

# Aesculap<sup>®</sup> OrthoPilot<sup>®</sup>

OrthoPilot<sup>®</sup> THA Dysplasia 3.3  
Navigated Surgical Technique



Aesculap Orthopaedics

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty



#### **OrthoPilot®**

OrthoPilot® helps with the precise implantation of knee and hip endoprotheses. One of the priorities in the development of the OrthoPilot® Navigation System was a seamless integration into the surgical flow. This is accomplished through the use of intuitive instrumentation and a surgeon-friendly interface with the software. From its inception, the system was designed to eliminate the need for costly CT and MRI scans, while still allowing for high OR efficiency.

- No CT required
- Ergonomic instruments precisely aligned to the surgical technique
- User-friendly navigational flow – integrates itself easily into the operative work flow
- Proven precision of implant alignment
- Intraoperative documentation with OrthoPilot®
- Numerous international studies confirm better alignment
- Routinely used in over 600 hospitals

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## Content

<b>1</b>	<b>Introduction</b>	<b>6</b>
<b>2</b>	<b>Navigation instruments</b>	<b>8</b>
<b>3</b>	<b>OrthoPilot® set-up</b>	<b>10</b>
	Covering the patient	11
	Lateral patient position	12
	Supine patient position	12
	Selecting the software application	12
	Entering patient data	13
	Selecting the implants	13
	Operating the foot pedal	14
<b>4</b>	<b>Registering the anterior pelvic plane</b>	<b>16</b>
	Pelvis transmitter fixation	16
	Iliac crest screw	16
	Pelvic nail (optional)	18
	Palpating the anterior pelvic plane	19
<b>5</b>	<b>Navigation procedure THA Dysplasia</b>	<b>20</b>
	Pelvis check function	20
	Registering the femur	21
	Registering medio-lateral reference point	22
	Registering cranio-caudal reference point	22
	Registering antero-posterior reference point	22
	Pilot hole preparation	23
	Registering the pilot hole	23
	Selecting the reamer shaft (optional)	24
	Selecting the curved reamer shaft	24
	Preparation of the acetabulum	25
	Selecting the Cup Impactor	25
	Positioning the trial cup	26
	Implantation of the pressfit cup	26
	Recording the new center of rotation	26

	Selecting the handle	27
	Profiler navigation	28
	Repositioning with rasp in place	28
	Stem navigation	29
	Repositioning with implanted stem	29
<b>6</b>	<b>Reporting</b>	<b>30</b>
<b>7</b>	<b>Schematic workflow THA Dysplasia</b>	<b>31</b>
<b>8</b>	<b>Overview of Instrument</b>	<b>32</b>
	Tray combinations	32
	Specific products	35

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 1 | Introduction

The OrthoPilot® navigation technology has been applied in thousands of hip arthroplasty procedures since 2000. The goal of any hip surgery is to produce a highly-stable and precise functioning hip joint, this can be accomplished using the OrthoPilot® THA software. OrthoPilot® is as a highly accurate tool designed to reduce leg length discrepancy and enable stable joint tension.

A key component of the OrthoPilot® software is that it provides the surgeon with important information before committing to each step of the surgery.

For example, OrthoPilot® THA displays real-time leg length information. This allows the surgeon to make adjustments during the procedure in order to achieve the optimal implant position based on the individual patient.

The 'OrthoPilot® HipSuite™' includes a complete collection of Aesculap's acclaimed hip navigation software. Every module is distinguished by its great user friendliness, a logical progression of navigation steps, and the high degree to which it can be customized to meet the requirements of each and every surgeon. Navigation plays a special role in the increasingly popular, minimally invasive access techniques. OrthoPilot® provides additional assistance with small incisions, where impaired visibility is a concern. The system provides the surgeon reliable implant position and alignment.

Numerous studies have been published on navigated hip implantation with the OrthoPilot®.

In these studies, the authors compare implant positioning between navigated and conventional procedures. The expediency of navigation in less invasive access techniques is discussed as well.

### **Note:**

You can also find an extensive listing of studies on the internet under [www.orthopilot.com](http://www.orthopilot.com) in the literature section.

## THA Dysplasia

THA Dysplasia is a powerful extension of the OrthoPilot® software platform. It was specifically designed for severe dysplastic cases. THA Dysplasia reflects the surgeon's own preoperational planning (Fig. 1). This means that THA Dysplasia can provide not only real-time leg length and offset information but also the planned cup position. It gives the surgeon exact control of position and precise orientation of the acetabular reamer and the cup. Leg length and offset information offered by THAplus functions are important variables to enable high stability and function of the hip joint.

As with the rest of the THA software platform, THA Dysplasia's surgical workflow can be adapted to the surgeon's needs. For example; the default setting for the reamer diameter can be set for 40 mm – 68 mm. The default head diameter can be set for 22.2 mm to 36 mm. In addition, the system allows for deletion and rearrangement of certain steps, in order to match the surgeons preferences. Other features, such as a depth gauge during cup insertion can be activated or deactivated.

Our Service Technician is happy to help with your customization needs.



Fig. 1

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 2 | Navigation instruments

### Instrument overview



The 'OrthoPilot® HipSuite™' provides integration of the navigation instruments into the accustomed operative procedure. In addition to the standard instruments, only a few specialized navigation instruments are required.

These are characterised in particular by:

- Ergonomic design
- Multiple use during the procedure
- Possibility of adapting for surgical approach and patient positioning
- Simple, straightforward sieve tray organization

### Transmitter technology

Using infrared technology, wireless transmitters provide precision accuracy. Wired transmitters are available to provide a hybrid option.






Passive transmitter	Passive transmitter	Passive transmitter	Passive transmitter
			
redFS635	yellowFS633	blueFS634	FS608

The marker spheres, which have a reflective surface layer, reflect the infrared light from the camera. Contaminates must be avoided or removed.



The following instruments are used in the course of the OrthoPilot® hip navigation procedure.

Universal instruments for palpation and imaging

THA pointer I	THA pointer II	Universal THA recorder handle	Hook pointer	Hammer pointer
				
angular, 45° FS934	straight FS871M	FS912R	FS856M	FS869R

Do not use a hammer when using these instruments

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 3 | OrthoPilot® set-up

Aesculap considers it necessary to carry out preoperative planning prior to any navigated surgery. This planning is carried out using the appropriate radiographic images and Aesculap X-ray templates, taking into consideration the intended implant size and the resulting leg length and offset figures.

