KNEE3

SURGICAL TECHNIQUE – MOTION

Femur First

BRAINLAB

Purpose

This Surgical Technique is based on the Brainlab KNEE3 software. It documents how KNEE3 may be used in a clinical setting, but it is not meant as a replacement to the KNEE3 Software User Guide. For questions regarding recommended use of Brainlab equipment and/or software, always refer to the KNEE3 Software User Guide as your first level of product support. The training provided to the customer is based on the product-specific training requirements. Users must be trained and qualified to operate the KNEE3 navigation system. Contact Brainlab Customer Support if new users require training.

KNEE3
MOTION

Femur First Technique

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A software guided surgery for total knee replacement

Contents

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OR Setup

Camera Placement

The ideal position for the camera is at a distance of about 1m to 1.5m on the opposite side of the surgeon's position on the table, approximately between 90° and 45° towards the foot of the patient. The camera is equipped with a laser pointer. Point the laser at the center of the knee joint when the knee is in flexion.

The camera should be switched on for several minutes prior to use, as the infrared source needs some time to reach maximum efficiency. Any light sources or highly reflective objects should not be within the camera's field of view, as reflections can interfere with the procedure.

Screen Placement

A good position for the display is on the opposite side of the surgeon's position next to the camera.

User interaction with the touchscreen is reduced to a minimum through an adaptive workflow. Nevertheless, sometimes it may be necessary to make inputs on the screen (e.g. to adjust implant size). In these cases, the optional footswitch or sterile monitor drape can optimize operating the navigation system.

Art. no. 18460 Footswitch
Art. no. 18071-50 Disposable Sterile Monitor Drapes 40 pcs

ASSISTENT

OPERATING SURGEON
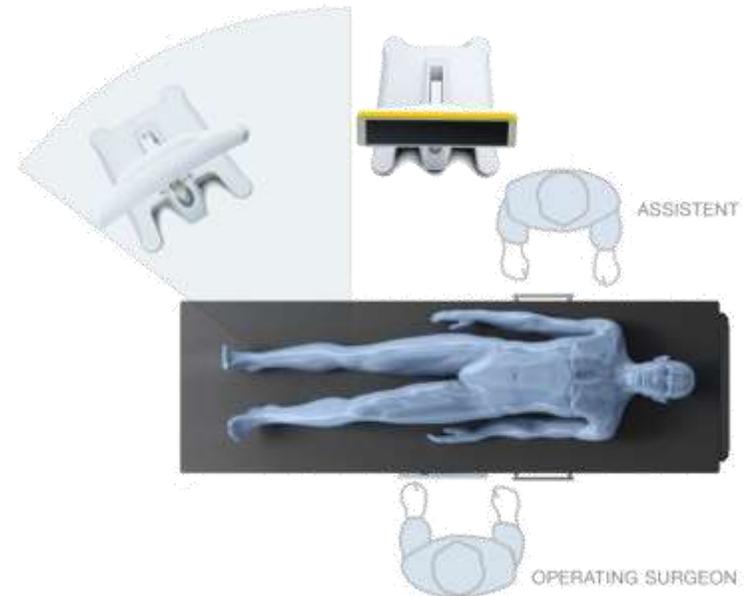
Software Start & Patient Selection

Start the KNEE3 Motion Workflow by pressing the corresponding icon on screen. Enter the patient name and ID or select a patient from the patient list. Press "Done" to proceed. To start the knee application, press the "KNEE3 Motion" icon. Select the implant and the treatment side.

The default resection settings are based on the manufacturer specifications, e.g. 3° of posterior tibia slope. Femoral component flexion is set to 3° by default.

NOTE: Femoral component flexion in KNEE3 is shown relative to the femoral mechanical axis. Conventional instrumentation uses either the distal anatomical axis or the femoral mid-shaft axis instead. Thus, depending on the patient population, neutral anatomical flexion corresponds to 3°-5° of flexion relative to the mechanical axis.

These parameters can be changed according to the surgeon's preference and are linked to the selected implant and user.

