OrthoPilot® helps with precise implantation of knee and hip endoprostheses. An important criterion for the development of OrthoPilot® was the full integration into the operative workflow. At the same time, one central topic was the patient-friendly navigation. From the beginning, a method was developed that dispenses with CTs and MRIs and the strain and expenses these entail, and requires less extra operation time.

- No CT required
- Ergonomic instruments precisely aligned to the surgery
- User-friendly navigational flow – integrates itself easily into the operative workflow
- Precise implant alignment
- Intra-operative documentation with OrthoPilot®
- Numerous international studies confirm significantly better alignment
- Routinely used in over 600 hospitals
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Indication and Contraindication

The OrthoPilot® navigation system with its Hip-Suite smart modules is suited for primary hip joint replacement with implants approved by Aesculap for navigated application. All forms of hip joint arthrosis and necrosis are generally included.

Use of a navigation system is contraindicated in the following cases:

- If the hip joint is too severely damaged
- If palpation of the landmarks is not possible
- In cases of severe pelvis deformities
- In cases of severe femoral deformities
- In cases of severe knee deformities

Contraindications for the respective implants, which are specified in the package insert, must additionally be observed.

Pre-operative Planning

Even if use of the navigation system is planned, preoperative planning is recommended in order to assess the patient-specific original state. Taking images in both planes (AP and ML) is recommended for this.

For all Aesculap hip implant systems, X-ray templates in 1.15:1 scale are available. These are also available in appropriate formats for digital planning systems.
HipSuite Smart

OrthoPilot® HipSuite smart includes applications that give a variety of important information for Total Hip Arthroplasty (THA) and can be used with different approaches and patient positions. HipSuite smart applications support conventional as well as minimally invasive surgical techniques. OrthoPilot® navigation can be used with a wide range of Aesculap cup and stem implants.

Hip Suite means the collection of all existing hip software applications. Each single application can furthermore be adapted to the individual surgeon’s needs.

THA Universal

As the most comprehensive software tool within the HipSuite smart THA Universal provides the possibility for cup positioning and orientation as well as leg length difference (LLD) and offset management. The feature of range of motion (RoM) is not included in the THA Universal so far. The software provides different options for pelvis orientation. The Acetabulum Center Axis (ACA) orientation is especially useful for lateral patient position THA whereas navigation using the Anterior Pelvic Plane (APP) as reference is most suitable for THA in supine patient position. Also integrated into THA Universal is a simple leg length and offset management tool for stem only navigation.

THA Universal software module can be ordered with the article number: FS236.
OrthoPilot® THA Universal

2 | NAVIGATION

Transmitter Technology

The OrthoPilot® navigation system works with state of the art wireless transmitter technology.

The single-use marker spheres with a reflective surface layer and an additional plastic protection, reflect infrared light falling on them from the camera. Contaminations with blood or soft tissue can be wiped away easily from the plastic cover. The cap markers can easily be mounted on the transmitters. A well attached cap marker gives a haptic and acoustic feedback (“click”).

As transmitters reflect the light from the camera, light coming from OR lamps can interfere with them. In these cases light from OR lamps should be turned away from the transmitters.

Affixed and Mobile Transmitters

Different color coded transmitters are used during the navigation workflow. In order to assure reliable navigation results transmitters need to be fixed tightly to the patient or the instruments, so that no movement of transmitters is possible.

The blue transmitter is fixed to the pelvis of the patient in order to locate the patient. This transmitter needs to be attached before dislocation or resection of the femoral head.

In order to record the reference points for the navigation of the cup or the stem implants the 45° bent pointer (FS934) is used with the yellow transmitter (FS633) attached to it.
INSTRUMENTS
Cup Navigation

Instruments used for THA can be navigated by attaching the appropriate transmitters.

Reamers and cup recorders are navigated with the yellow transmitter (FS633).

The cup impactors, for the navigation of the trial cup as well as the implantation of the final cup are navigated with the impactor Rigid Bodies FS608 for Plasmacup® and FS609 for Plasmafit®.

Stem Navigation

For the rasp navigation the blue transmitter is affixed to the rasp handle by using the corresponding transmitter adapter.

For the stem navigation in reduced position with rasp or implant, the 45° pointer with the yellow transmitter is needed.

NOTE
It must also be taken care during the complete surgical procedure that the OrthoPilot® system can always clearly detect both the fixed as well as the mobile transmitters.
INSTRUMENTS
Platform Rasp Handles

For each implant system, a range of specific handles, according to the surgical approach, is available.

Bicontact®, Excia® and TRJ® implants work with the same Platform rasp handles. This reduces the learning curve as well as the instruments stock in the OR and makes the interchange of different implants easier.

OrthoPilot® THA Universal software application is backwards compatible and also works with non-Platform handles of previous generations.

Generally the rasp handles used for navigated THA are the same used for conventional surgical procedures. For navigation, the appropriate adapter for the transmitter is attached to the respective handle. Adapters are available for supine (FS916R and FS716R) as well as for lateral (FS918R and FS718R) patient positions.