With OrthoPilot® HipSuite™, the cup inclination and anteversion definition is RADIOGRAPHIC for normal use. However, there are servicing options that allow you to choose the cup angle definition as RADIOGRAPHIC, OPERATIVE or ANATOMICAL.



### Caution!

The OrthoPilot® navigation system may only be used by qualified surgeons that are experienced in applying the manual operating technique. Prior to beginning surgery with the system, make certain all instruments required for the manual operating technique are available.



Designation	Art. no.
Instruction for use of OrthoPilot® System FS100	TA010004
Instructions for use of OrthoPilot® System FS101...FS106	TA012658
Quick Guide for OrthoPilot® System FS104/FS106	TA012653
Instructions for use OrthoPilot® operating system, operation, software (FS101 / FS102)	TA012659
Instructions for use OrthoPilot® FS100/FS010 – operating system, operation, software	TA012821
Instructions for use of OrthoPilot® THA Dysplasia	TA013149
Bicontact® Brochure	010702
Excia® Brochure	018802
Metha® Brochure	028002
Trilliance® Brochure	037802
Plasmacup® SC Brochure	014702
Cemented Cup Brochure	010411

### Covering the patient

Cover the patient in such a way that the palpation of the anterior pelvic plane (anterior superior iliac spine and symphysis) will not be obstructed.

If a screw is used for fixating the reference transmitter on the pelvis, this must be taken into account when covering the patient.

Make certain that the cover is not too thick and that it is of even thickness in the region of the iliac spine.



# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 3 | OrthoPilot® set-up

The OrthoPilot® camera must maintain direct line-of-sight with the trackers attached to the patient and to the instruments throughout the surgical procedure.

### Lateral patient position

For the lateral positioned procedure, the ideal camera position is 2 m from the operative hip joint. The camera is positioned at the head contralateral to the side that the patient is operated on. The camera should be above the level of the patient's navel, but should not exceed 45 degree relative to the operative field. The exact camera position is determined intra-operatively and can be adjusted at any time during the procedure (Fig. 2).

### Supine patient position

For a procedure in the supine position, the ideal camera position is 2 m from the ipsilateral hip joint. The camera is positioned at the foot of the patient on the contralateral side of the operated hip. The camera should be positioned below the patient's feet approximately 10° to the ipsilateral field. The exact camera position is determined intra-operatively and can be adjusted at any time during the procedure (Fig. 3).

### Selecting the software application

THA Dysplasia software application should be selected from the OrthoPilot®. All other options are selected within the OrthoPilot® Dysplasia software application.

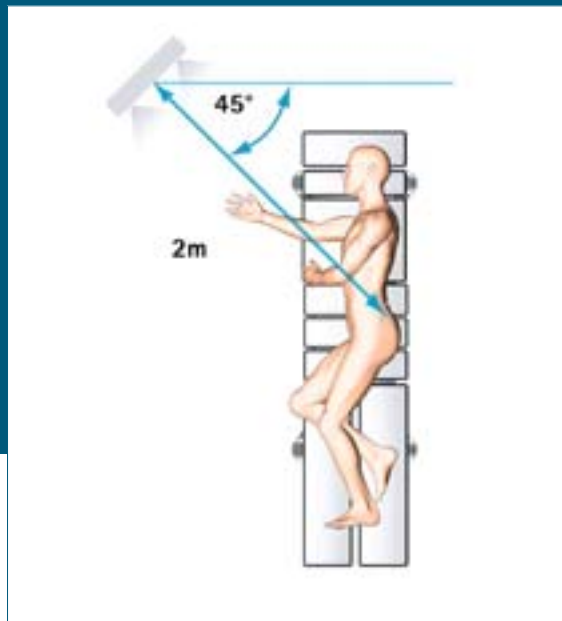


Fig. 2

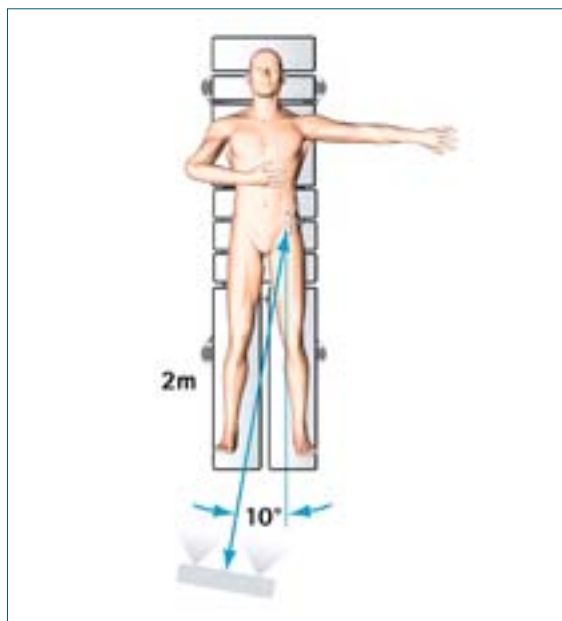


Fig. 3

## Entering patient data

### Surgeon

Name: name of operating surgeon

Department: name of the hospital

### Patient

First Name: or patient identification number

Last Name:

Date of Birth:

Sex: male or female should be chosen



The screenshot shows a software window titled 'Patient Data'. On the left is a sidebar menu with options: Patient, Parameters, Trial Cup, Implant, Map, and Stem. The main area is divided into two sections. The 'Surgeon' section has 'Name: DOKTOR' and 'Department: HOSPITAL'. The 'Patient' section has 'First Name: PATIENT', 'Last Name: PATIENT', 'Date of Birth: 31-Dec-1950', and 'Sex: FEMALE' (highlighted in blue). A question mark icon is in the top left of the main area.

Fig. 4

## Selecting the implants

Side: Choose the side of the operated hip – left or right leg

Position: Choose the position of the patient – supine or lateral

Approach: Select the surgical approach. Anterior for all approaches with external rotation of the femur, and posterior for all approaches with internal rotation of the femur

Instrument Set: Input of transmitter type – passive or hybrid



The screenshot shows a software window titled 'Implant Selection'. The sidebar menu is the same as in Fig. 4. The main area has three sections. The 'Cup' section has 'Name: PLASMACUP SC' and 'Fixation: PRESSFIT', with a small image of a cup. The 'Stem' section has 'Name: TRILLIANCE' and 'Fixation: CEMENTED', with a small image of a stem. Below these are 'Operated side: LEFT', 'Position: SUPINE', 'Approach: ANTERIOR', and 'Instrument Set: PASSIVE'. A question mark icon is in the top left of the main area.