To proceed, press "Navigate".
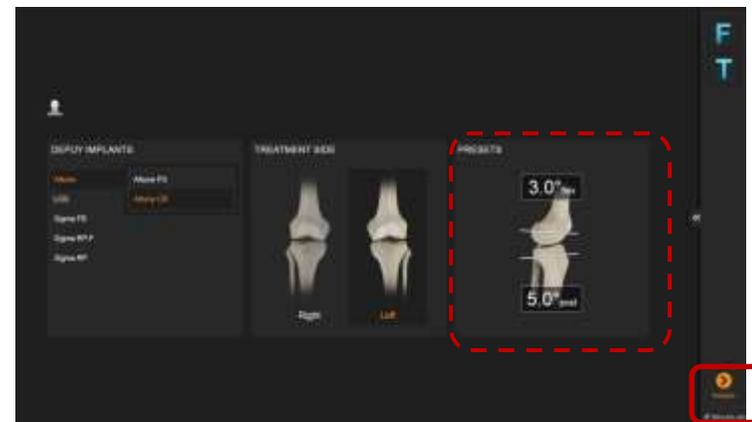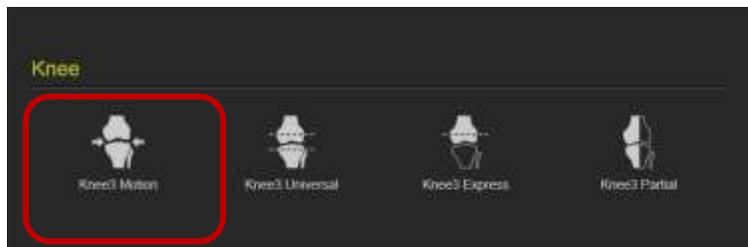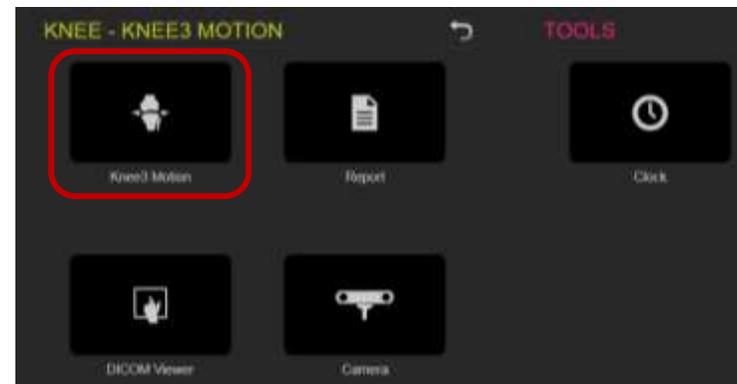
Instrument Preparation

At the scrub table, prepare instruments with marker spheres. 12 marker spheres are needed for a surgery. Tightly screw the spheres onto the socket. If the markers are not tightly screwed on the socket the instruments might not be detected at the correct position. If a marker is soiled the detected instrument position might be wrong. Remove reference arrays before resection to avoid soiling.

Art. no. 41774 Disposable Marker Spheres 270 pcs

Art. no. 41773 Disposable Marker Spheres 90 pcs

The Y-shaped array is placed on the femur, the T-shaped array on the tibia. During navigation they define the position of the bones.

Art. no. 52410 Reference Array T-Geometry, X-Press

Art. no. 52411 Reference Array Y-Geometry, X-Press

The pointer is used for registration of anatomical landmarks and measurements throughout the case. To ensure that the pointer is not bent, place it into the corresponding gauge.

Art. no. 53109 Pointer Straight

Art. no. 53101 Pointer Angled (optional)

The Plane Tool or Universal Cutting Block Adapter are used for navigating and verifying resections. The foot of the Plane Tool is inserted into the corresponding cutting block while fixing the block onto the bone.

Art. no. 53200 Plane Tool

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Incision & Exposure

Incision and exposure to the knee joints should be performed based on the surgeons' choice of technique. Brainlab knee navigation instruments support all standard approaches.

The incision must allow good exposure of the compartment to be resurfaced.

After initial exposure, assess the extent of arthritic damage and the ligaments including the ACL and remove all prominent osteophytes from the medial (or lateral) edges of femur and tibia and in the intercondylar notch.

Reference Marker Placement

Brainlab Knee instruments are designed to be used with a variety of pins. It is recommended to use 3.2mm self-drilling, self-tapping pins as available from Brainlab. Alternatively, any pins between 3mm and 4mm can be used based on surgeons' preference. Please refer to the respective user guide for drilling, if using different pins.

Art. no. 54932 Adapter For AO Coupling (for 54922)
Art. no. 54922 Disposable Schanz Screw (AO) 3,2mm x 100mm
Art. no. 54908 Disposable Schanz Screw (AO) 4mm x 125mm

Tibia

The tibial array can be placed either inside or outside the incision. The pins need to be placed distant from the intended positions of both the femoral and tibial instruments to avoid any contact during bone resection and drilling.

When placing the pins inside the incision, a position slightly medial of the anticipated position of the cutting block, angled slightly downwards is recommended.

