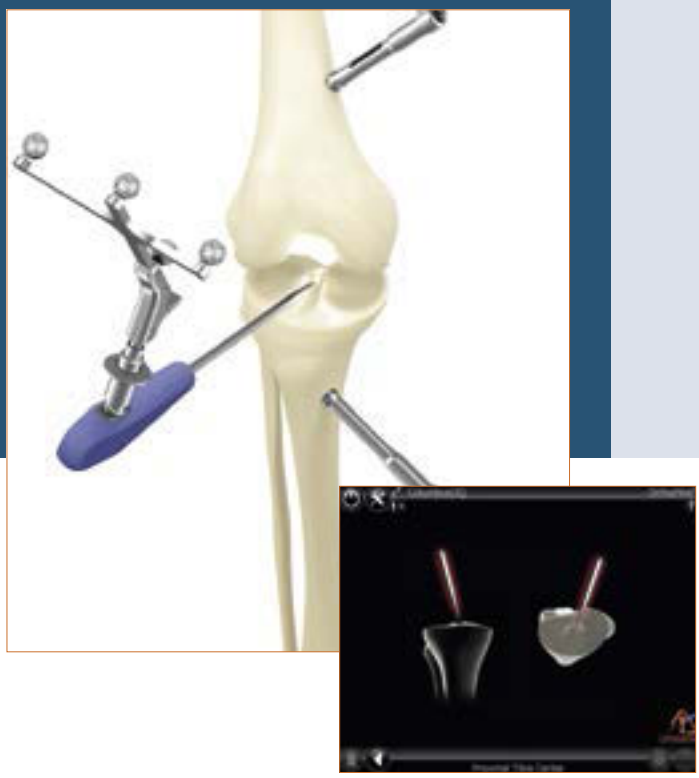


OrthoPilot® TKA – Total Knee Arthroplasty

10 | Determination of tibia centre

In this step, the centre of the anterior edge of the anterior cruciate ligament has been recorded. If there is no cruciate ligament or in the case of degenerative changes, the following point is found:

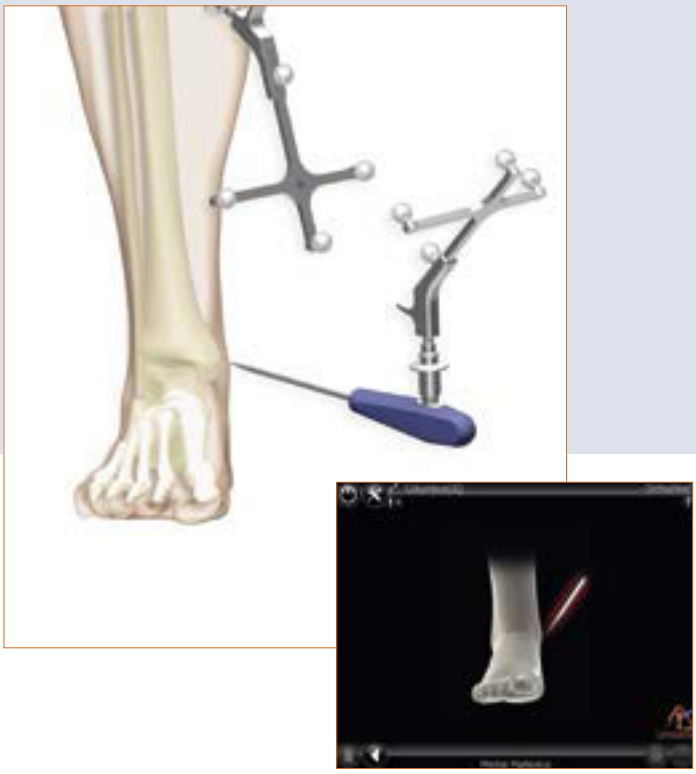
- in the middle of the medial-lateral diametral line of the tibial head,
- at the transition from the first to the second third of the anterior/posterior diametral line of the tibia head, measured from the anterior edge.



11 | Ankle joint palpations

11.1 Medial and lateral malleolus

The pointer is placed at the centre of the medial malleolus and the respective point is recorded using the right pedal. The recording on the lateral side is made in the same manner.



11.2 Anterior ankle joint point

For the recording, the pointer is placed at the anterior edge of the distal tibia as close as possible to the ankle joint gap. The following step is displayed: "Anterior ankle". This palpation point should lie on the central tibial axis immediately adjoining the ankle joint centre. It should be palpated there (as indicated by the white point).
The screen display helps the surgeon to find the anterior ankle point by a percentage display having its origin in the palpation of the medial malleolus. A green "safe zone" is displayed around 49 % +/- 5 %.

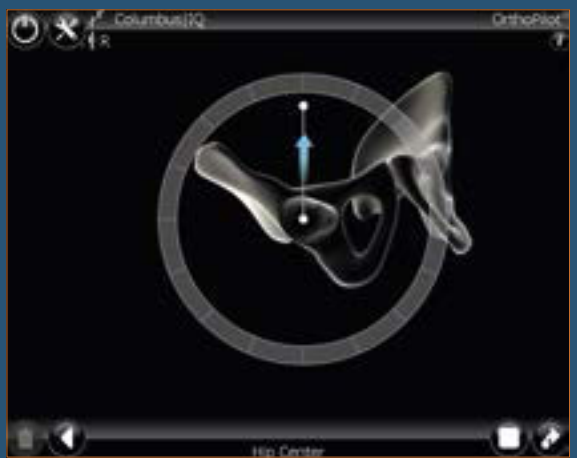
TIP

The second metatarsus/second ray or the extensor hallucis longis tendon can be used as a reference here. The percentaged indicator serves as a plausibility check. If the anterior point (second ray) lies outside the green security area, it is advisable to repeat the palpation of the malleoli.

OrthoPilot® TKA – Total Knee Arthroplasty

12 | Registration of the hip joint centre

The start screen for registration of the hip joint centre is displayed.
Only when the leg is not moving, an upward pointing arrow appears and the data entry can start with the movement of the femur in the 12 o'clock direction.



TIP

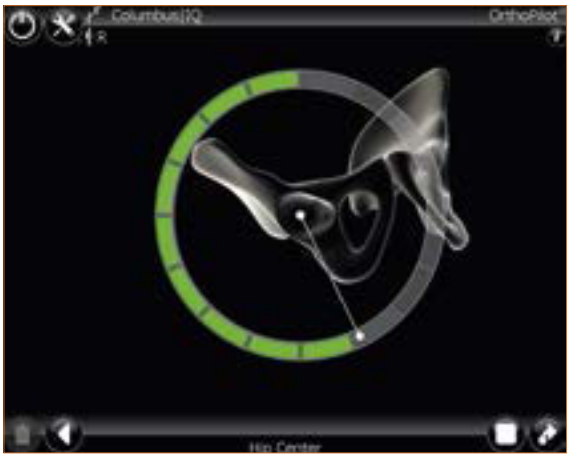
The circular movement, which is described, can be performed in a clockwise or counterclockwise direction depending on the physician's preference.
Thereby the femur is moved in such a way, so that the white point is moving over the fields arranged in a circle. As soon as sufficient measurement data for determining the femoral hip centre have been registered, the program automatically moves to the next step.

In the case of a restless or too large movement, the messages "Incorrect data" or "Too wide movement" may appear and the movement must be repeated.