Fig. 5

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 3 | OrthoPilot® set-up

For THA Dysplasia, cup position reflects the standard preoperative planning of the cup. The new femoral head center is defined by the input for both distances, from the most lateral point of the Osteophyte at the acetabular superior rim and the distance from the Tear-Drop line. The point at the Osteophyte at acetabular superior rim will be used as reference point for the navigation of the acetabular reamer and cup positioning for medial – lateral direction. The point at the Tear-Drop line is the reference for the cranio/caudal distance to the planned center and gives you necessary information for your accurate reamer and cup positioning.

THA Dysplasia software uses surface reference palpations to acquire the anatomical data of the patient specific anatomy. To register a surface palpation, attach the transmitter to the palpation instrument. The landmark positions are determined by placing the tip of the instrument on the skin or bone using mild force and confirming this point by pressing the right foot pedal. The landmark positions are determined by placing the tip of the instrument on the skin or bone using mild force and confirming this point by pressing the right foot pedal. Using a long or short press depending on which of the two buttons in the right lower corner correspond to the red 'record' button (Fig. 8). The user can return to any step in the navigation sequence by pressing the left pedal with a short or long press corresponding to the 'back arrow' button (Fig. 7). To delete a landmark, long-press the left foot pedal when the trash can button is visible (Fig. 7). To re-register the same landmark again, press the right foot pedal with the appropriate instrument in place. The size of the instruments or implants can be selected by the plus (+) or minus (-) icon with the foot pedal (Fig. 8).



Fig. 6



Fig. 7 ① ②



Fig. 8 ③ ④

### Operating the foot pedal

- ① Long press of left foot pedal
- ② Short press of left foot pedal
- ③ Short press of right foot pedal
- ④ Long press of right foot pedal

#### Note:

Incorrect navigation results due to imprecise X-ray images.

- Make certain that the scale of the X-ray is determined correctly.
- Make certain that any distortion of the X-ray images is kept to a minimum.

It is necessary to maintain unobstructed visual contact between the transmitters and the camera for data acquisition. The traffic light indicator will illuminate green ⑤ when the array is well seen, and when the array is not completely seen, the indicator will illuminate yellow ⑥ or red ⑦ (Fig. 9). When the camera is approximately 2 m away, the circle in the lower left section of the screen will be surrounded in green ⑧. It also shows the visual field of view of the camera (Fig. 10). When using passive markers, be sure to keep the reflective balls clean and dry as blood and fluid can reduce the visibility by camera. If a ball needs to be cleaned, gently wipe it using a clean wet sponge, followed by a clean dry tissue.

To exit the OrthoPilot® program at any time, click the 'X' ⑨ in the upper left corner (Fig. 11).

**Note:**

Even though the data is saved automatically, it is not possible to resume at the same step after exiting before completion of the surgery.



Fig. 9

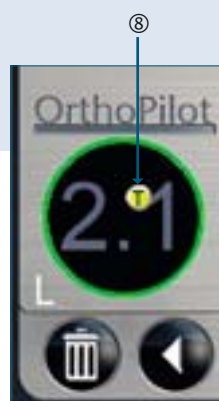


Fig. 10

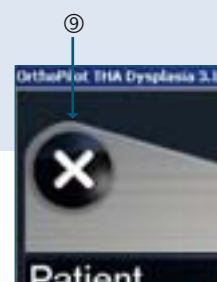


Fig. 11

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 4 | Registering the anterior pelvic plane

### Pelvis transmitter fixation

There are two options for the fixation of the transmitter to the pelvis: an iliac crest screw or a supra-acetabular pelvic nail. The iliac crest screw option can be used for all surgical approaches, however the nail in the ilium may only be used when the patient is maintained in the lateral position throughout the surgical procedure.

### Iliac crest screw

The iliac crest screw insertion is performed prior to the primary hip incision. A 1 cm skin incision is performed approximately 5 to 8 cm posterior to the ipsilateral ASIS on the iliac crest. A periosteal elevator is used to gain direct access to the surface of bone on the rim of the crest. The 40 mm bicortical screw is placed through the Rigid Body holding sleeve until the screw is rigidly fixed to the bone. To avoid stripping the threads, the final screw position must be completed by hand. The connection hub of the pelvis transmitter should be oriented so that the transmitter is visible to the camera throughout the procedure. For procedures in which the patient is rolled from supine to lateral, be sure to position the transmitter so that it is visible in both positions, supine and lateral (Fig. 12, 14).



Fig. 12

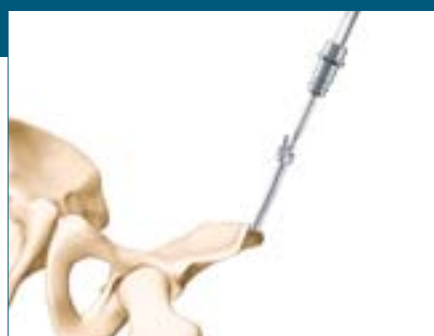


Fig. 13



Fig. 14

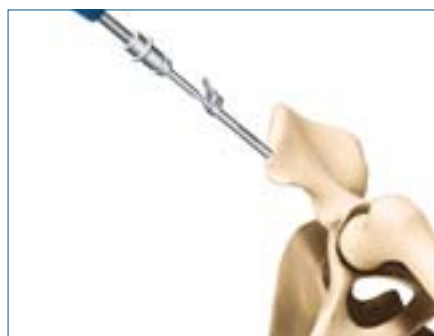


Fig. 15



Pre-condition for precise calculation of the angle of inclination and anteversion of the cup is the exact registration of the landmarks. To make this possible, the thickness of the surgical draping of the iliac spines and the symphysis must be even. During palpation, the surgeon should also push subcutaneous layers of fat overlying the landmarks to the side. A well-tried procedure for this is to push the fatty tissue layers on the iliac spines from lateral to medial and to take the bony projection between two fingers (Fig. 16). The fatty tissue layers overlying the symphysis should be shifted from caudal to cranial (Fig. 18).

The angle of inclination results from the straight line defined by palpation of the two iliac spines (Fig. 17). It changes when the landmarks are shifted in a cranial or caudal direction. Palpation of the ASIS must therefore be performed symmetrically (e.g. both points from cranial to caudal).