Alternatively, the pins can be placed through small stab incisions on the anterior cortex approximately in the middle of the tibia.

If the pins are angled slightly to the medial side, extra medullary tibial instrumentation can be used for cutting block placement and adjustment as well as additional stability.

Please refer to standard instructions for the placement of pins and screws, such as the AO Guidelines, for exact safe zones for angulation and placement of the pins.

Place the first pin directly at the desired location, slide the Bone Fixator 2-Pin over the first pin (make sure the fixation screw is open) and place the second pin through the pinhole. Tighten the fixation screw securely to the bone in the correct orientation.

The T-reference array is connected to the fixation using the X-press mechanism. The T-reference has a joint with two degree of freedom, allowing adjustment of the orientation. Recommended orientation of the T-reference is rotated towards the camera, slightly tilted upwards parallel to the tibia.

Note the adjustment mechanism allows for discrete positions in both degrees of freedom. Make sure the interface is in one of these positions before tightening the screw. If placed at in-between positions, the mechanism might snap into one of the predefined positions during the procedure, and thus losing the fixed reference.

Femur

The femoral array can be placed either inside or outside the incision. If placed outside the incision, care must be taken to limit soft tissue damage. Excess stress on pin fixation must be avoided during range of motion intra-operatively. Inside the incision, make sure to leave space for femoral instrumentation as well as resections during final preparation.

Again, place the first pin directly at the desired location, slide the Bone Fixator 2-Pin over the first pin (make sure the fixation screw is open) and place the second pin through the pinhole. Tighten the fixation screw securely to the bone in the correct orientation.

Art. no. 52429 Bone Fixator 2-Pin, Flip-Flop, X-Press

Recommended orientation of the Y-reference is rotated towards the camera, substantially tilted upwards from parallel to the femur. This will allow visibility of the femoral reference even in deep flexion. Again ensure the interface is not at in-between positions before tightening the fixation screw.

Art. no. 52411 Reference Array Y-Geometry, X-Press

Alternatives

The optional Brainlab adjustable cutting block allows precise adjustment of the distal femur cut, while only a rough initial placement is necessary. In addition, the femoral reference array can be attached to the base of the cutting block, therefore requiring no extra pins. Note that this allows only navigation and resection of the distal femoral cut, as the fixation pins for the block and base will interfere with the anterior femoral resection.

Art. no. 5323x Adjustable Cutting Block – Femur Kit 1.19/ 1.27/ 1.37mm

Instead of the 2-pin fixation described above, 1-pin fixations can be used both on tibia and femur. 1-pin fixation requires 5mm screws to be used for fixation. Refer to the user manual for instructions. 1-pin fixation is not recommended in weak bone quality and in cancellous bone areas in particular when placed inside the incision.

Art. no. 54909 Disposable Schanz Screw (AO) 5mm X 175mm
Art. no. 5242x Bone Fixator 1-Pin Size S/M/L

Registration

After again checking visibility of the reference arrays over flexion and extension of the knee, start registering the anatomical landmarks.
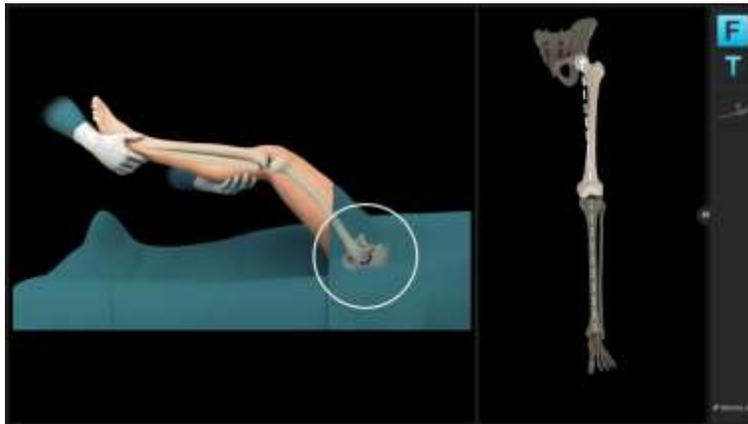
Femur

On the femoral side, the following bone landmarks are registered:

- Femoral Head Center
- Distal Femoral Axis Point
- Medial and lateral epicondyles
- Whiteside's Line (optional)
- Medial and lateral femoral condyles (optional)
- Anterior Cortex

Femoral Head Center

The femoral head center point defines the proximal part of the Mikulicz Line and femoral mechanical axis.