TIP

The camera must not be moved during this step.
Special attention should be paid to:

- Visibility of the femur transmitter during the entire movement cycle
- Unrestricted freedom of circular movement (no obstruction by holding and fixing equipment)
- Avoiding transmission of force via the femur to the pelvis
- Avoiding any pelvic movement (responsibility of the surgeon; if this cannot be avoided, alternative determination of hip centre, achieved via longpress of right footswitch can be performed. This would require an additional RB fixed to the iliac crest.)
- Avoidance of a hip flexion angle > 45°



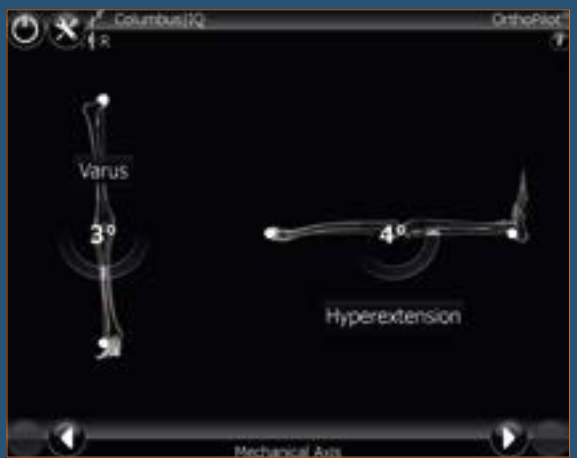
13 | Registration of the knee joint centre

In this program step, the movement of the transmitter at the femur is tracked in relation to the transmitter at the tibia, and the centre of the knee joint is thus determined.
The message "knee center" is displayed on the screen. By pressing the right pedal, determination of the knee joint centre is started. Flexion and extension movements are next carried out with the leg. For this, the leg should be grasped with one hand under the heel.
In order to coordinate the actual movement with the display on the screen, it is recommended to start the movement with the knee in approximately 90° flexion position.
Rotation of the tibia is not mandatory. Nevertheless, rotation at 90° flexion may be carried out to increase accuracy as soon as two arrows are displayed on the screen. Filled arrows indicate that the data were recorded. As soon as sufficient measurement data have been recorded, the software automatically moves on to the next program step. If the maximum range of movement was repeatedly covered (even without inward or outward rotation), the next step can optionally be called up by the user by pressing the right pedal.

OrthoPilot® TKA – Total Knee Arthroplasty

14 | Representation of the mechanical leg axis

In the following step, the registered axis situation is displayed in coronal and in sagittal view. The axis situation is displayed dynamically while the relationship between the mechanical tibial axis and the mechanical femoral axis is calculated on a moment by moment basis. The system thus enables dynamic goniometry of the knee joint, including specification of the current axis deviation or flexion position within the scope of movement.



TIP

This step can be used as a plausibility check of the abnormal axis position in various flexion positions of the leg, and also permits preliminary conclusions to be drawn regarding the ligament situation by applying varus and valgus stress.

Note:

For the Femur First technique, please see Chapter 23: Femur First technique

15 | Resection of the tibia plateau

Depending on which leg is being operated on, the tibial cutting block or, respectively the modular RB adapter of the cutting guide (IQ instruments) is attached to the corresponding transmitter. The exact resection height in relation to the bones of the medial and lateral (program steps "Medial tibia reference" or "Lateral tibia reference") reference points of the tibia, can be determined on a proximal or distal basis through the movement of the cutting block. The tibial cutting block can be navigated on the basis of the desired varus/valgus and slope value in relation to the mechanical axis. Aesculap recommends 0° posterior slope for its prosthesis systems.

The tibial cutting guide is initially fixed from the anterior side using two headless screw pins. The cutting guide can now still be relocated via the available pin holes in 2 mm steps if this is required.

The block is finally fixed at the desired set resection height, slope and varus/valgus alignment using an additional screw pin with a medially or laterally inclined head. Resection can now be performed.

Due to previous palpations, the provisionally calculated femur size in the anterior-posterior dimension is displayed on top, in the center of the screen. In addition the possible combinations of femur to tibia sizes in combination with the selected prosthesis system is shown.

TIP

In order to avoid contamination of the marker spheres on the transmitters, it is advisable to either remove the transmitters or to cover them appropriately until resection has been completed.

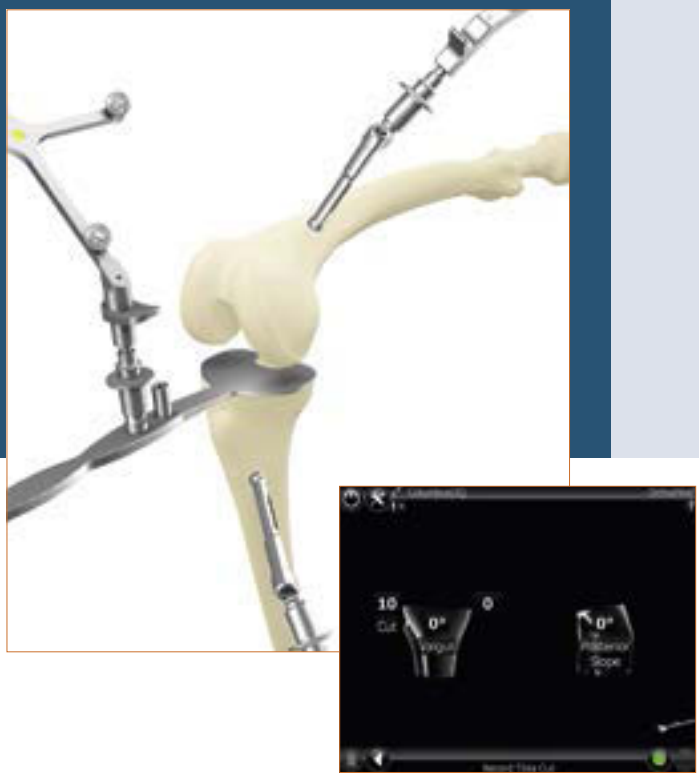
TIP

In many cases it was beneficial first to adjust the anterior/posterior slope and the cutting height and then correct the varus/valgus around the initially placed pin in order to be able to get closer to the desired position iteratively.

OrthoPilot® TKA – Total Knee Arthroplasty

16 | Reassessing the tibial resection

The tibia control plate NP617R or NP617RM with attached transmitters serves for reassessing and recording the tibial resection. The actual orientation and position of the resection surface to the mechanical axis with respect to the varus/valgus angle and the tibial slope is displayed on the screen.
The data recorded here using the right pedal are used for further calculations, and it is therefore imperative to record this value afresh if resection of the tibia is repeated.



17 | Condyle recording

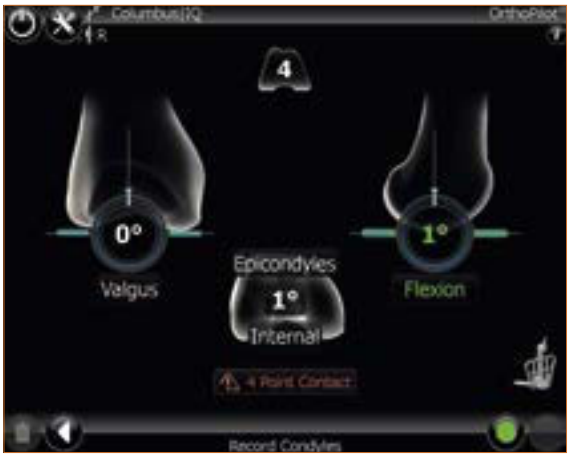
The distal and posterior condyles are recorded with the help of the corresponding orientation block with foot plates which must be in contact with both the distal as well as the posterior condyles (4-point contact!). The alignment in the sagittal plane is displayed on the right half of the screen. The data capture should take place when the block is located in the sagittal plane perpendicular to the mechanical femur axis (i.e. the display on the screen has a slope of about 0°).

When the epicondyles have been palpated (optionally), the angle between the trans-epicondyle line and the posterior condyle line, which is known over the foot plates in contact with the posterior condyles, is displayed in the middle of the screen. If this value is not plausible, it is recommended to perform again the palpation of the epicondyles.