Precision for inclination:

$\Delta \pm 10 \text{ mm}$  cranial and caudal direction =  $\pm 1.5^\circ$

$\Delta \pm 20 \text{ mm}$  cranial and caudal direction =  $\pm 3.0^\circ$

The angle of anteversion depends on the tilt of the plane resulting from palpation of all three landmarks, the height of the symphyseal point having the greatest influence on the angle of anteversion. The angle of anteversion displayed on the OrthoPilot® decreases with growing distance between the palpated point and the bone surface (corresponding to the thickness of the tissue layer).

Precision for anteversion:

$\Delta + 10 \text{ mm}$  anterior direction =  $- 4.0^\circ$

$\Delta + 30 \text{ mm}$  anterior direction =  $- 12.0^\circ$

#### Note:

In order to avoid misidentifying landmarks under the drapes, it is recommended to place an EKG electrode pad adjacent to the bony landmark prior to draping the patient. After draping the patient, the prominent button makes it easier to identify and palpate the bony landmark. Be sure not to palpate on top of the electrode pad, as this adds to errors in the depth of the palpation.



Fig. 16

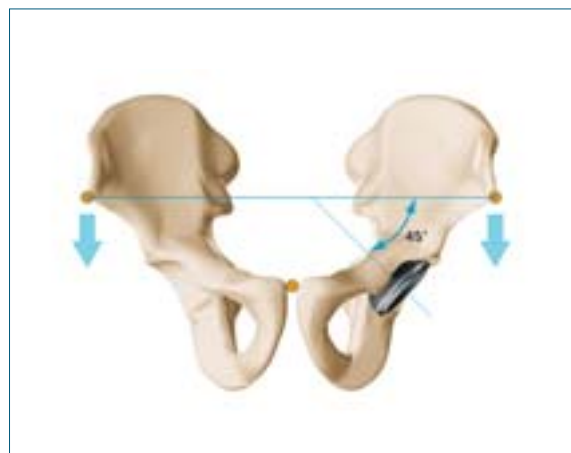


Fig. 17



Fig. 18

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 4 | Registering the anterior pelvic plane

### Pelvic nail (optional)

For procedures in which the patient remains in lateral positions, it is possible to use the Pelvic Nail (FS985R). This technique avoids an additional incision on the iliac crest. Dissect to the hip joint, but do not dislocate the hip. Load the Pelvic Nail (FS985) into the end of the pelvic nail impactor/extractor (FS936R) and place the tip of the nail 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. Be sure that this position will not interfere with the reaming of the acetabulum. Impact the nail through the ilium until the tip engages but does not perforate the medial cortex, which is felt by the surgeon. Remove the nail impactor/extractor from the nail by gently pulling vertically. If the connection hub of 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/extractor around the connection hub of the nail and pulling vertically.

### Palpating the anterior pelvic plane

Attach the blue transmitter (FS634) to the iliac crest screw or the pelvic nail. Attach the yellow transmitter (FS633) to the pointer (FS934).

The APP is required by the OrthoPilot® THA Dysplasia software to provide an accurate measurement of the acetabular inclination and anteversion.

Place the tip of the pointer on the most anterior point of the ipsilateral ASIS. Make sure to place the tip at the appropriate superior/inferior position as well as the appropriate depth. Record the point by short-pressing the right foot pedal. Repeat for the contralateral ASIS, then record the height of the symphysis pubis, making sure that the plane defined by three palpations is parallel to the plane of the APP (Fig. 19 – 21). For accurate registration, it is essential that the drapes on the iliac crest and the symphysis pubis are lying flat and even. The surgeon should push aside layers of subcutaneous fat over the landmarks.

Following the registration of the anterior pelvic plane, the surgeon may continue the navigation sequence for THA Dysplasia. Be sure to avoid pressure on the tip of the curved hip pointer to avoid bending the instrument or perforating the drapes.

#### Note:

To obtain correct data, apply mild force when using the pointer. Do not bend the pointer. Use of bent instrument will result in erroneous computation of angles and distances.



Fig. 19



Fig. 20



Fig. 21

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 5 | Navigation procedure THA Dysplasia

### Pelvis check function

Place a small screw into the pelvic bone that is easy to access at each step of the surgery. In each stage, the stability of the pelvic Rigid Body can be tested by palpating this screw.

If you would like to check the stability of the Rigid Body, which was placed at the pelvis simultaneously press both pedals of OrthoPilot® system FS010/FS100 or press central button on the foot control switch of OrthoPilot® system FS101.

A pull-down menu with 3 menu items will be displayed. Press the left pedal buttons to switch to the next item on the pulldown menu. Select reference frame 'Pelvis check' and briefly press the right pedal button. The pelvis check screen (Fig. 24) will open. The pelvis check screen shows the change of the distance between the initially palpated screw position and the current position. The numerical values shown in the white ellipses below the 3-line cross show the difference in distance for all three directions: Proximal-Distal, Cranio-Caudal and Medio-Lateral. If the three numbers show 0, the Rigid Body position has not moved. The single number on the left is the combined change of distance for all three directions.

#### Note:

Please choose the preferred handling of this feature:

- this pelvis check reference will be skipped if the servicing option is set to NO and appears if it is set to YES.



Fig. 22



Fig. 23



Fig. 24

## Registering the femur

After the positioning of the pelvic Rigid Body and registration of the APP, the THA Dysplasia workflow proceeds to the femoral registration. The software measures the initial leg length and femoral offset accurately, without the use of a transmitter fixed to the femur. The femoral registration is performed by simultaneously palpating a point on the top of the greater trochanter and on the center of the patella. At this time, the patient's hip joint is required to be intact. The greater trochanter is palpated using the curved hip pointer (FS934) with the passive yellow transmitter, and the patella is palpated using the THAplus pointer (FS871M) with the red transmitter (Fig. 25).

The leg length is determined by the patella palpation point. For most surgical techniques, it is possible to fixate this point by bringing the femur in 90 degree flexion and palpating the center of the patella, which is held under soft tissue tension.