Make sure the femoral reference array is visible to the camera. The system will produce a humming visibility sound (if turned on in Settings, see Appendix) while the femur reference is visible.
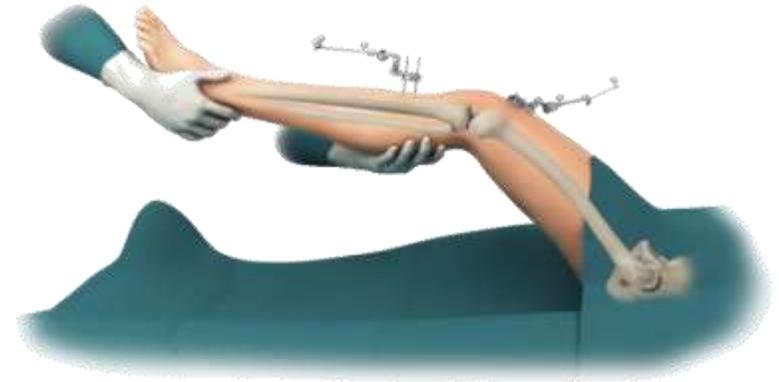
Bring the leg from flexion to extension and back, then slightly rotate the leg externally and repeat the flexion-extension movement. Alternatively, apply circular motions of the femur around the hip center.

The system calculates a series of points to determine the rotational center and will automatically proceed when the rotational center has been accurately calculated.

Make sure that the patient's pelvis is not moved during registration, as this may lead to miscalculation of the femoral head center. If the surgeon is having difficulty acquiring the femoral head center, it is helpful to have an assistant hold the pelvis firmly.

Furthermore do not move the Camera while moving the leg.

Distal Femoral Mechanical Axis Point

Defining the femoral mechanical axis is important for determining the varus/valgus and flexion/extension alignment of the femoral component, as well as overall leg alignment. Care should be taken to be as accurate as possible when collecting this point. The pointer should be placed slightly in medial at the posterior aspect of the femoral notch point (as indicated on screen) and pivot the pointer.

The acquisition of this point along with the femoral head center completes the femoral mechanical axis.

Epicondylar Line

Acquisition of the medial and lateral epicondylar points is used to define the epicondylar line as well as a reference for internal calculations.

Note that it has been shown in various studies that the epicondylar axis might be difficult to locate in particular in knees with large deformities. It is recommended to use the surgical transepicondylar axis as defined by the most prominent points on the medial and lateral epicondyles, but keeping in mind the variability of that landmark in particular in deformed knees when using it as the main rotation reference.

Whiteside's Line (Anteroposterior Axis)

Whiteside's Line is used to define the femoral AP direction. Furthermore it can be used as an optional reference for femoral component rotational alignment. It may be marked initially using electrocautery or a sterile pen. It is easiest to draw by looking along the horizon of the trochlear groove. Align the pointer along the line marked and hold the pointer still for two seconds to register.

Note: This registration step can be skipped if desired. This will result in no rotation to Whiteside's line being displayed during navigation and planning.

Femoral Condyles

A number of points along the surface of the medial and lateral condyles are acquired using the pointer. The tip of the pointer should "paint" the surface of the condyles. Points should be acquired as posteriorly as possible and along the distal part of the affected condyles. The system determines the most distal and most posterior points from all the data collected.

Start with pivoting on the distal aspect of the condyle, then move to posterior in a zig-zag motion to make sure to cover the most prominent points of the condyles.

The screen shows the current position of the pointer in one of the five sectors. In each sector, a certain number of points need to be collected. The software will proceed once all sectors are covered.

Note: Registration of one or both condyles can be skipped, in particular if for example in a revision from a partial to a total knee replacement one condyle is missing. A skipped condyle will result in no resection levels or joint line information being displayed on the respective side, as well as no rotation to the posterior condylar line being shown during navigation and planning. All other functionalities, including gap calculations, are not affected.