TIP

The 4-point contact is essentially important!
The following items are based on it:

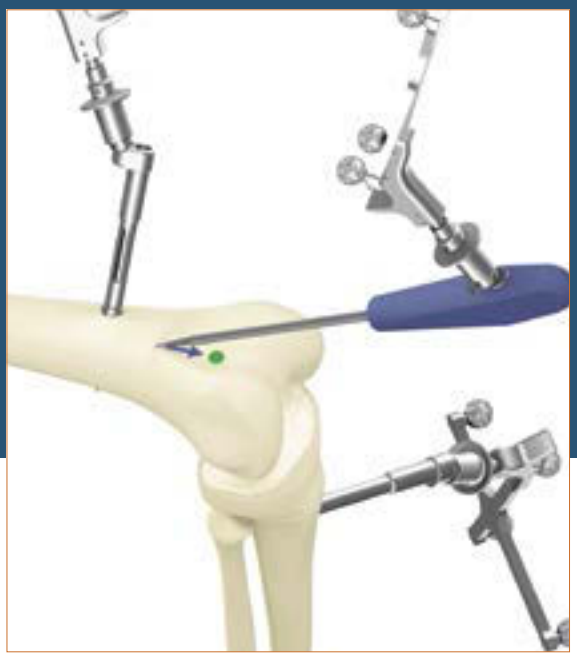
- the proposal for the femur component size,
- the display of the gap values, in extension and flexion, as well as
- the cutting height display for the distal and posterior femur resection, and
- the rotation display for the femur component.



OrthoPilot® TKA – Total Knee Arthroplasty

18 | Optimization of anterior cortex

After the distal and posterior condyles have been recorded, an optimization of the anterior points on the femur with the pointer FS604 and the respective transmitter takes place. Proceed with the pointer tip on the anterior stem in proximal or distal direction until the two value fields show the same numbers. The value field that is distal to the femur component shows the size of the femur implant in the AP direction. The value field above the femur component shows the size of the femur implant in the proximal/distal direction.



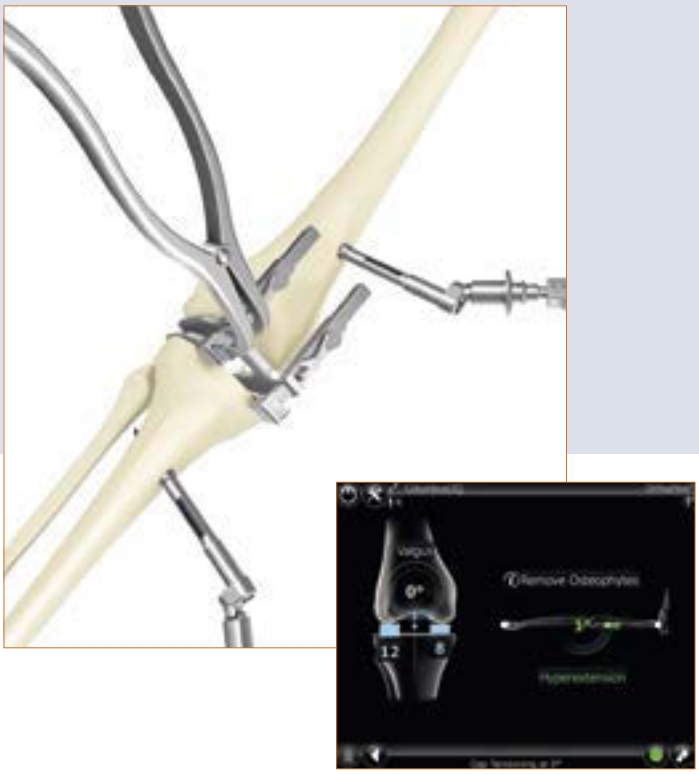
The blue arrows show in what direction the pointer has to be moved in order to obtain optimal palpation of the anterior point with respect to the A/P and the proximal-distal implant size.

Below, in the middle of the screen, there is a so-called "running display". Displayed is the femur size and the possible combination of tibia size for the current position of the pointer while moving the pointer proximally or distally on the femur. These combinations are based on the implant system initially selected.

19 | Measuring the joint gap in extension and flexion

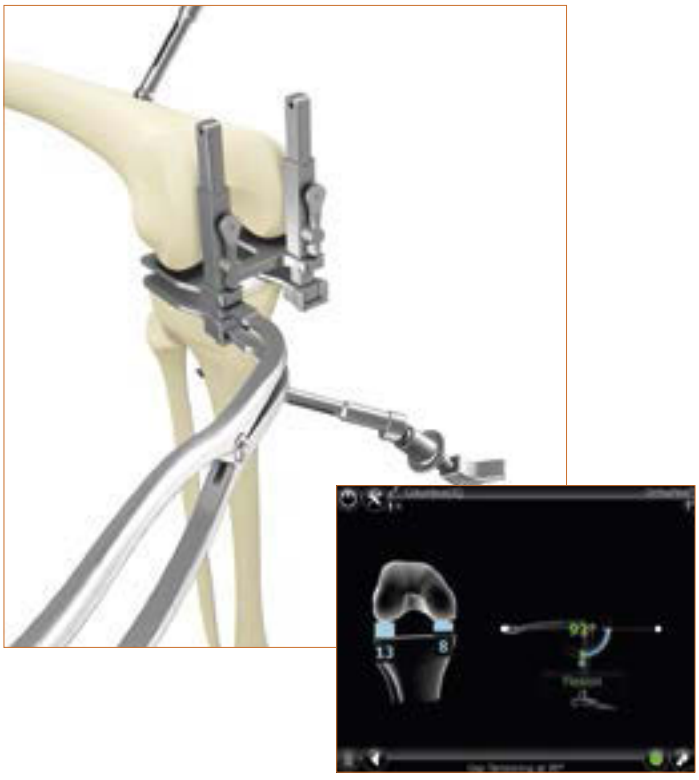
19.1 Measuring the joint gap in extension

Before measuring the flexion/extension gap, osteophytes which could influence ligament tension and capsular tension must be removed. With the leg extended as far as possible (0° +/- 5°, depending on the measured tibial slope), the distractor NP604R is introduced between the tibial resection and the distal femur condyles and is forced apart with identical force medially and laterally using the spreader forceps NP609R.
The plates of the distractor must lie flat on the tibial resection surface in order to ensure precise measurement.
The OrthoPilot® screen indicates the medial and lateral gap distances in millimetres and the mechanical leg axis in degrees, revealing possible ligament release, as well as the flexion position of the leg. After recording the data by pressing the right pedal, the distractor is released and the leg moved into a 90° flexion position.



19.2 Measuring the joint gap in flexion

With the leg in 90° +/- 5° flexion (depending on the measured tibial slope), the distractor is again forced apart medially and laterally with identical force using the spreader forceps, and the gap situation is thus recorded.



OrthoPilot® TKA – Total Knee Arthroplasty

20 | Femoral planning

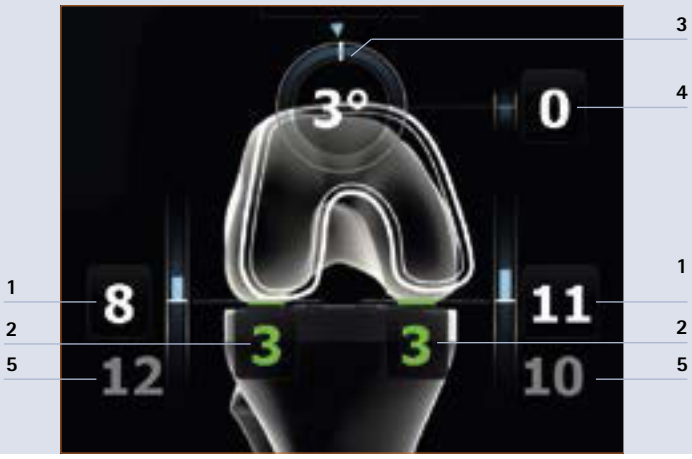
20.1 In extension

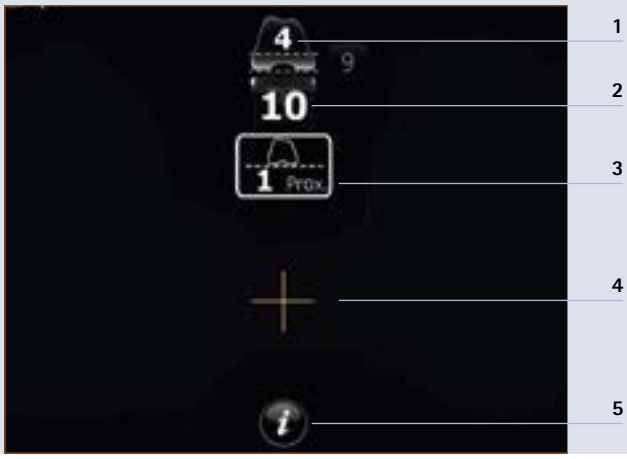
1 Distal femoral cutting height, here laterally and medially 10 mm respectively 10 mm, indicated by blue columns and white numbers.