The femoral offset is determined by the greater trochanter point which must be palpated at its most lateral point – shown by the area as a red ellipse by

### Note:

For surgical techniques that prevent 90 degree knee flexion, such as the direct anterior approach, it is crucial that the surgeon marks a point which remains rigid relatively to the knee center. Potential skin movement should be confirmed prior to marking with a pen, as any error in the proximal/distal direction will result in an error in leg length measurement.

the OrthoPilot®. Ensure that this point will not be damaged after the femoral osteotomy, and that it can be palpated during femoral preparation. Palpating the point inaccurately will result in an error in femoral offset measurement.



Fig. 25

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 5 | Navigation procedure THA Dysplasia

### Registering medio-lateral reference point

Place the tip of the pointer on the superior point of the secondary acetabular rim which might be formed by a osteophyte. This point is the medio – lateral reference point for the new cup center. Make sure to place the tip at the appropriate position in superior/inferior. Record the point by short-pressing the right foot pedal (Fig. 26).

### Registering cranio-caudal reference point

Essentially, the initial floor of the acetabulum corresponds to the radiographic teardrop. The teardrop lies in the inferomedial portion of the acetabulum, it is just above the obturator foramen.

The lateral and medial margins correspond to the external and internal acetabular wall. The tear drop gives an accurate assessment of how much medialization is necessary to have the acetabular component rest on the true acetabular floor, so place the tip of the pointer on the teardrop and palpate the surroundings of the teardrop with up to 5 points. Record the point by short-pressing the right foot pedal. The teardrop is the caudal reference for the cup implantation, so the selected point for calculating the distance will be the most caudal point (Fig. 27).

### Registering antero-posterior reference point

The acetabular posterior rim extends from obturator foramen through posterior aspect of the weight bearing dome of the acetabulum and then obliquely through greater sciatic notch, so place the tip of the pointer on the posterior rim of acetabulum and palpate this surroundings with up to 5 points. Record the points by short-pressing the right foot pedal. The selected point for calculating the distance will be the most posterior point (Fig. 28).

#### Note:

During the palpation of the teardrop as well as during the palpation of the posterior rim it is necessary to record at least one point. If you are satisfied with less than 5 points, you can skip the remaining by long-pressing the right foot pedal.

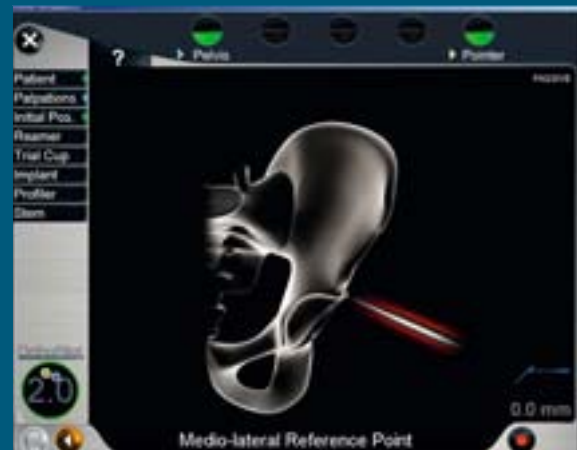


Fig. 26



Fig. 27



Fig. 28



### Pilot hole preparation

To get an information of the bone thickness and to define a sagittal reference plane for the position of the new cup, a pilot hole is drilled. Making the pilot hole at the point with the thinnest bone at the base of the acetabulum is essential to prevent a fracture of the acetabulum by reaming too far medially. Theoretically, the planned position of the cup center and the position of the pilot hole entry point are identical in a Dysplastic hip case. This is because reaming will first take place parallel to the teardrop transverse plane, down to the thickness of the medial wall plus several millimeters, by using a smaller reamer than planned. After this initial reaming, in following steps the anteversion and inclination are decided while using bigger reamer sizes up to the desired cup size. The navigated reaming method is the safest and easiest for determining the planned cup position.

To place this pilot hole at the new cup center, the cranial-caudal distance between the planned cup center and the tip of the pointer is displayed (Fig. 29). In addition, the anterior-posterior distance between the planned cup center and the tip of the pointer is shown. A pilot hole is marked by using hammer pointer (FS869R) with hammer at the medial wall, perpendicular to the bottom of the cup.

#### Note:

Instead of pilot hole registration, the medial wall registration is also available.

The reference point for this procedure is at the deepest place of the fossa acetabuli (medial wall).



Fig. 29



Fig. 30

### Registering the pilot hole

The medial side of the inner wall of the pelvis is palpated and registered through the pilot hole with a hook pointer (FS856R) (Fig. 30).

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 5 | Navigation procedure THA Dysplasia

### Selecting the reamer shaft (optional)

Preparation of the acetabulum can be carried out with a variety of Aesculap reamer heads and reamer shafts (Fig. 31). All available types of reamer heads and shafts are integrated in the navigation program (Fig. 32). To reduce operation time, the reamer selection can be pre-adjusted by the Aesculap technical service.

### Selecting the curved reamer shaft

If a curved reamer shaft is selected, the next OrthoPilot® step is to determine the position of the transmitter adapter on the reamer shaft. For this, six positions are possible in order to optimize the visibility of the transmitter and handling of the reamer. The selected position (A, B, C, D, E, F) must coincide with the laser marking on the instrument (Fig. 33). Adjustment on the OrthoPilot® is carried out via the foot pedal.



Fig. 31



Fig. 32



Fig. 33



## Preparation of the acetabulum

As in the conventional surgical procedure, secure anchorage of the cup implant remains the highest priority in the navigated surgery. The system-specific characteristics must be observed when preparing the implant bed and when inserting the implant.

The acetabulum is prepared using navigated reamers. For this, the yellow transmitter is attached to the adapting position of the reamer sleeve.

The display shows critical information. The angles of inclination and anteversion relative to the anterior pelvic plane are displayed. Using the distance from the reamer's surface to the pilot hole point, the reaming depth and sagittal plane is displayed. Finally, the hip center shift (translation values), with respect to the planned cup center, is shown. All of this valuable data is in real time. In accordance with preoperative planning, the new acetabular center can be prepared. The reamer size to be used is adjusted with the foot switch.

As mentioned above, during the reaming process, the distance between the reamer surface and the pilot hole point and pilot hole sagittal plane is displayed. Over-reaming of this point is indicated by underlying the number in red and the corresponding value in millimeters with a minus sign (Fig. 34).

After completing preparation of the acetabular bed, the surgeon can record the last reamer position by long-pressing the right foot pedal.