Implant Systems

Most implants of the Aesculap hip implant portfolio can be navigated with OrthoPilot® THA Universal software:

Stem Implants
- Bicontact® System (incl. Bicontact® S, H, D, SD, N, E, EH)
- Excia® System (incl. Excia®, Excia® L, Excia® T & Excia® TL)
- Metha® Short Stem System (incl. Metha® monobloc & Metha® modular)
- SLA Stem
- Trilliance System (incl. Trilliance & Trilliance H)
- TRJ® System (incl. TRJ® STD & TRJ® LAT)

Cup Implants
- Plasmafit®
- Plasmacup®
- Cemented Cup
Rasp handle overview

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<tr>
<th>Approach</th>
<th>Offset</th>
<th>Bicontact® &amp; Excia®</th>
<th>TRJ®</th>
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<tr>
<td>supine</td>
<td>straight</td>
<td>NT001R, NT003R*</td>
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<td>FS716R</td>
<td>NF180R, NF140R*</td>
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<td></td>
<td>left</td>
<td>NT004R, NT006R*</td>
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<td></td>
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<td>NT005R, NT007R*</td>
<td>NT010R</td>
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<tr>
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<td>posterior</td>
<td>straight</td>
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<td>NF144R</td>
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<td>left</td>
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<td>NT009R</td>
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* DAA (Direct Anterior Approach)
Pelvis Orientation

Pelvis orientation is the basis for the navigation of the cup component. There are different ways to orient the pelvis.

Either the Anterior Pelvic Plane (APP) defined by both spinae iliaca anterior superior (ASIS) and the symphysis or the Acetabular Center Axis (ACA) can be used for the orientation of the pelvis.

Acetabular Center Axis

THA ACA reference is patient-specific independent of variations in anatomy or pelvic position. The surgeon gets the orientation of the reamer or cup impactor in relation to the actabular center axis of rotation and can therefore determine the cup orientation and position in relation to the original hip center.

The new cup center should preferably be within 4 mm of the acetabular center axis for a good stability and minimal impingement risk. Desired aim for cup inclination is 0° whereas the anteversion should be kept within ±5°.

ACA referencing relies on landmarks palpated around the acetabular rim. The use of the Acetabular Center Axis for pelvis orientation is especially recommended for THA in lateral patient position.
Anterior Pelvic Plane

The anterior pelvic plane remains the most used reference for the navigation of cup inclination and anteversion.

The anterior pelvic plane is defined by the anterior superior spines and the symphysis. Based on this plane, the cup can be oriented according to the so called Lewinnek safe zone with $15 \pm 10^\circ$ anteversion and $40 \pm 10^\circ$ inclination to limit the risk of dislocation.

The most important point to get an accurate cup orientation regarding inclination and anteversion angles is the palpation of the bony landmarks.

Inclination

The angle of inclination results from the straight line defined by the palpation of the two iliac spines. It changes when the landmarks are shifted in cranial or caudal direction. Palpation of the ASIS must therefore be performed symmetrically.

Anteversion

The angle of anteversion depends on the tilt of the plane resulting from the palpation of all three landmarks. The height of point on the symphysis has the greatest influence on the anteversion angle. The angle of anteversion displayed on navigation screen decreases with growing distance between the palpated point and the bone surface, corresponding to the thickness of the soft tissue layer.
ORIENTATION
1 **Lateral Patient Position**

Regarding the positioning of the camera for lateral patient position, generally the ideal position is opposite the surgeon at a distance of approx. 2 m from the hip joint on the cranial side. The OrthoPilot® is set up at the height of the patient’s head at an angle of 45°.

For different approaches in lateral patient position the surgeon can stand on the front or on the back side of the patient. For all approaches where the surgeon is standing dorsal to the patient the OrthoPilot® camera is positioned as described above on the ventral side of the patient, in order to assure a good view on the screen and visibility of the instruments during the navigation workflow.

2 **For all approaches where the surgeon is standing on the front side of the patient e.g. the so called modified Röttinger approach, the OrthoPilot® has to be positioned as described above but on the dorsal side of the patient, in order to assure a good view on the screen and visibility of the instruments during the navigation workflow.**

**NOTE**

For positioning and sterile draping of the patient the standard procedures are followed. When using the Anterior Pelvic Plane for reference in lateral patient position it is advisable to affix the patient holders in more cranial position to allow unhindered access to the palpation points of the anterior superior iliac spine and the symphysis.

3 **Supine Patient Position**

For supine patient position, the ideal position of the camera is on the opposite side of the operated hip joint at the foot of the operating table at a distance of approx. 2 m and an angle of 10° to the surgical field.