Anterior Cortex

A number of points along the surface of the anterior cortex are acquired using the pointer. To register, put the pointer tip on the anterior femoral cortex and pivot the pointer to start the acquisition. Slide the pointer over the bone surface to "paint" the surface of the cortex. Points should be acquired on the lateral side of the anterior femoral cortex, until the superior border of the femoral implant.
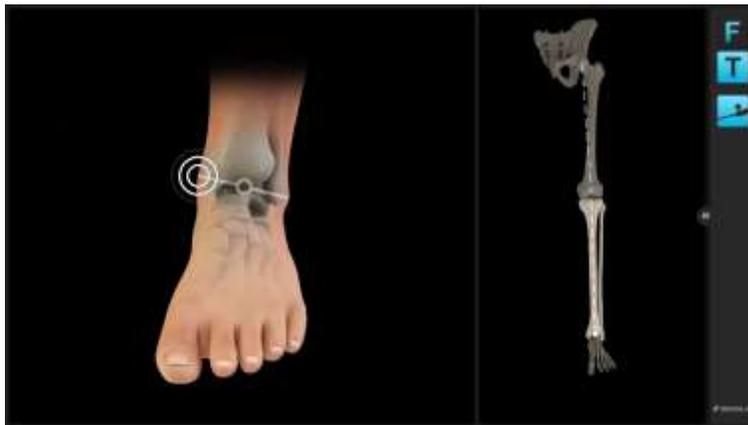
The anterior cortex is used as a reference for the exit of the anterior cut plane and determines the femoral components AP position and sizing.
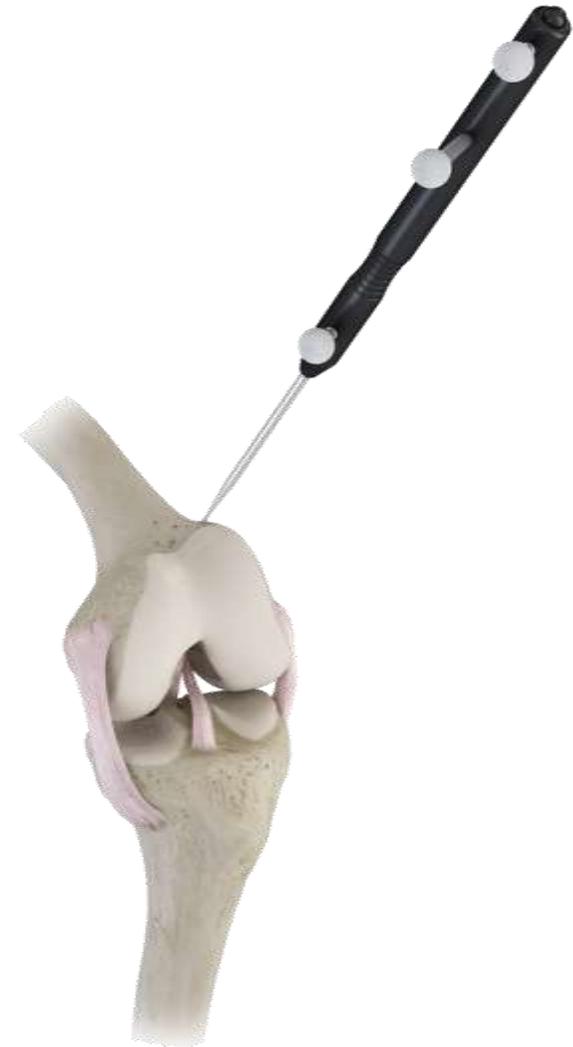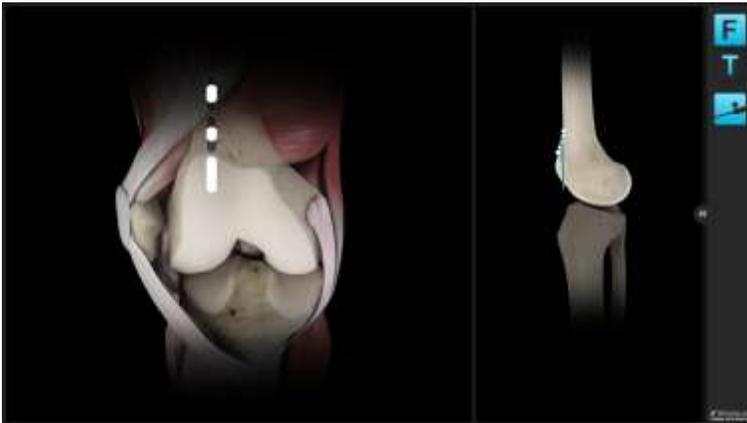
Tibia

On the tibial side, the following bone landmarks are registered:

- Medial and lateral malleolus
- Proximal tibial mechanical axis point
- Tibial AP direction
- Medial and lateral tibial plateau (optional)

Malleoli

The malleoli can usually be located by palpating of the most prominent point of the malleoli before acquiring the points. It is important that draping or bandaging is reduced to a minimum to enable the malleoli to be located and registered accurately.

Place the tip of the pointer on the medial malleolus and pivot the pointer. Once the system has registered the medial malleolar points, the lateral malleolar point can be registered in the same way. Acquiring the malleoli defines the most distal point of the axis.

Proximal Tibial Mechanical Axis Point

The proximal point on the tibial mechanical axis is defined by acquiring the posterior aspect of the ACL tibial insertion point.