## Selecting the Cup Impactor

Different lengths of cup impactors offer solutions for approach or patient specific requirements. All commonly used impactors are integrated in the software. For impactor selection, palpate the tip of the cup impactor with the pointer (FS871M). The passive Rigid Body (FS608) should be attached. OrthoPilot® will show the referent article number at left side bottom in the screen (Fig. 35).



Fig. 34



Fig. 35

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 5 | Navigation procedure THA Dysplasia

### Positioning the trial cup

The trial cup can optionally be inserted to check the acetabular bed and the angle of inclination and anteversion together with the distance information about the distance from the pilot hole point and pilot hole sagittal plane. This is particularly appropriate when using the pressfit cup in order to check if a secure pressfit anchoring will be possible. The current data is displayed in a field with green background. If the final reamer position has been recorded, these values will be displayed with a grey background (Fig. 36).



Fig. 36

### Implantation of the pressfit cup → acetabular component

The final acetabular implant is inserted in the next step. The inclination and anteversion values of the previous screen, corresponding to either the inserted trial cup or the last recorded reamer position, is displayed in the fields with grey background.

When implanting the final implant, the neutral transmitter (FS608) is attached to the standard insertion instrument. The straight as well as the curved impactor can be used.

The current depth of the acetabular component and the distance to the pilot hole can optionally be displayed (Fig. 37). This requires registration of the last reamer position. It will show the difference in cup depth between the final reamer and the current cup center. Additional instruments are used for implanting the Aesculap screw cup or a cemented PE cup. The selected implant type is displayed in the lower left screen corner.



Fig. 37

### Recording the new center of rotation

After implantation of the acetabular component, the new center of rotation is recorded using the recorder handle (FS912R) and the pivoting ball with the corresponding diameter.

Pivoting balls are available for head diameter of 28, 32 and 36 mm. The shift of the center in relation to the planned center of rotation is displayed as 'Cup Values' in the left hand corner of the screen (Fig. 38).



Fig. 38

## Selecting the handle

Different designs of handles offer solutions for approach-specific requirements. All commonly used handles are integrated in the software. Your Aesculap Technical Service Representative can eliminate unused handles, so only the handles used in your hospital are displayed. The image on the screen shows the selected handle and also the correct position of the transmitter and the adapter on the handle. Switching between the handles is possible by pressing the right and left foot switch '+' and '-' (Fig. 39).

The following steps can be navigated:

- Profiler navigation
- Trial reduction with profiler in place
- Navigation of stem implantation
- Reduction with implanted stem

Using a long press of the right foot pedal, the individual steps named above can be skipped.



Fig. 39



Fig. 40

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 5 | Navigation procedure THA Dysplasia

### Profiler navigation

After inserting the final rasp, the Rigid Body adapter (FS918R or FS916R or FS716R or FS718R) with the appropriate holding handle and the blue transmitter is affixed to the rasp handle.

The points at the patella and greater trochanter, which were previously recorded and marked, are again registered consecutively. The patella is recorded first in 90 degree flexion, followed by the point at the greater trochanter.

The straight pointer FS871M with the red transmitter is used for recording the point on the patella. This is done to detect changes in leg length. The offset changes are then determined using the curved pointer FS934 with the yellow transmitter (Fig. 41).

Next, the

- profiler size can be selected and the
  - stem type (standard or offset)
  - head diameter and
  - head neck length
- can be planned.

For this, the curved pointer FS934 with the yellow transmitter is aligned to the screen and used as a virtual mouse pointer. By positioning the orange circle which appears on the screen, the respective implant components are selected and can be changed with the foot switch.

### Repositioning with rasp in place

The leg length and offset can be checked versus the pelvis Rigid Body with the rasp still in place. The trial head has to be put on the rasp.

The femur is repositioned and the blue Rigid Body is fixed to the pelvis Rigid Body again.

By recording the patella point in the same manner as before, the overall leg lengthening is shown. After the palpation of the greater trochanter, in the same manner as before, the value for the offset is shown (Fig. 43).

If the result is acceptable and the position of the rasp, and therefore the stem, has been confirmed, the rasp can now be removed.



Fig. 41



Fig. 42



Fig. 43

## Stem navigation

To navigate the final position of the stem with the femur dislocated, the stem is first implanted.

The blue cone (FS981, FS982), corresponding to the stem neck taper (8/10 or 12/14) is screwed onto the recorder handle (FS912R). The blue Rigid Body is attached to it.

The recorder handle is then firmly but gently attached to the stem's neck while the patella point is palpated with the red Rigid Body on the pointer FS871M. The leg lengthening is once again displayed for the different necks available. Next, the point at the greater trochanter is recorded while the recorder handle is still applied to the stem neck taper. The offset shift is shown for this stem position (Fig. 44).

The Metha® modular short stem prosthesis offers the possibility of joining the taper either before ('extracorporeal') or after ('intracorporeal') implantation of the stem.

In this extracorporeal procedure option, the position of the stem is recorded by means of the recorder handle FS912R with the taper adapter sleeve FS982. For this, the assembled instrument with the blue transmitter is attached to the taper of the implanted prosthesis.

In the intracorporeal joining procedure, the position of the stem is detected via the implant pointer with the blue transmitter, which must be inserted into the taper as far as it will go.

## Repositioning with implanted stem

Recording the femur position after repositioning allows the change in leg length and offset to be checked with the final condition of the implanted stem. As soon as the hip joint has been repositioned, the points that were palpated for femoral referencing are again recorded consecutively and the final values for the changes in leg length and offset are displayed (Fig. 45).



Fig. 44



Fig. 45

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 6 | Reporting

A documentation is automatically created for each patient. This is accessed by the 'Reports' module, which appears on the start screen.