**NOTE**

For positioning and sterile draping of the patient the standard procedures are followed. Especially in supine patient position, when using the Anterior Pelvic Plane for reference, care must be taken not to fix excessively thick layers of draping foil in the region of the palpation points of the anterior superior iliac spine and the symphysis.
OrthoPilot® THA Universal

Navigation Workflows

CUP FIRST WORKFLOW

1. SET-UP
   1. Set surgery technique
   2. Set patient data
   3. Set surgery data
   4. Select navigated tools

OPTIONAL TOOLS
   1. Tool viewer
   2. Check pelvis reference
   3. Check pelvis measurement

2.A ACA CUP REFERENCES
   1. Record table vertical axis
   2. Record femur initial geometry
   3. Acquire superior rim
   4. Acquire anterior rim
   5. Acquire posterior rim
   6. Display of ACA diameter
   7. Acquire reaming limit

2.B APP CUP REFERENCES
   1. Acquire ipsilateral spina iliaca
   2. Acquire contralateral spina iliaca
   3. Acquire symphisis
   4. Record femur initial geometry
   5. Acquire reaming limit
   6. Acquire original hip center

3. CUP NAVIGATION
   1. Reaming
   2. Select cup size
   3. Navigate the cup

4. HIP CENTER ACQUISITION
   1. Acquire new hip center
   2. Select head diameter

5. STEM NAVIGATION
   1. Prepare rasp handle
   2. Select rasp size
   3. Record femur geometry with dislocated hip (optional)
   4. Dislocated simulation
   5. Select reduction set-up
   6. Acquire reduced femur (optional)

SUMMARY

End of “Cup only” Workflow

endless loop
STEM FIRST WORKFLOW

1. SET-UP
   1. Set surgery technique
   2. Set patient data
   3. Set surgery data
   4. Select navigated tools

2. A ACA CUP REFERENCES
   1. Record table vertical axis
   2. Record femur initial geometry
   3. Acquire superior rim
   4. Acquire anterior rim
   5. Acquire posterior rim
   6. Display of ACA diameter
   7. Acquire reaming limit

3. RASP SIMULATION
   1. Prepare rasp handle
   2. Select rasp size
   3. Record femur geometry with dislocated hip
   4. Dislocated simulation

4. CUP NAVIGATION
   1. Ream acetabulum
   2. Select cup size
   3. Implant cup

5. HIP CENTER ACQUISITION
   1. Acquire new hip center
   2. Select head diameter

6. FINAL RESULTS
   1. Select reduction set-up
   2. Acquire reduced femur

OPTIONAL TOOLS
   1. Tool viewer
   2. Check pelvis reference
   3. Check pelvis measurement

2. B APP CUP REFERENCES
   1. Acquire ipsilateral spina iliaca
   2. Acquire contralateral spina iliaca
   3. Acquire symphysis
   4. Record femur initial geometry
   5. Acquire reaming limit
   6. Acquire original hip center

SUMMARY

endless loop
OrthoPilot® THA Universal

6 | Navigation Set-up

**1 Set Surgery Technique**

In this step patient position, surgical approach and position of the OrthoPilot® camera are selected.

For cup navigation ACA or APP pelvis orientation can be used. For the stem, leg length and offset can be navigated with the femur in dislocated position with the rasp in-situ or in reduced position with rasp or implant in-situ. The software also provides a femur first option.

The information on the surgery technique will be memorized and pre-defined for the next surgery.

**NOTE**

ACA function might be disabled. For enabling please get in contact with Aesculap.

**2 Set Patient Data**

In the next step hospital and patient related data is entered into the software.

The hospital related data can also already be pre-defined via the installation.

**NOTE**

All fields must be filled with information to be able to advance to the next step.
3 Set Surgery Data

Now the operated side is selected and the surgery related implant information is entered.

The selected implant can be adapted later during the workflow, if necessary.

The possible implant choice displayed in this step can be pre-defined via the installation by the Aesculap service technicians, according to the implants available on site.

4 Select Navigated Tools

All instruments needed for the selected navigation options will be displayed in this step.

For reamers, cup impactors or cup recorders as well as rasp handles further definition might be necessary during this step.

All instrument definitions made for the selected navigation options will be memorized and pre-defined for the next surgery.
Fixation of the Pelvis Transmitter

At the beginning of the surgery the blue transmitter (FS634) is fixed to the pelvis of the patient. This needs to be done before dislocation or resection of the hip joint. For supine and lateral position different fixing devices are available.

Supine Position – Pelvis Screw

For achieving exact navigation results the secure attachment of the reference transmitters to the patient’s bone for the whole duration of the navigation is important. For this purpose, the pelvic reference transmitter is affixed with the appropriate holding screw by making a stab incision of approx. 1 cm about 5 cm posterior from the ipsilateral anterior superior iliac spine (ASIS). The holding screw is first screwed in by machine, and then by hand for the last turns using the screw driver. The adapting position for the transmitter must point in a medial direction to ensure visibility by the camera.
Lateral Position – Pelvis Nail