This is indicated by the circle on the screen. Additionally the intersection of the mid-coronal and mid-sagittal planes can be used for the identification of this point.

The definition of the mechanical axis is the basis for all further calculations and should be acquired as accurate as possible. Final implant position will be referenced to the mechanical axis.

Tibial AP Direction

The pointer is placed horizontally in the AP direction, so that it lies on the tibial eminence. The handle should be in line with the medial third of the tibial tubercle. The pointer is held in place for a few seconds to allow the system to calculate the direction.

The system determines the direction the tibia is facing and the direction of any intended slope which may need to be cut. The rationale behind this is to avoid a compound tibial slope (oblique tibial slope). Accurate acquisition of the AP direction will help to avoid an oblique tibial slope in the anteromedial to posterolateral direction or anterolateral to posteromedial direction.

Compound slope can put the tibial component into varus or valgus and lead to poor tibial/femoral contact. This can in turn lead to malalignment.
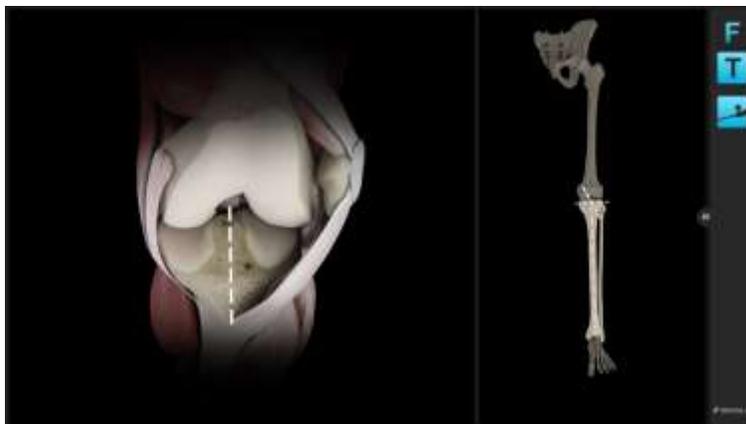
Tibial Plateau

A single point on each plateau is used to calculate the tibial resection level. Careful consideration should be given if there is bone defect present. The software will show resection height numbers from this reference point.

Note: Registration of one or both tibia plateau points can be skipped, in particular if for example in a revision from a partial to a total knee replacement one plateau is missing. A skipped condyle will result in no resection levels being displayed on the respective side during navigation and planning. All other functionalities, including gap calculations, are not affected.
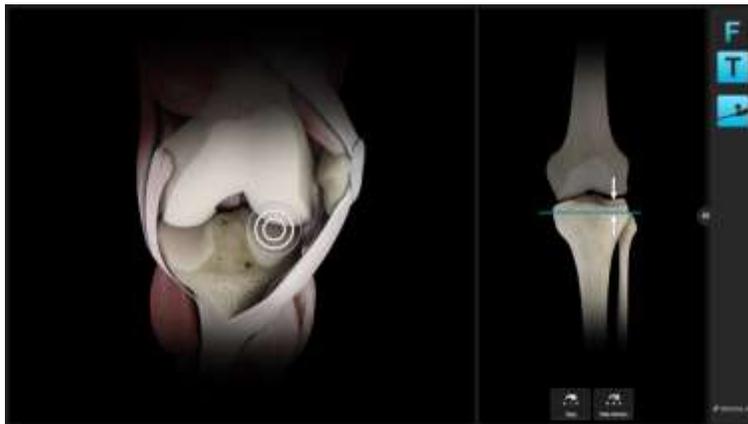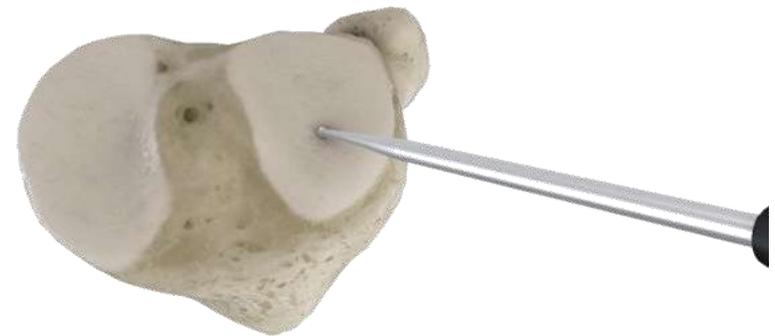
Surgical Technique Overview

This document describes a femur first technique; however KNEE3 Motion does not use predefined workflows leading the surgeon in a particular sequence of resections. The software instead simply follows the sequence of steps performed surgically. Nevertheless, depending on the sequence of resection, surgical considerations at each step might be slightly different, due to the available options for cutting block positioning.