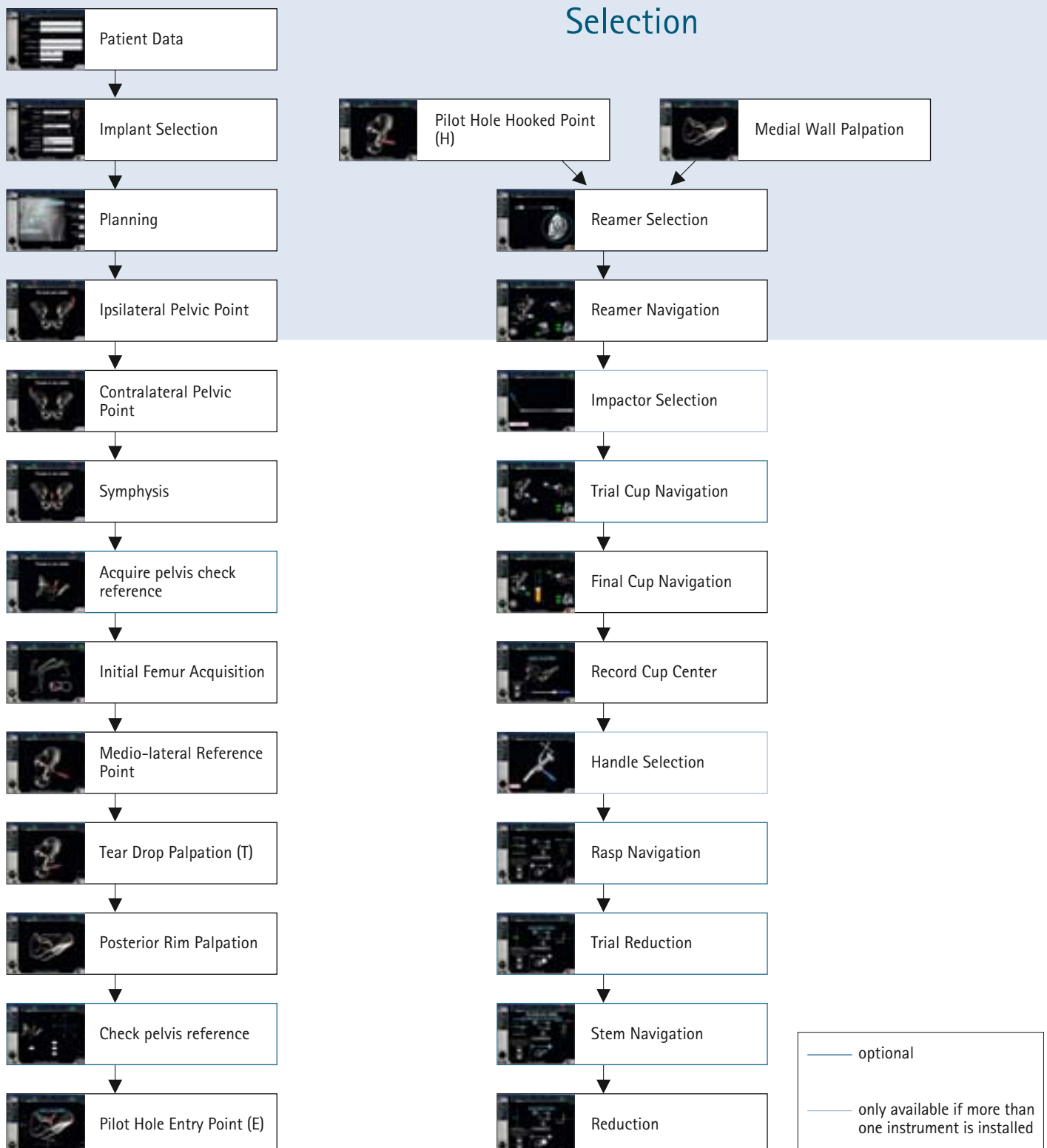
The patient-specific data can be retrieved via the search field function.

The report itself is issued in an HTML file format and can be transmitted to a USB stick or an SD card, depending on the OrthoPilot® model.





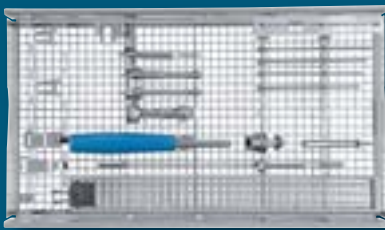
## 7 | Schematic workflow THA Dysplasia



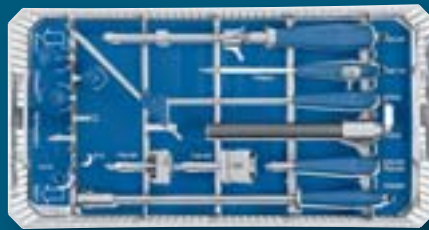
# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 8 | Overview of Instrument

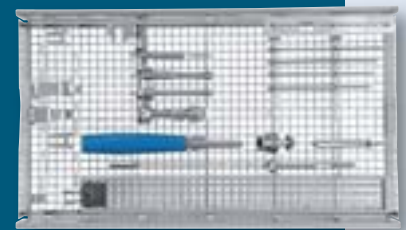
Supine position – upper tray



Supine position – lower tray



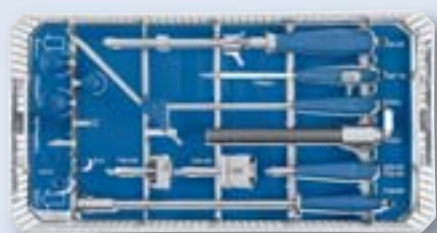
Lateral position/anterior approach – upper tray



FS703			FS703			FS704		
1	OrthoPilot® Rigid Body adapter for screw	NP619R	1	OrthoPilot® THA positioning for FS702-FS705	FS706R	1	OrthoPilot® Rigid Body adapter for screw	NP619R
1	OrthoPilot® RB adapter	NP626R	1	Graphics template for FS706R (FS703-FS705)	TE917	1	OrthoPilot® RB adapter	NP626R
1	OrthoPilot® bicort. RB holding screw 35 mm	NP621R	1	OrthoPilot® THA recorder handle	FS912R	1	OrthoPilot® bicort. RB holding screw 35 mm	NP621R
1	OrthoPilot® bicort. RB holding screw 40 mm	NP622R	1	OrthoPilot® ACL pointer str.	FS871M	1	OrthoPilot® bicort. RB holding screw 40 mm	NP622R
1	OrthoPilot® bicort. RB holding screw 45 mm	NP623R	1	OrthoPilot® THA in/out impactor for nails	FS936R	1	OrthoPilot® bicort. RB holding screw 45 mm	NP623R
1	OrthoPilot® bicort. RB holding screw 50 mm	NP624R	1	OrthoPilot® THA glove protector	FS939	1	OrthoPilot® bicort. RB holding screw 50 mm	NP624R
1	Acculan® II hex-chuck (Targon®)	GB413R	1	OrthoPilot® THA active pointer, angled 45°	FS934	1	Acculan® II hex-chuck (Targon®)	GB413R
1	Manual screw-in tool for attachment pins	NP614R	1	OrthoPilot® THA pivoting sphere, D 28 mm	FS979	1	Manual screw-in tool for attachment pins	NP614R
1	Screw driver A/F 3.5 Torx, motor-driven	NE358R	1	OrthoPilot® THA pivoting sphere, D 32 mm	FS980	1	Screw driver A/F 3.5 Torx motor-driven	NE358R
1	OrthoPilot® THA, extension for C-clamp 60 mm	FS908R	1	OrthoPilot® THA pivoting sphere, D 36 mm	FS983	1	OrthoPilot® THA, extension for C-clamp 60 mm	FS908R
1	OrthoPilot® THA pelvic nail, dorsal pos.	FS984R	1	OrthoPilot® THA taper adapter 8/10 mm	FS981	1	OrthoPilot® THA, pelvic nail, lateral pos. 95 mm	FS985R
1	OrthoPilot® THA, C-clamp for dorsal pos.	FS906R	1	OrthoPilot® THA taper adapter 12/14 mm	FS982	1	OrthoPilot® THA, C-clamp for lateral pos., anterior	FS901R
1	OrthoPilot® THA, C-clamp for dorsal pos., small	FS897R				1	OrthoPilot® THA, C-clamp for lateral pos., large, ant.	FS898R
1	1/1 Sieve tray lid, large perforat. 489 x 257 mm	JH217R				1	1/1 Sieve tray lid, large perforat. 489 x 257 mm	JH217R