2 Remaining extension gap according after planned installation of implant components of 2 mm laterally and 0 mm medially, indicated by green columns and green numbers. As soon as the remaining gap distances become negative, they are presented by yellow columns and yellow numbers. A negative/yellow gap distance in clinical terms signifies distension of the soft tissue (e.g. ligaments).

3 Varus/valgus display, here 0°, indicated by the arc inside the femur and the white number.

4 After pressing the "i-button" at the bottom center of the screen, the in previously steps measured joint gap can be switched on and off as a reminder that appears in grey, as all OrthoPilot® reminder values do. Measured extension gap, here for example of 12 mm lateral and 9 mm medial.





20.2 In flexion

1 Posterior femoral cutting height, here 8 mm laterally and 11 mm medially, indicated by blue columns and white numbers.
2 Remaining flexion gaps after planned installation of the implant components, here of 3 mm laterally and 3 mm medially, indicated by green columns and green numbers or, respectively, by yellow columns and yellow numbers if the remaining extension gap becomes negative. A negative or yellow gap distance in clinical terms signifies distension of the soft tissue (e.g. ligaments).
3 Rotation, here 3° external rotation to the recorded posterior condyles, indicated by the arc inside the femur and the white number.
4 Anterior cutting height, here of 0 mm in relation to the anterior palpated point (position of the anterior femur shield at this measured point). This value turns red as soon as the femoral shield would come to lie below palpated point (notching). (see Chapter 7.2 and Chapter 18)
5 After pressing the "i-button" at the bottom center of the screen, the joint gap measured in previous steps can be switched on and off as a reminder that appears in grey, as all OrthoPilot® reminder values do. Measured flexion gap, here for example of 12 mm lateral and 10 mm medial.

20.3 Display and control elements (centre)

1 Femoral implant of size 4 with distal implant thickness of 9 mm for Columbus®.
2 Total height of tibial component (metal plate with PE inlay), here 10 mm.
3 Information about the displacement of the joint line to proximal or distal, here of 1 mm based on the most prominent distal condyle recorded in the step "record condyles". The jointline display is an option. This option can generally be switched on or off during the installation of the software.
4 Orange crossheirs representing a virtual pointer/ virtual mouse which can be controlled by moving the yellow transmitter.
5 After pressing the "i-button", the flexion and extension gaps measured in previously steps can be switched on and off. They appear in grey colour.

OrthoPilot® TKA – Total Knee Arthroplasty

20 | Femoral planning

20.4 Control elements (bottom)

1 Recycle bin:
With a long press on the left pedal, the recycle bin can be activated. All actively modified values are reset to the initial values calculated by the software again. This step is used if a completely new planning is desired. Once the planning screen was already left regularly for the following stage, the actively modified values remain. The initial situation can´t be called up again by using the recycle bin function.

2 White arrow pointing to the left:
With a short press on the left pedal the previous step can be reached.

3 White arrow pointing to the right:
With a short press on the right pedal the next step can be reached.

4 Crossheirs:
With a long press on the right pedal the "virtual pointer" can be reinitialized, if the visibility should not be good enough.

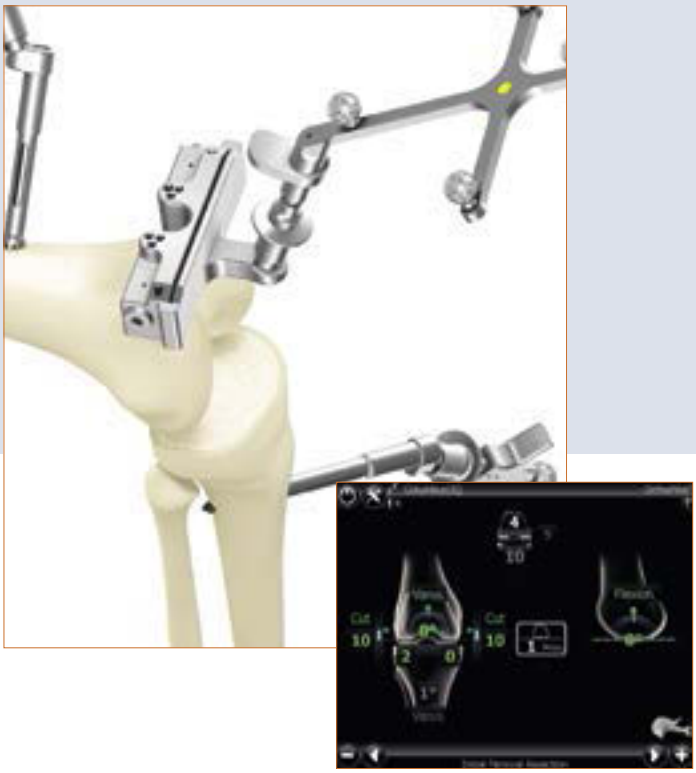
TIP

Once the values are selected on the screen by using the virtual pointer, the arrow keys on the bottom of the screen change in a plus or minus sign. This allows the user to change the selected values with a short press accordingly on the right or left pedal. For advancing to the next step with a short press on the right pedal no other value (except the white arrow at the bottom right 3) must be selected.

21 | Distal femur resection, control and rotational orientation

21.1 Distal femur resection

The distal femur resection block respectively the modular RB adapter of the sawing guide (IQ instruments) is fitted with the corresponding passive transmitter FS633. The precise resection height in relation to the bony reference points palpated on the distal femoral condyles medially and laterally is determined by moving the cutting guide in a proximal or distal direction.
The target values are those which were selected during femoral planning. If these values are reached in terms of varus/valgus angle, resection height and slope, the colour of the ellipses in which the values are displayed, changes to green.
An additonal reference point for the approximate resection height is the distal thickness of the femoral implant, displayed at the top center of the screen. Additionally, as an option the indication of deviation of the measured joint plane from the step "record condyles" is displayed in the center of the screen , here for example with 1 mm.



TIP

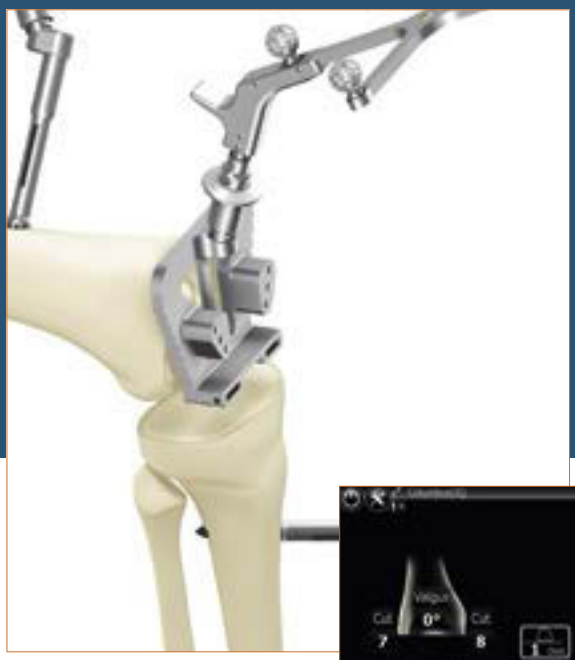
In order to avoid contamination of the marker balls on the transmitters, it is advisable to either remove the transmitters or to cover them appropriately until resection has been completed.

The femoral cutting guide is fixed from the anterior side using two headless screw pins. The cutting guide can now be relocated via the available pin holes (in 2 mm steps). When the desired resection height has been set, the cutting guide is additionally fixed medially and laterally via oblique headed pins, and the resection can be performed. In this step an adaptation of the femoral size still is possible, with a long press on the right or left pedal.