For procedures with lateral patient position, it is suitable to use the pelvic nail (FS983R). This technique avoids an additional incision on the iliac crest. The hip joint is dissected but not yet dislocated. The pelvic nail (FS983) is placed into the holder at the end of the pelvic nail impactor (FS936R). Then the tip of the nail is placed superior to the acetabulum with the extraction feet of the nail extractor pointing inferiorly. The nail should be placed approximately 2 cm superior and slightly anterior to the superior rim of the acetabulum and be oriented vertically. It has to be assured that the position will not interfere with the reaming of the acetabulum. The nail is impacted through the ilium until the tip engages but does not perforate the medial cortex. The nail impactor can be removed by gently pulling it vertically. If the bone connection for the nail is more than 1 cm below the surface of the skin, the extra long pelvic nail (FS986R) may be used. The nail can be removed at the end of the surgery by hooking the extraction feet of the nail impactor around the connection hub of the nail and pulling vertically.
OrthoPilot® THA Universal

8 | Optional Navigation Tools

Camera Adjustment

THA Universal provides the possibility to adjust the camera to the surgical field. The field of view of the camera is shown on the screen as a cylindrical volume. The transmitters within the field are displayed as colored balls corresponding to their color coding. When both transmitters are at an optimal distance from the camera, the camera field of view is bordered in green on the screen. The distance from the camera to the transmitters is given in meters, the desired distance is 1.7-2.2 meter. The screen for positioning the camera can be accessed at any time via the toolbox-menu in the upper left corner of the screen.

NOTE
When aligning the camera take into account that the leg is extended, abducted or adducted during the surgery. The camera must be set up in such a way that it can register the transmitters in every position. The runner can adjust the camera during the surgery at any time – except during the registration of the table axis and the initial femur palpation.

Screen Calibration

Each time the virtual pointer is used to make choices on the screen, THA Universal provides the possibility to recalibrate the screen in order to ease the use of the virtual pointer.

To recalibrate the screen, apply a long press on the right footswitch. Then, aim the screen using the yellow transmitter and record the new calibration by pressing the right footswitch. It is also possible to exit the step without recording a new calibration, by pressing the left footswitch.

NOTE
When using the virtual pointer, only the transmitter position and orientation is taken into account, not the tool on which the transmitter is mounted. Therefore it can occur that the virtual pointer aims at the center of the screen whereas the tool (e.g. reamer) aims at the ground. Please take this into account when calibrating the screen.
Distance to Original Hip Center

Via the toolbox-menu it is possible to enter two distance measurement tools: “Distance to Original Hip Center” and “Pelvis Measurement”.

The first measurement option provides information on the distance to the original hip center. Therefore any point on the pelvis can be palpated with the pointer (FS934) and on the screen the information on the distance of this point to the original hip center in anterior/posterior, medial/lateral as well as cranial/caudal direction is displayed. Additionally the average distance from the point palpated to the original hip center is displayed on the pelvis image.

Pelvis Measurement

The pelvis measurement tool provided in the toolbox gives the opportunity to measure the distance between two palpated points on the pelvis.

In the first step the reference point on the pelvis is acquired with the pointer (FS934). As soon as the next point is palpated the information on the distance to the first point in anterior/posterior, medial/lateral as well as cranial/caudal direction is displayed on the screen. Additionally the average distance from the second point palpated to the first point palpated is displayed on the pelvis image.

NOTE

In order to save the tool screens into the report files the right foot pedal needs to be pressed shortly. In order to leave the tool screens and to get back to the navigation workflow the right foot pedal needs to be pressed long.
1 Record Vertical Axis

The cup position is defined via the registration of the vertical axis. In order to register this axis the table is moved upwards 10 cm.

The indicator on the right side shows the height of movement, as soon as the required height is achieved, the screen will automatically switch to the next screen.

NOTE
For lateral patient position the movement of the table defines the medial/lateral axis.

For supine patient position the movement of the table defines the anterior/posterior axis.

2 Acquire Initial Femur

The initial femur position is recorded by palpating references on the trochanter and the knee. The femur must be kept in a straight position. Both points should be pre-marked as they need to be palpated again during the navigation procedure.

The point on the trochanter major serves as reference for the offset and the leg lengthening values. Ideally the trochanter major is palpated at its most lateral point. A cortical screw can be used as a possible mark, but also a deep notch in the bone surface.

The femur cranio-caudal axis is referenced via the point palpated on the knee. The point can either be on the patella or on the medial or lateral epycondyle. The chosen point can be marked with a sterile pencil.

NOTE
It is important not to move the leg in-between the palpation of trochanter and knee references.
Acetabular Center Axis Acquisition

For the calculation of the acetabular center axis points along the acetabular rim are palpated in three steps.

1. First the registration of 3 points in the superior area of the acetabular rim is required.

2. Then 3 points in the anterior area of the acetabular rim are palpated.

3. Finally the palpation of 3 points along the posterior part of the acetabular rim is required.

First Superior Palpation Point

The registration of the first point on the superior rim is most crucial. This point is determined by a line from the prominent iliac tubercle to the origin of the posterior transverse acetabular ligament (acetabular notch).