Femur First Technique

Femur first techniques are probably the most common technique for total knee replacement. Note that in contrast to conventional femur first techniques, using computer navigation with KNEE3, the final implant stability effect of the tibial resection, while not being performed, can still be anticipated during the femoral resection steps, potentially enabling the surgeon to use that information to alter the femoral component position slightly to accommodate for potential unbalanced gaps.

An extension gap first balancing technique, with tibial resection performed after the distal femoral resection, does enable the surgeon to use a fixed spacer block to balance the knee joint in extension and subsequently adjust the flexion gap to the established extension gap during positioning of the anterior resection.

Tibia First Technique

In contrast to the femur first techniques, the tibia first technique allows access to the back of the joint and at least partial removal of osteophytes for balancing, before any compromises have been made on the femoral cuts. Therefore, this technique offers the most options to achieve balanced gaps in extension and flexion using the desired implant size.

If no other surgical considerations stand against this approach, this sequence of steps is recommended.

For a detailed description of the Tibia First sequence refer to the dedicated Brainlab KNEE3 Motion Tibia First Surgical Technique.

Adaptive Workflows

Brainlab KNEE3 follows the user. It automatically identifies the current treatment step and displays the matching content on the screen. If for example the tibia cutting block with the Plane Tool is positioned on the tibia cortex the software displays tibia cut navigation values.

The following navigation steps are available:

- Distal femur cut navigation
- Anterior femur cut navigation
- Tibia cut navigation

Simply use the Plane Tool for navigation or the pointer for measurements and the software will automatically display the according information.

Note: The order of cuts can be chosen by the user and is not predefined in the software.

When no tool (Plane Tool, Pointer) is used, the software displays the leg alignment screen. It allows evaluating leg axis and flexion range as well as joint stability.

When the software detects that a cutting block is positioned on the bone, it displays all relevant information for the respective resection. All values are calculated relative to bone references.

Blue lines show the current cut position relative to bone landmarks. White lines represent the planned and yellow lines the verified cut.

Note: All values are referenced to bone landmarks. If you want to navigate to your planned resections you can use the yellow lines as visual guide.

Femur First Technique

Initial Leg Alignment - Screen Layout

After registration is finished, the screen is basically split into two parts:

The left hand side of the screen shows the current bony anatomical situation and measurements regarding the implant position, the right hand side shows the expected stability of the knee joint after implantation, even if no resections have been done yet. The software uses the planned, the current or the verified resection plane position to calculate the predicted stability. All calculations are based on a virtual implantation; therefore at any time in the procedure, the numbers denote the same values.

Initially, the implant is placed based on measured resection principle philosophy, with no joint line shift, neutral femoral flexion and coronal alignment, and femoral rotation based 3° external to the posterior condyles (or another rotation reference if selected), and the standard values defined by the implant manufacturer. As the surgeon makes changes to the planned implant position throughout the procedure, the implant position and the stability graph is updated accordingly.

Varus/Valgus Stress Testing

Bring the leg into full extension and apply varus and valgus stress to test stability and check for fixed flexion or other deformities. Bring the leg into maximum flexion, again applying varus and valgus stress during the movement. The stability graph on the right now shows the calculated implant stability assuming the implant position on the left screen side.

At this stage, based on the alignment information, decisions might be already derived regarding potentially necessary releases. In case of fixed flexion deformities, full extension might not yet be reached.

Storing Pre-operative Alignment

To store the pre-operative alignment, bring the leg in full extension without applying stress, then lift the fully extended leg approximately 10 cm. The software will interpret the lifting gesture and store the alignment.

Alternatively, pressing the "Store" button on screen will also store the alignment.

Note: At this step, tibial AP registration can be crosschecked kinematically. At 90° flexion, the tibial mechanical axis should not deviate significantly from the long leg mechanical axis. A significant deviation either denotes excessive tibial rotation or an erroneously registered tibial AP direction.
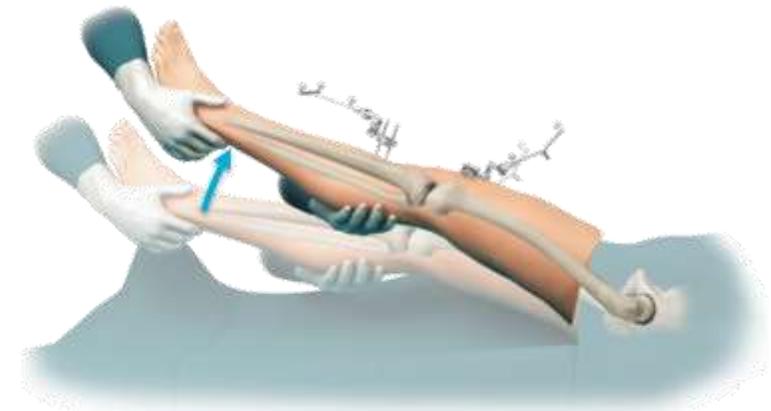
Distal Femoral Resection