21 | Distal femur resection, control and rotational orientation

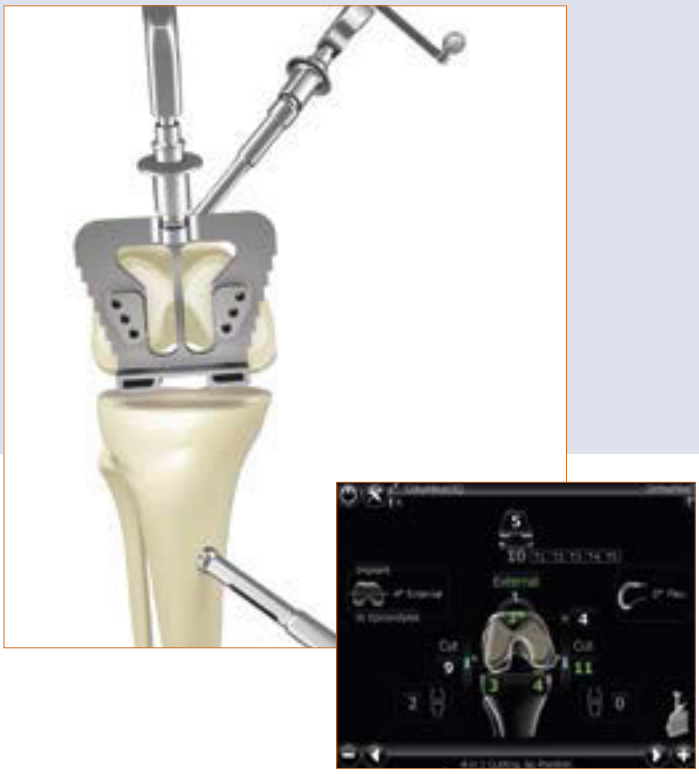
21.2 Reassessing the distal resection

After reassessing the distal femur resection using the femur orientation guide respectively the respective 4-in-1 cutting guide with the modular RB adapter (IQ instruments), rotational adjustment and the A/P positioning is performed according to the prior planning.



21.3 Setting the rotational alignment

The rotational alignment is set with the corresponding femur orientation guide or with the 4-in-1 cutting guide (IQ instruments). The femoral orientation guides can be aligned according to the favoured value. After the desired position has been reached, the two holes for the fixation pins of the 4-in-1 cutting block is performed through the marked holes corresponding to the sizes S, M or L. The orientation guide can be removed and the 4-in-1 cutting guide can be fixed medially and laterally in the two prepared holes with the help of oblique pins. After that the cuts can be performed in the order anterior, posterior followed by the oblique cuts. The 4-in-1 cutting guides with RB adapter (IQ instruments) can be fixed directly after the desired rotational position has been reached and the cuts can be performed in the order anterior, posterior, followed by the oblique cuts. After completing resections implantation can now be performed at first with trial implants and then with the final implants.



TIP

The rotation value is displayed thereby in relation to the recorded posterior condyles. At this point, both an adjustment to the palpated epicondyles (option!) and a visual examination of the rotation position with respect to the Whiteside's line can be performed (Information on the left).

In addition to the planned femoral size, the possible tibia implant combinations depending on the selected prosthesis system are displayed. In addition the extension/flexion angle is displaye on the right side of the screen. In this step an adaptation of the femoral size still is possible, with a long press on the right or left pedal.

OrthoPilot® TKA – Total Knee Arthroplasty

22 | Mechanical axis

The mechanical axis achieved postoperatively (varus valgus angle), as well as the maximum possible extension of the leg can already be checked using trial implants, and at the end using the final implant. A documented result of the operation is thus provided, which can if desired be attached to the patient file.

Note:

The instrumentation and the assembly of the implants take place as described in the following manual surgical techniques:

e.motion®	O25902
Columbus®	O25402
e.motion® MIOS®	O28502
Columbus® MIOS®	O28602
VEGA System®	O43302
e.motion® IQ	O43602
Columbus® IQ	O47502
e.motion® Pro System	O47002

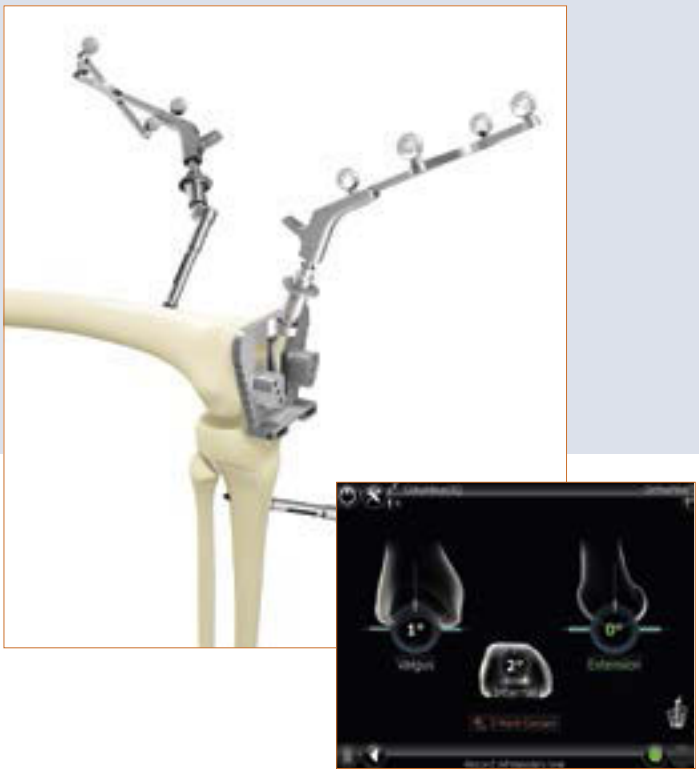
23 | Femur First technique

Note:

Please follow all steps up to and including Chapter 14.

23.1 Condyle recording/Recording Whiteside's Line

The distal condyles are recorded with the help of the corresponding orientation block which must be in contact with the distal condyles. The alignment in the sagittal plane is displayed on the right half of the screen. The data capture should take place when the block is located in the sagittal plane perpendicular to the mechanical femur axis (i.e. the display on the screen has a slope of about 0°). The angle between the posterior condyle line and the orienting block is displayed in the middle of the screen.

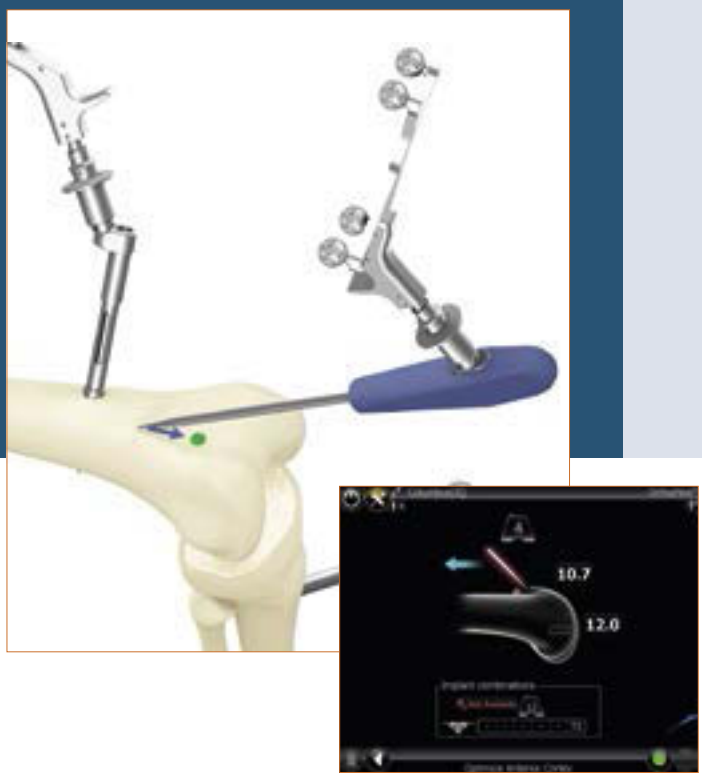


23 | Femur First technique

23.2 Optimization of anterior cortex

After the distal and dorsal condyles have been recorded, an optimization of the anterior points on the femur with the pointer FS604 and the respective transmitter takes place. Proceed with the pointer tip on the anterior stem in proximal or distal direction until the two value fields show the same numbers. The value field that is distal to the femur component shows the size of the femur implant in the AP direction. The value field above the femur component shows the size of the femur implant in the proximal/distal direction. The blue arrows show in what direction the pointer has to be moved in order to obtain optimal palpation of the anterior point with respect to the A/P and the proximal-distal implant size.