NOTE

The first superior point is not strictly at 12.00 o'clock but varies slightly to 01.00 o'clock for a left hip and to 11.00 o'clock for a right hip.
**OrthoPilot® THA Universal**

9 | ACA Cup Navigation

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6 | **Calculated ACA Diameter**

The best fit circle defined by the points palpated around the acetabular rim is the basis for the calculation of the ACA diameter.

The ACA diameter is displayed automatically after the palpation of the posterior rim points. The next navigation step can be entered by pressing the right foot switch.

7 | **Acquire Reaming Limit**

After the resection of the femoral head reference points in the deepest area of the acetabulum are palpated (medial wall). To acquire this reaming limit 1–5 points need to be registered.

In the following reaming procedure the depth of the reaming is displayed in respect to the limit palpated. The distance between the reamer shell and the points palpated, displayed on the screen during the reaming process, provides an indication for avoiding excessive reaming of the acetabulum or protrusion.
Before the reaming navigation can be started the accurate size of the reamer shell has to be chosen by the use of the virtual pointer.

Also during the reaming process the table with the size selection will appear automatically whenever the reamer is moved away from the acetabulum (e.g. for shell size changes).

A new size can be selected with the virtual pointer and registered by using the right foot switch. If there is no size change necessary the right foot switch can be used to re-enter the reaming navigation screen.

The acetabulum is prepared with the navigated reamer equipped with the yellow transmitter.

The OrthoPilot® gives the information on the reaming depth (intern–extern) in relation to the palpated reaming limit. Over-reaming of this limit is indicated with a red warning message: “Check reaming limit”

Furthermore the relative inclination and anteversion angles in relation to the native acetabular plane are displayed as well as the hip center shift in medial/lateral, cranial/caudal and anterior/posterior directions.

In accordance with pre-operative planning the new acetabular center can be prepared.
Select Cup Size

Before the final cup can be implanted the size of the implant has to be defined.

On the screen the last reamer size used is displayed. The implant size can now be selected corresponding to the last reamer size.

For Plasmacup® SC and Delta as well as Plasmapit® Plus and Poly, in addition to the sizes the maximum inlay, respectively head diameter, available is displayed.

Implant Cup

During the cup implantation step a trial cup in the selected size can optionally be inserted and the depth as well as relative inclination and anteversion angles can be checked.

The same step is then used for the implantation of the final cup implant. The implanting depth displayed on the screen shows the distance between the center of the cup implant and the center of the registered reamer position.

Inclination and anteversion angles are displayed in relation to the original acetabular plane.
1 Acquire new Hip Center

After the implantation of the acetabular component, the new hip center of rotation is recorded with a Plasmafit® impactor or the recorder handle FS912R with a screwed-on pivoting ball with the defined diameter.

Pivoting balls are available for head diameters of 22.2, 28, 32, 36 as well as 40 mm.

The shift of the center in relation to the original center of rotation is displayed on the right side of the screen.

2 Select Head Diameter

After the acquisition of the new center of rotation the planned head diameter is selected with the virtual pointer. The selection can be confirmed with the right foot switch.
Acquisition of Spinae Iliaci

The anterior pelvic plane defines the reference plane for the orientation of the cup inclination and anteversion.

1. Registration of this plane is performed by consecutive palpation of the ipsilateral and the contralateral anterior superior iliac spine and then the symphysis, with the mobile pointer.

Precision for inclination:
\[ \theta \pm 10 \text{ mm} = \pm 1.5^\circ \]
\[ \theta \pm 20 \text{ mm} = \pm 3.0^\circ \]

NOTE
The angle of inclination results by the straight line defined by the palpation of both spina iliaca (ASIS). The precision of the later-on displayed inclination angle is therefore influenced by the symmetry of this palpation.

Acquisition of Pubic Symphysis

During palpation of the symphysis a percentage figure is displayed on the screen indicating the ratio of the pointer position between the two palpated points of the anterior superior iliac spine.

Precision for anteversion:
\[ \theta \pm 10 \text{ mm} = -4.0^\circ \]
\[ \theta \pm 30 \text{ mm} = -12 \]

NOTE
The angle of anteversion depends on the tilt of the plane resulting from the palpation of all three landmarks, with the height of the symphysis having the greatest influence. Therefore the precision of the later-on displayed anteversion angle is influenced by the thickness of the tissue layer above the symphysis.
4 Acquire Initial Femur

NOTE
When using the anterior pelvic plane for pelvis orientation the acquisition of the initial femur is only necessary if the stem is navigated.

The femur must be kept in a straight position for the acquisition and should not be moved in-between palpations. The points palpated should be pre-marked as they need to be palpated again during the workflow.

The point on the trochanter major serves as reference for the offset and the leg lengthening values. Ideally the trochanter major is palpated at its most lateral point. A cortical screw can be used as a possible mark, but also a deep notch in the bone surface.

The femur cranio-caudal axis is referenced via a point palpated on the knee. The point can either be on the patella or on the medial or lateral epycondyle. The chosen point can be marked with a sterile pencil.