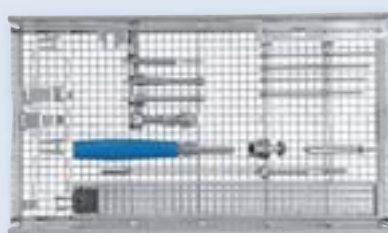
**Lateral position/anterior approach – lower tray**



**FS704**

1 OrthoPilot® THA positioning for FS702-FS705	FS706R
1 Graphics template for FS706R (FS703-FS705)	TE917
1 OrthoPilot® THA recorder handle	FS912R
1 OrthoPilot® ACL pointer str.	FS871M
1 OrthoPilot® THA in/out impactor for nails	FS936R
1 OrthoPilot® THA glove protector	FS939
1 OrthoPilot® THA active pointer, angled 45°	FS934
1 OrthoPilot® THA pivoting sphere, D 28 mm	FS979
1 OrthoPilot® THA pivoting sphere, D 32 mm	FS980
1 OrthoPilot® THA pivoting sphere, D 36 mm	FS983
1 OrthoPilot® THA taper adapter 8/10 mm	FS981
1 OrthoPilot® THA taper adapter 12/14 mm	FS982

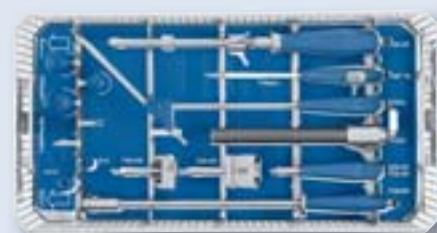
**Lateral position/posterior approach – upper tray**



**FS705**

1 OrthoPilot® Rigid Body adapter for screw	NP619R
1 OrthoPilot® RB adapter	NP626R
1 OrthoPilot® bicort. RB holding screw 35 mm	NP621R
1 OrthoPilot® bicort. RB holding screw 40 mm	NP622R
1 OrthoPilot® bicort. RB holding screw 45 mm	NP623R
1 OrthoPilot® bicort. RB holding screw 50 mm	NP624R
1 Acculan® II 6-KT chuck (Targon®)	GB413R
1 Manual screw-in tool for attachment pins	NP614R
1 Screw driver A/F 3.5 Torx, motor-driven	NE358R
1 OrthoPilot® THA, extension for C-clamp 60 mm	FS908R
1 OrthoPilot® THA, pelvic nail, lateral pos. 95 mm	FS985R
1 1/1 Sieve tray lid, large perforat. 489 x 257 mm	JH217R
1 OrthoPilot® THA, C-clamp for lateral pos., post.	FS907R
1 OrthoPilot® THA sm. C-clamp for lateral pos., post.	FS899R

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



**FS705**

1 OrthoPilot® THA positioning for FS702-FS705	FS706R
1 Graphics template for FS706R (FS703-FS705)	TE917
1 OrthoPilot® THA recorder handle	FS912R
1 OrthoPilot® ACL pointer str.	FS871M
1 OrthoPilot® THA in/out impactor for nails	FS936R
1 OrthoPilot® THA glove protector	FS939
1 OrthoPilot® THA active pointer, angled 45°	FS934
1 OrthoPilot® THA pivoting sphere, D 28 mm	FS979
1 OrthoPilot® THA pivoting sphere, D 32 mm	FS980
1 OrthoPilot® THA taper adapter 8/10 mm	FS981
1 OrthoPilot® THA taper adapter 12/14 mm	FS982
1 OrthoPilot® THA pivoting sphere, D 36 mm	FS983

# OrthoPilot® THA Dysplasia – Total Hip Arthroplasty

## 8 | Overview of Instrument

### Reference markers, passive



### Instruments please order separately

FS926			FS928		
1	OrthoPilot® THA position- ing transm., passive	FS919R	1	Hook pointer	FS856M
1	OrthoPilot® passive Rigid Body, yellow	FS633	1	Hammer pointer	FS869R
1	OrthoPilot® passive Rigid Body, blue	FS634	1	OrthoPilot® THA passive Rigid Body Plasmacup®	FS608
1	OrthoPilot® passive Rigid Body, red	FS635	1	OrthoPilot® THA Metha® implant pointer supine position	FS903R
1	1/1 basket tray lid, perforated, 489 x 257 mm	JF217R	1	OrthoPilot® THA Metha® implant pointer lateral position posterior	FS904R
			1	OrthoPilot® THA Metha® implant pointer lateral position anterior	FS905R
			1	OrthoPilot® THA RB adapter supine position	FS716R
			1	OrthoPilot® THA RB adapter lateral position	FS718R
			1	OrthoPilot® THA RB adapter for Metha® supine position	FS916R
			1	OrthoPilot® THA RB adapter for Metha® lateral position	FS918R

## Specific products

Software module		CD		Consumables	
OrthoPilot® THA Dysplasia	FS223R	Demonstration DVD	M04811	16 passive markers, sterile, marking spheres, indiv. packed	FS617
		Instruction for use THA Dysplasia	TA013149		



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