Below, in the middle of the screen, there is a so-called "running display". Displayed is the femur size and the possible combination of tibia size for the current position of the pointer while moving the pointer proximally or distally on the femur. These combinations are based on the implant system initially selected.



23.3 Distal femur resection

The distal femur resection block or the modular RB adapter of the femoral cutting guide (IQ instruments) is fitted with the corresponding passive transmitter FS633. The precise resection height in relation to the bony reference points palpated on the distal femoral condyles medially and laterally is determined by moving the cutting guide in a proximal or distal direction. The target values are those which correspond with the distal thickness of the respective femoral implant. The size of the respective femoral implant is indicated in the upper central part of the screen. Additionally as an option the deviation from the joint level measured during the step "condyle reference", here for example 0 mm, is indicated.

TIP

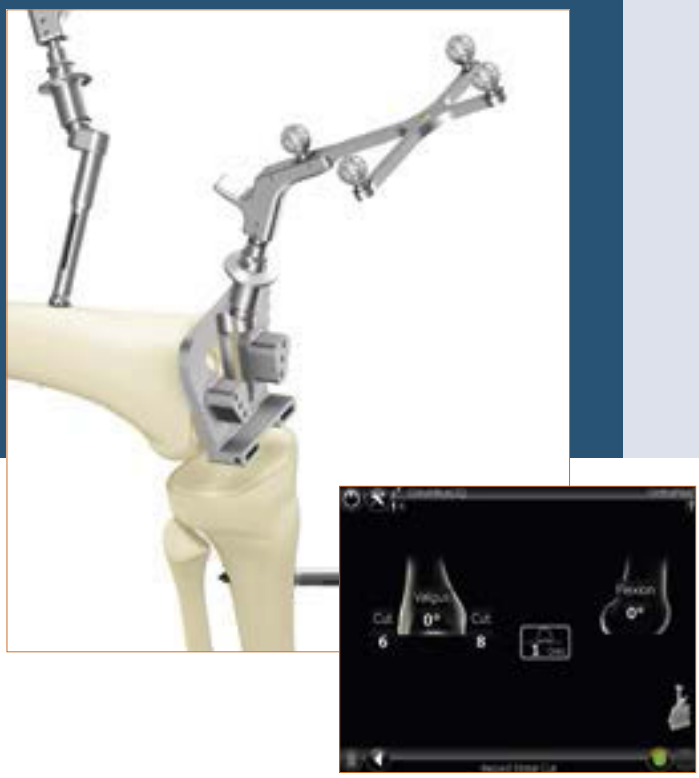
In order to avoid contamination of the marker balls on the transmitters, it is advisable to either remove the transmitters or to cover them appropriately until resection has been completed.

The femoral cutting guide is fixed from the anterior side using two headless screw pins. The cutting guide can now be relocated via the available pin holes (in 2 mm steps). When the desired resection height has been set, the cutting guide is additionally fixed medially and laterally via oblique headed pins, and the resection can be performed In this step an adaptation of the femoral size still is possible, with a long press on the right or left pedal.

23 | Femur First technique

23.4 Reassessing the distal resection

The reassessing of the femur resection takes place with the corresponding femur orientation guide or, respectively the corresponding 4-in-1 cutting guide with modular RB adapter (IQ instruments).



23.5 Setting the rotational alignment

The rotational alignment is set with the corresponding femur orientation guide or with the 4-in-1 cutting guide (IQ instruments). The femoral orientation guides can be aligned according to the favoured value. After the desired position has been reached, the two holes for the fixation pins of the 4-in-1 cutting block are drilled through the marked holes corresponding to the size S, M or L. The orientation guide can be removed and the 4-in-1 cutting guide can be fixed medially and laterally in the two prepared holes with the help of oblique pins. After that the cuts can be performed in the order anterior, posterior followed by the oblique cuts.
The 4-in-1 cutting guides with RB adapter (IQ instruments) can be fixed directly after the desired rotational position has been reached and the cuts can be performed in the order anterior, posterior, followed by the oblique cuts.

In addition to the planned femoral size, the possible tibia implant combinations depending on the selected prosthesis system are displayed. In addition the extension/flexion angle is displaye on the right side of the screen.
In this step an adaptation of the femoral size still is possible, with a long press on the right or left pedal.

TIP

The indicated rotation value is when reaching the same rotational position as in the step "record whiteside's line" displayed in green. An additional visual examination of the rotational position to Whiteside's line is possible at any time.

Note:

After preparation of the femur, the procedure is continued by following the steps described in chapters 15-16. The final display and reassessment of the postoperative mechanical leg axis is analogous to chapter 22 of the tibia first technique.

Note:

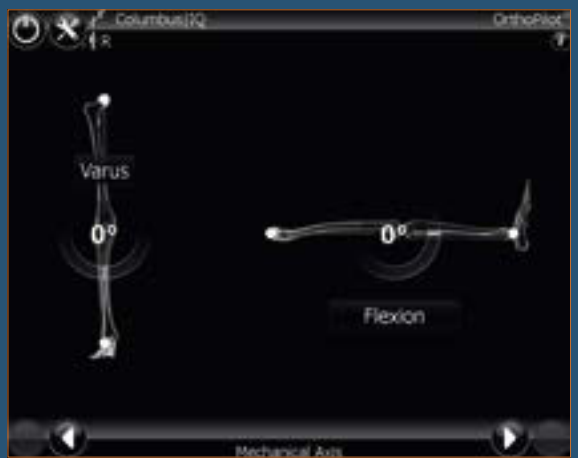
The instrumentation and the assembly of the implants take place as described in the following manual surgical techniques:

e.motion®	025902
Columbus®	025402
e.motion® MIOS®	028502
Columbus® MIOS®	028602
VEGA System®	043302
e.motion® IQ	043602
Columbus® IQ	047502
e.motion® Pro System	047002

OrthoPilot® TKA – Total Knee Arthroplasty

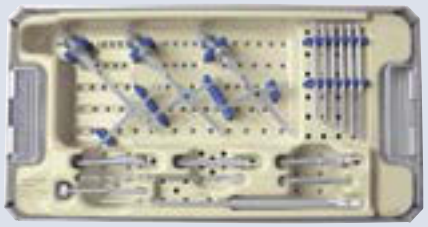
24 | Mechanical axis

The mechanical axis achieved postoperatively (varus valgus angle), as well as the maximum possible extension and flexion of the leg can already be checked using trial implants, and at the end using the final implant.
A documented result of the operation is thus provided, which can if desired be attached to the patient file.