5 Acquire Reaming Limit

After the resection of the femoral head reference points in the deepest area of the acetabulum are palpated (medial wall). To acquire this reaming limit 1-5 points need to be registered.

In the following reaming procedure the depth of the reaming is displayed in respect to the limit palpated. The distance between the reamer shell and the points palpated, displayed on the screen during the reaming process, provides an indication for avoiding excessive reaming of the acetabulum or protrusion.
Acquire Original Hip Center

The original hip center is registered by the use of the reamer. The correct reamer shell size ends at the level of bone surface and can be seated tightly but without pressfit in the acetabulum.

Registration of the original hip center is carried out in order to display the shift of hip center and to calculate the influence on the offset change.

Original Hip Center – Size Selection

Subsequent to the registration of the original hip center the size of the utilized reamer shell has to be selected. The correct size can be selected with the virtual pointer and confirmed with the right foot switch.
Before the reaming navigation can be started, the accurate size of the first reamer shell that will be used, has to be chosen with the virtual pointer.

Also during the reaming process, the table with the size selection will appear automatically whenever the reamer is moved away from the acetabulum (e.g., for shell size changes).

A new size can be selected with the virtual pointer and registered by using the right foot switch. If there is no size change necessary, the right foot switch can be used to re-enter the reaming navigation screen.

The acetabulum is prepared with the navigated reamer equipped with the yellow transmitter.

The OrthoPilot® gives the information on the reaming depth (intern-extern) in relation to the palpated reaming limit. Over-reaming of this limit is indicated with a red warning message: “Check reaming limit”

Furthermore, the inclination and anteversion angles are displayed as well as the hip center shift in medial/lateral, cranial/caudal and anterior/posterior direction.

In accordance with "Lewinnek safe zone" and pre-operative planning, orientation and positioning of the cup can be prepared.
Select Cup Size

Before the final cup can be implanted the size of the implant has to be defined.

On the screen the last reamer size used is displayed. The implant size can now be selected corresponding to the last reamer size.

For Plasmacup® SC and Delta as well as Plasmafit® Plus and Poly, in addition to the sizes the maximum inlay, respectively head diameter, available is displayed.

Implant Cup

During the cup implantation step a trial cup in the selected size can optionally be inserted and the depth as well as inclination and anteversion angles can be checked.

The same step is then used for the implantation of the final cup implant. The implanting depth displayed on the screen shows the distance between the center of the cup implant and the center of the registered reamer position.

Furthermore the inclination and anteversion angles are displayed.
**Acquire new Hip Center**

After the implantation of the acetabular component, the new hip center of rotation is recorded with a Plasmafit® impactor or the recorder handle FS912R with a screwed-on pivoting ball with the defined diameter.

Pivoting balls are available for head diameters of 22.2, 28, 32, 36 as well as 40 mm.

The shift of the center in relation to the original center of rotation is displayed on the right side of the screen.

**Select Head Diameter**

**NOTE**

When using the anterior pelvic plane for pelvis orientation the selection of the head diameter is only necessary if the stem is navigated.

After the acquisition of the new center of rotation the planned head diameter is selected with the virtual pointer. The selection can be confirmed with the right foot switch.
1 Prepare Rasp Handle

Before the rasping process this screen indicates how to mount the blue transmitter on the rasp handle by the use of the appropriate adapter.

In this step it is also possible to adjust the previously selected stem implant parameters.

NOTE
The navigation of the rasp is optional. If the rasp is not navigated, this step is called: “Confirm Stem Choice” and gives the possibility to adjust the implant related information.

2 Select Rasp Size

To start the navigation process the appropriate rasp size inserted into the femur has to be selected with the yellow transmitter as virtual pointer. The selection can be confirmed with a right foot switch.

NOTE
The navigation of the rasp is optional. If the rasp is not navigated this step will be called: “Select Rasp/Implant Size” and will indicate the size for the rasp or implant in-situ for the trial reduction step.
3 Acquire Dislocated Femur

The pre-marked landmarks for offset and leg length measurement are then palpated with the femur in dislocated position and the rasp in-situ.

Offset and leg length changes are calculated on the basis of the trochanter landmark. The knee palpation is used to compute the femoral axis.

NOTE
For accurate leg length and offset measurement it is important to palpate exactly the same landmarks as for the initial acquisition. Accuracy regarding the palpation points can be increased by putting the leg always in the same position (straight or bent) whenever it is palpated during the workflow (initial – dislocation – reduction).

4 Select Stem Set-up

The stem set-up shows the simulation for the offset and leg length changes according to the different implant options available:

- Neck size
- Standard or high offset version
- Modular or monobloc version (for Metha® system)
- CCD angle (for Metha® system)
- Neck antetorsion (for Metha® modular)

Another rasp size can be selected by aiming with the virtual pointer at the rasp symbol (at the top of the screen) and using the right foot switch. For the adjusted rasp size the dislocated femur has to be palpated again.

NOTE
If the same rasp size has to be navigated one more time the existing information can be deleted with a short left foot switch followed by a long left foot switch for the trash bin.
Select Reduction Set-up

The trial reduction can be conducted with a rasp or an implant in-situ. This choice needs to be indicated during the reduction set-up.

The reduction set-up can be selected by the use of the yellow transmitter as virtual pointer. The implantation options need to be configured as in-situ. The options are:

- Rasp/implant
- Rasp or implant size
- Standard or high offset version
- Modular or monobloc version (for Metha® system)
- Neck size
- CCD angle (for Metha® system)
- Neck antetorsion (for Metha® modular)

NOTE
The reduction navigation is optional. If the rasp is not navigated it will appear directly after the step: “Select Rasp/Implant Size”.

Acquire Reduced Femur

The pre-marked landmarks for offset and leg length measurement are then palpated with the femur in reduced position and the rasp or the implant in-situ.

Offset and leg length changes are calculated on the basis of the trochanter landmark. The knee palpation is used to compute the femoral axis.

NOTE
For accurate leg length and offset measurement it is important to palpate exactly the same landmarks as for the initial acquisition. Accuracy regarding the palpation points can be increased by putting the leg always in the same position (straight or bent) whenever it is palpated during the workflow (initial – dislocation – reduction).
Reduced Femur

After the palpation of the femoral landmarks the final result for the reduction set-up is displayed on the screen.

The icon above the patient indicates whether the reduction has been conducted with a rasp or an implant.

In order to do another reduction the virtual pointer needs to be aimed at the rasp/implant icon above the patient and the reduction set-up step is entered again. After the set-up has been changed trochanter and knee reference have to be palpated again.

NOTE

If the same rasp set-up should be navigated one more time the existing information can be deleted with a short left foot switch followed by a long left foot switch for the waste bin.

Summary

At the end of each workflow a summary report is displayed giving the following information:

- Navigation time*
- Hip center shift
- Cup angles
- Cup implant type & size
- ACA diameter (ACA pelvis orientation)
- Acetabulum diameter (APP pelvis orientation)

If the stem is also navigated:

- Lengthening and offset
- Stem implant type
- Stem implant size
- Fixation
- Neck size
- Head component size
- CDD/antetorsion (for Metha® system)

* starts at first table axis record or first palpation record depending on the workflow
1 Record Vertical Axis

The cup position is defined via the registration of the vertical axis. In order to register this axis the table is moved upwards 10 cm.

The indicator on the right side shows the height of movement, as soon as the required height is achieved, the screen will automatically switch to the next screen.

NOTE
For lateral patient position the movement of the table defines the medial/lateral axis.

For supine patient position the movement of the table defines the anterior/posterior axis.

2 Acquire Initial Femur

The initial femur position is recorded by palpating references on the trochanter and the knee. The femur must be kept in a straight position. Both points should be pre-marked as they need to be palpated again during the navigation procedure.

The point on the trochanter major serves as reference for the offset and the leg lengthening values. Ideally the trochanter major is palpated at its most lateral point. A cortical screw can be used as a possible mark, but also a deep notch in the bone surface.

The femur cranio-caudal axis is referenced via the point palpated on the knee. The point can either be on the patella or on the medial or lateral epycondyle. The chosen point can be marked with a sterile pencil.

NOTE
It is important not to move the leg in–between the palpation of trochanter and knee references.
Acquire Original Hip Center

The original hip center is registered by the use of the recorder handle FS912R with a trial cup. The correct trial cup size ends at the level of bone surface and can be seated tightly but without pressfit in the acetabulum.

Registration of the original hip center is carried out in order to display the shift of hip center and to calculate the influence on the offset change.

Select Trial Cup Size

Subsequent to the registration of the original hip center the size of the utilized trial cup has to be selected. The correct size can be selected with the virtual pointer and confirmed with the right foot switch.
**OrthoPilot® THA Universal**

12 | Stem Only Navigation

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**1 Acquire new Hip Center**

After the non-navigated implantation of the acetabular component, the new center of rotation is recorded with the recorder handle FS912R with a screwed-on pivoting ball with the defined diameter.

Pivoting balls are available for head diameters of 22.2, 28, 32, 36 as well as 40 mm.

The shift of the center in relation to the original center of rotation is displayed on the right side of the screen and its influence on the offset change will be taken into account for the stem navigation.

**2 Select Head Diameter**

After the acquisition of the new center of rotation the planned head diameter is selected with the virtual pointer. The selection can be confirmed with the right foot switch.
1 Prepare Rasp Handle

Before the rasping process this screen indicates how to mount the blue transmitter on the rasp handle by the use of the appropriate adapter.

In this step it is also possible to adjust the previously selected stem implant parameters.

NOTE
The navigation of the rasp is optional. If the rasp is not navigated, this step is called: “Confirm Stem Choice” and gives the possibility to adjust the implant related information.

2 Select Rasp Size

To start the rasping process the appropriate rasp size inserted into the femur has to be selected with the yellow transmitter as virtual pointer. The selection can be confirmed with a right foot switch.