25 | Instrument set overview OrthoPilot® TKA

25.1 Standard Instruments



OrthoPilot® TKA periph. instr. passive

NP168		
1	Rigid Body, yellow	FS633
1	Rigid Body, blue	FS634
1	Rigid Body, red	FS635
1	Storage	NP169899
1	Tray, perforated	JF213R
1	Drill guide, Ø 3.2 mm	NP616R
3	Transmitter mounting sleeve	NP619R
1	Screw drill bit, Ø 3.2 mm	NP615R
1	Screw length gauge	NP281R
1	RB screwdriver on motor, Ø 3.5 mm	NP618R
2	OrthoPilot® Bicort. RB-screw, 30 mm	NP620R
2	OrthoPilot® Bicort. RB-screw, 35 mm	NP621R
2	OrthoPilot® Bicort. RB-screw, 40 mm	NP622R
2	OrthoPilot® Bicort. RB-screw, 45 mm	NP623R
2	OrthoPilot® Bicort. RB-screw, 50 mm	NP624R
2	OrthoPilot® Bicort. RB-screw, 55 mm	NP625R
1	IFU for passive Rigid Body	TA011029
1	Packing stencil for NP169P (NP168)	TE899

OrthoPilot® TKA implantation instruments

NP602		
1	Cut check plate	NP617R
1	Foot plate	NM769R
1	Universal positioning gears	NP608R
1	Pointer, active	FS604
1	Storage	NP603899
1	Tray, perforated	JF213R
1	Tibial cutting block, left	NP597R
1	Tibial cutting block, right	NP596R
1	Femoral cutting block distal	NP598R
2	Elastic foot straps	NM743

Optional: MIOS®-Set

e.motion® MIOS® instrumentation

NE490		
1	e.motion® MIOS® Set Instruments Part 1	NQ930
1	e.motion® MIOS® Set 4-in-1 cutting guides	NQ932
1	MIOS® storage tray for bone lever set	NQ939P
1	1/1 size perf. tray basket 485 x 253 x 106 mm	JF214R
1	Packing stencil for NQ931P+NQ933P (NE490)	TE893

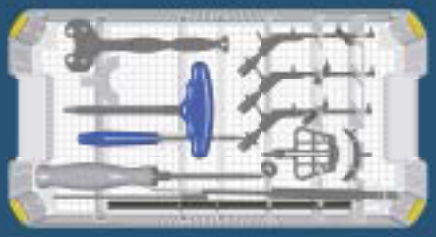
Columbus® MIOS® instrumentation

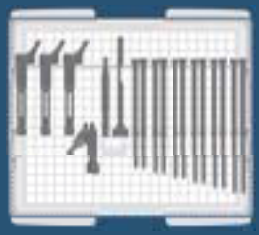
NE340		
1	Columbus® MIOS® Set Instruments Part 1	NQ934
1	Columbus® MIOS® Set 4-in-1 cutting guides	NQ936
1	MIOS® storage tray for bone lever set	NQ939P
1	1/1 size perf. tray basket 485 x 253 x 106 mm	JF214R
1	Packing stencil for NQ935P+NQ937P (NE340)	TE894

OrthoPilot® TKA – Total Knee Arthroplasty

25 | Instrument set overview OrthoPilot® TKA

25.2 IQ Instruments



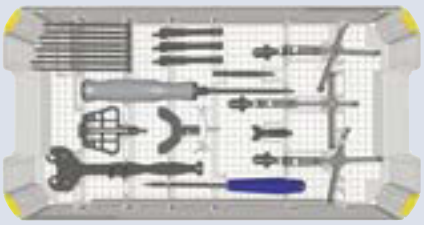


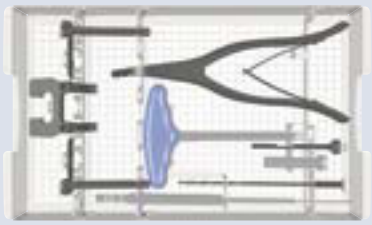
IQ Set instruments navigation

NS720		
1	IQ storage tray instruments navigation	NS721R
1	IQ e.motion® insert nav. instruments for NS721R	NS726R
1	OrthoPilot® Tibia control plate modif.	NP617RM
1	OrthoPilot® Active pointer 0°	FS604
1	OrthoPilot® Passive Rigid Body, yellow	FS633
1	OrthoPilot® Passive Rigid Body, blue	FS634
1	OrthoPilot® Passive Rigid Body, red	FS635
3	OrthoPilot® Rigid Body Adapter for screws	NP619R
1	OrthoPilot® foot plate	NM769R
2	OrthoPilot® elastic foot strap	NM743
1	OrthoPilot® drill Ø 3.2 mm 160/80 mm	NP615R
1	OrthoPilot® RB screwdriver on motor	NP618R
1	OrthoPilot® screw length gauge	NP281R
1	OrthoPilot® screw drill guide Ø 3.2 mm L 100 mm	NP616R
2	OrthoPilot® Bicort. RB-screw 30 mm	NP620R
2	OrthoPilot® Bicort. RB-screw 35 mm	NP621R
2	OrthoPilot® Bicort. RB-screw 40 mm	NP622R
2	OrthoPilot® Bicort. RB-screw 45 mm	NP623R
2	OrthoPilot® Bicort. RB-screw 50 mm	NP624R
2	OrthoPilot® Bicort. RB-screw 55 mm	NP625R
1	MIOS® tissue protection sleeve for Rigid Body	NQ941R

NS720		
1	MIOS® handle for tissue protection sleeve	NQ940R
1	IQ OrthoPilot® TKA RB-adapter modular	FS626R
1	IQ femur orientation/alignment block	NS320R
1	MIOS® Y-foot plate for alignment block	NQ958R
1	Lid for Ortho Tray DIN	JA455R
1	IQ screwdriver SW 3.5	NS423R
1	IFU for Knee instruments	TA020007
1	Packing stencil for NS721R (NS720)	TF070
1	IFU for packing stencil	TA014010

25.3 Reset IQ instruments navigation





Reset IQ instruments navigation

NP138		
1	Reset IQ instruments navigation	NP139R
1	IQ-lid for tray	JA455R
1	OrthoPilot® Active pointer 0°	FS604R
1	OrthoPilot® Passive Rigid Body, yellow	FS633R
1	OrthoPilot® Passive Rigid Body, blue	FS634R
1	OrthoPilot® Passive Rigid Body, red	FS635R
1	Laminar spreader	NE750R
1	Spreading forceps	NP609R
1	OrthoPilot® Tibia checkplate	NP617RM
1	OrthoPilot® RB screwdriver on motor	NP618R
3	OrthoPilot® Rigid Body Adapter for screws	NP619R
2	OrthoPilot® Bicort. RB-screw 30 mm	NP620R
2	OrthoPilot® Bicort. RB-screw 35 mm	NP621R
2	OrthoPilot® Bicort. RB-screw 40 mm	NP622R
2	OrthoPilot® Bicort. RB-screw 45 mm	NP623R
1	IQ OrthoPilot® TKA RB-adapter modular	FS626R
1	IQ femur orientation/alignment block	NS320R
1	MIOS® Y-foot plate for alignment block	NQ958R
1	IQ screwdriver SW 3.5	NS423R
1	OrthoPilot® screw drill guide Ø 3.2 mm L 100 mm	NP616R

Reset IQ instruments navigation

NP138		
1	OrthoPilot® drill Ø 3.2 mm 160/80 mm	NP615R
1	IFU for Knee instruments	TA020007
1	Packing stencil for NP139R (NP138)	TF149

Optional

1	OrthoPilot® foot plate	NM769R
1	OrthoPilot® elastic foot strap	NM743R
1	OrthoPilot® screw length gauge	NP281R
1	MIOS® handle for tissue protection sleeve	NQ941R
1	MIOS® tissue protection sleeve for Rigid Body	NQ940R

OrthoPilot® TKA – Total Knee Arthroplasty

26 | Software and Consumeables

26.1 Software OrthoPilot® TKA FS235

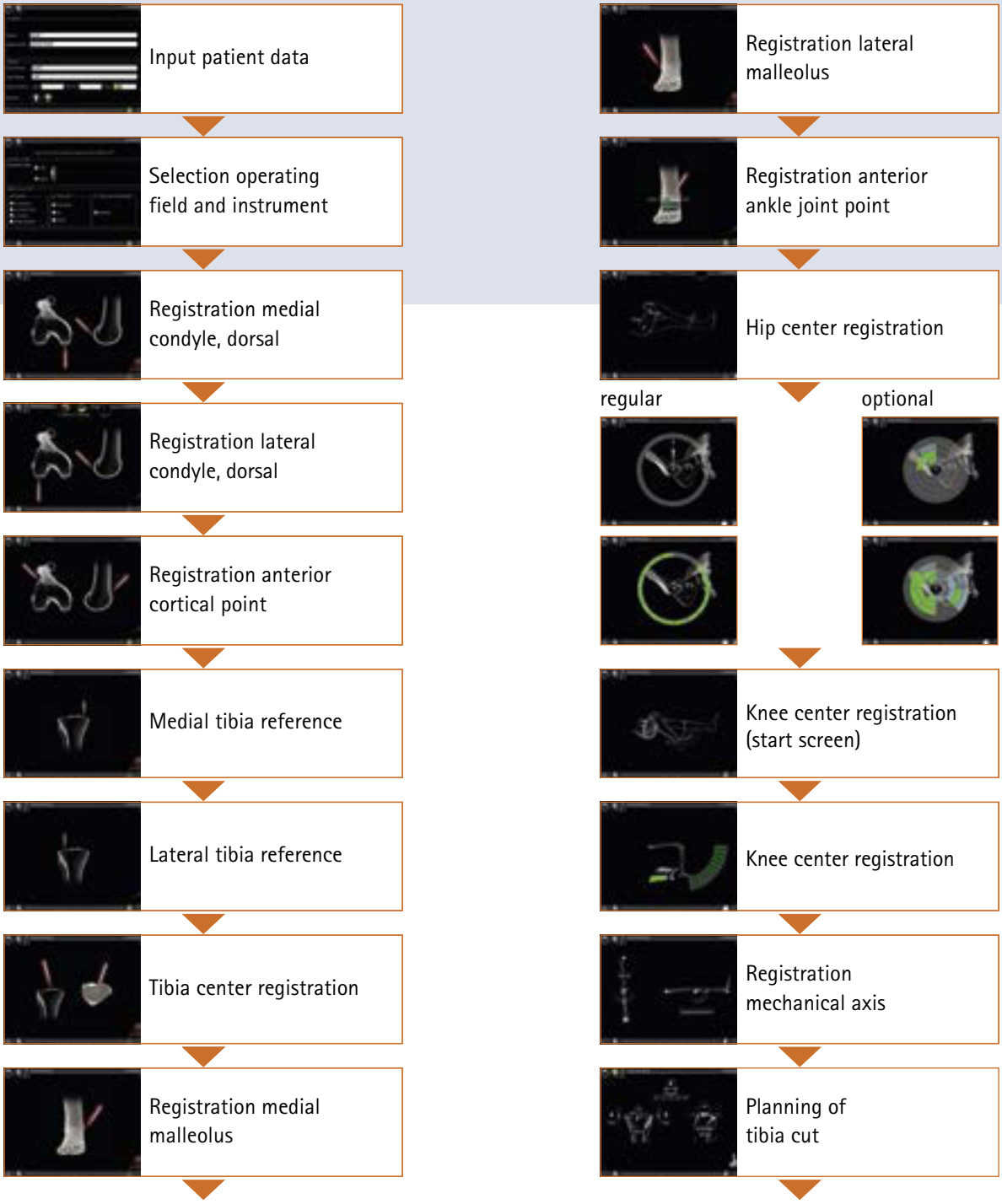
Software Module	
OrthoPilot® TKA	FS235

26.2 Consumeable passive marker spheres

Marker spheres	
NDI single-use passive markers (3 x 4 pcs.)	FS616
CAP single-use passive markers (3 x 4 pcs.)	FS618SU

27 | Schematic program flow TKA

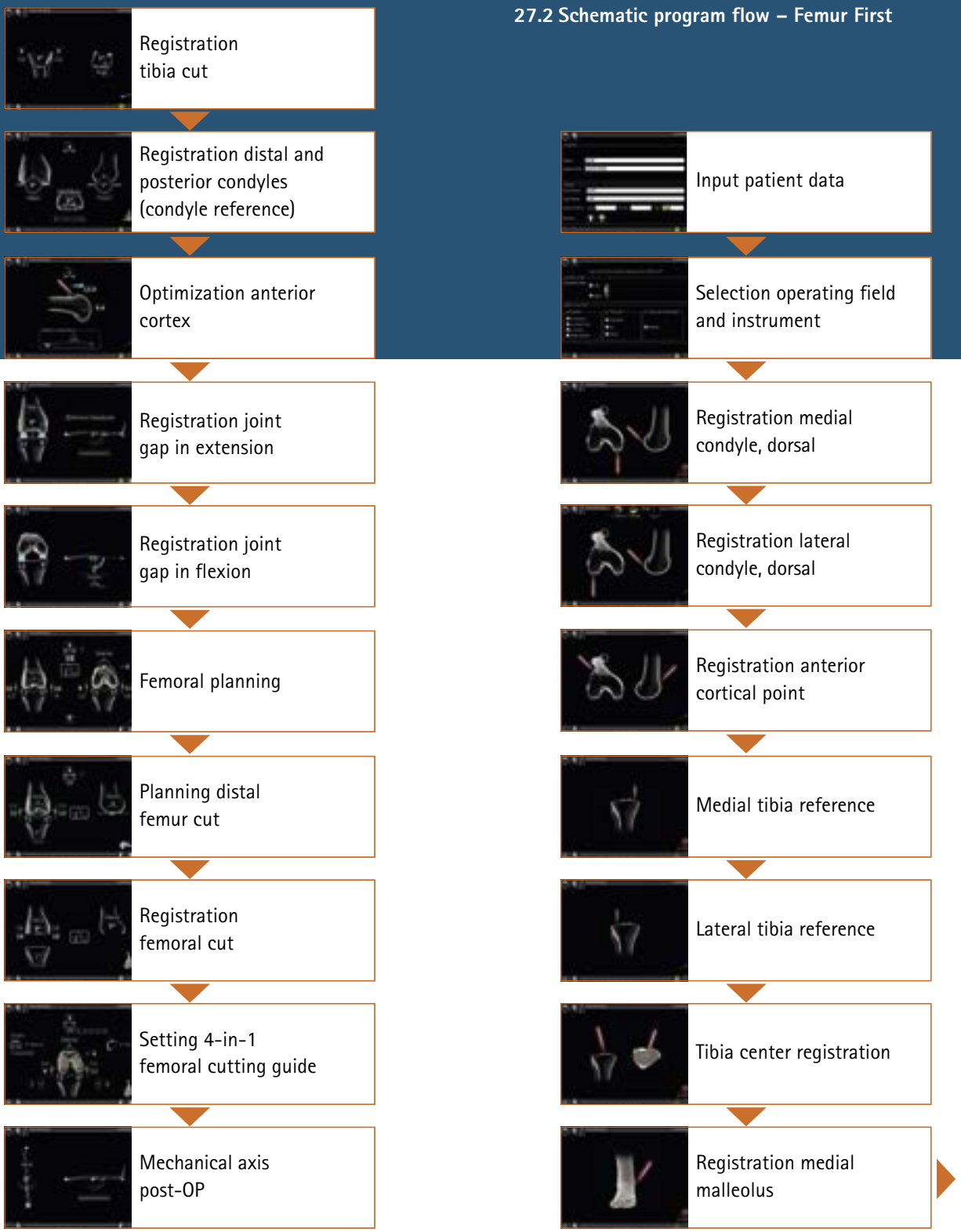
27.1 Schematic program flow – Tibia First



OrthoPilot® TKA – Total Knee Arthroplasty

27 | Schematic program flow TKA

27.2 Schematic program flow – Femur First



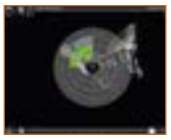
Registration lateral malleolus

Registration anterior ankle joint point

Hip center registration

regular

optional



Knee center registration (start screen)

Knee center registration

Registration mechanical axis

Condyle reference/ record Whiteside's line

Optimization anterior cortex

Planning distal femur cut

Registration femoral cut

Setting 4-in-1 femoral cutting guide

Planning of tibia cut

Registration tibia cut

Mechanical axis post-OP

Notes

Aesculap AG | Am Aesculap-Platz | 78532 Tuttlingen | Germany
Phone +49 7461 95-0 | Fax +49 7461 95-2600 | www.aesculap.com

Aesculap – a B. Braun company

Brochure No. 046702 0615/1/3