NOTE
The navigation of the rasp is optional. If the rasp is not navigated this step will be called: “Select Rasp/Implant Size” and will indicate the size for the rasp or implant in-situ for the trial reduction step.
3 Acquire Dislocated Femur

The pre-marked landmarks for offset and leg length measurement are then palpated with the femur in dislocated position and the rasp in-situ.

Offset and leg length changes are calculated on the basis of the trochanter landmark. The knee palpation is used to compute the femoral axis.

**NOTE**
For accurate leg length and offset measurement it is important to palpate exactly the same landmarks as for the initial acquisition. Accuracy regarding the palpation points can be increased by putting the leg always in the same position (straight or bent) whenever it is palpated during the workflow (initial – dislocation – reduction).

4 Select Stem Set-up

The stem set-up shows the simulation for the offset and leg length changes according to the different implant options available:

- Neck size
- Standard or high offset version
- Modular or monobloc version (for Metha® system)
- CCD angle (for Metha® system)
- Neck antetorsion (for Metha® modular)

Another rasp size can be selected by aiming with the virtual pointer at the rasp symbol (at the top of the screen) and using the right foot switch. For the adjusted rasp size the dislocated femur has to be palpated again.

**NOTE**
If the same rasp size has to be navigated one more time the existing information can be deleted with a short left foot switch followed by a long left foot switch for the waste bin.
**Select Reduction Set-up**

The trial reduction can be conducted with a rasp or an implant in-situ. This choice needs to be indicated during the reduction set-up.

The reduction set-up can be selected by the use of the yellow transmitter as virtual pointer. The implantation options need to be configured as in-situ. The options are:

- Rasp/implant
- Rasp or implant size
- Standard or high offset version
- Modular or monobloc version (for Metha® system)
- Neck size
- CCD angle (for Metha® system)
- Neck antetorsion (for Metha® modular)

**NOTE**

The reduction navigation is optional. If the rasp is not navigated it will appear directly after the step: “Select Rasp/Implant Size”.

**Acquire Reduced Femur**

The pre-marked landmarks for offset and leg length measurement are then palpated with the femur in reduced position and the rasp or the implant in-situ.

Offset and leg length changes are calculated on the basis of the trochanter landmark. The knee palpation is used to compute the femoral axis.

**NOTE**

For accurate leg length and offset measurement it is important to palpate exactly the same landmarks as for the initial acquisition. Accuracy regarding the palpation points can be increased by putting the leg always in the same position (straight or bent) whenever it is palpated during the workflow (initial – dislocation – reduction).
Reduced Femur

The pre-marked landmarks for offset and leg length measurement are then palpated with the femur in dislocated position and the rasp in-situ.

For the offset change the reference on the trochanter is re-palpated. For the leg length management the knee reference is re-palpated.

Summary

At the end of each workflow a summary report is displayed giving the following information:

- Navigation time*
- Hip center shift
- Lengthening and offset
- Stem implant type
- Stem implant size
- Fixation
- Neck size
- Head component size
- CDD/antetorsion (for Metha® system)

* starts at first table axis record
### Supine position – upper tray

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<td>OrthoPilot® RB adapter</td>
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<td>OrthoPilot® bicort. RB holding screw 40 mm</td>
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### Supine position – lower tray

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<td>OrthoPilot® THA taper adapter 8/10 mm</td>
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<td>OrthoPilot® THA taper adapter 12/14 mm</td>
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### OrthoPilot® THA Universal

#### Article Overview

**Lateral position/anterior approach – upper tray**

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**Lateral position/anterior approach – lower tray**

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Lateral position/posterior approach – upper tray

- OrthoPilot® RB adapter for screw NP619R
- OrthoPilot® RB adapter NP626R
- OrthoPilot® bicort. RB holding screw 35 mm NP621R
- OrthoPilot® bicort. RB holding screw 40 mm NP622R
- OrthoPilot® bicort. RB holding screw 45 mm NP623R
- OrthoPilot® bicort. RB holding screw 50 mm NP624R
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- OrthoPilot® THA, extension for C-clamp 60 mm FS908R
- OrthoPilot® THA, pelvic nail, lateral pos. 95 mm FS985R
- OrthoPilot® THA, C-clamp for lateral pos., posterior FS907R
- OrthoPilot® THA C-clamp for lateral pos., posterior, small FS899R
- Tray lid 489 x 257 mm JH217R

Lateral position/posterior approach – lower tray

- OrthoPilot® THA positioning for FS702-FS705 FS706R
- Graphics template for FS706R TE917
- OrthoPilot® THA recorder handle FS912R
- OrthoPilot® ACL pointer str. FS871M
- OrthoPilot® THA in/out impactor for nails FS936R
- OrthoPilot® THA glove protector FS939
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- OrthoPilot® THA pivoting sphere, ø 36 mm FS983
- OrthoPilot® THA taper adapter 8/10 mm FS981
- OrthoPilot® THA taper adapter 12/14 mm FS982
OrthoPilot® THA Universal

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Transmitter, passive

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