In a femur first technique, the next step is the distal femoral resection. Attach the navigation plane tool to the distal cutting block for your implant. You may use optional adjustable distal cutting block as well for this step, refer to the user manual guide for details.

The software automatically switches to the distal femoral navigation information as soon as the resection block with the plane tool is close to the right position. The current position of the cutting plane is shown as a blue plane.

Art. no. 53202 Knee Plane Tool - Cutting Block Adapter
Art. no. 53201 Knee Plane Tool – Tracking Array
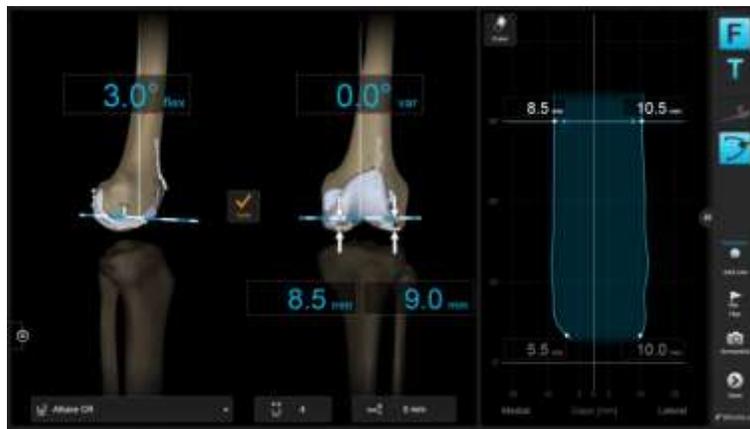
Initially, the femoral component is placed according to manufacturer specifications following a measured resection philosophy. Femoral sizing is based on the AP dimensions of the registered femur. All measured numbers are shown in relation to the corresponding femoral landmarks.

Note that femoral component flexion is shown in relation to the femoral mechanical axis, while conventional instrumentation is using anatomical axes instead. Depending on the type of intramedullary rod, a neutral component flexion is based either on the distal anatomical axis, or the femoral mid-shaft axis. Depending on your particular patient population, this axis might be in 3°-5° of flexion to the mechanical axis.

Stability Information

While navigating the distal femoral cutting block to the desired location, the stability graph on the right shows in real time the effect of the current cutting block position on the final result. Increasing resection height opens up the extension gap, adding more flexion or proximalizing the resection closes the gap in flexion.

Make sure at this point the software is using the same femoral component size you have pre-operatively planned for this patient. If the size deviates, change it using the controls on the bottom of the screen. Compare the difference between the flexion gap and the extension gap. With the correct implant size chosen, flexion and extension gaps should be approximately equally large.

Note that equality of the medial and lateral gaps in flexion is not influenced by this step and will be addressed with the anterior resection later. To assess and compare the flexion and extension gap size, you might use the sum of medial and lateral gap in flexion at this point.

Note that in case of a fixed flexion deformity, the extension gap might still increase after subsequent releases (e.g. posterior capsule and/or posterior osteophytes) after getting access to the back of the joint.

At this point, the extension gap can be altered by increasing or decreasing the distal femoral resection. A distalized resection level will close the extension gap, while a proximalizing opens the extension gap. To open the flexion gap, downsizing the femoral component might be considered.

If an extension gap asymmetry cannot be solved by osteophyte removal or soft tissue releases, anatomical alignment of the distal femoral cut might be considered.

Placement of Cutting Block & Resection

Once the cutting block is at the desired position, place the first pin fixing the cutting block. Constantly check for changes in alignment during drilling. Place the second pin, correcting for any alignment deviations from the first pins. If necessary, fix the block using additional oblique pins and perform resection.

Cut Verification

After performing the resection, verify the resected surface by placing the cutting block adapter on the resection. Hold the plane tool still and the software records the resections plane position, updating the stability graph.

Alternatively press the "Verify" button on screen to verify the cut. Verifying distal resection will show the effect of potential deviations from the desired position immediately, making it easy to judge if the deviation can be accepted or need reassessment of the cut.

Note that verification of a resected surface will adjust the plan accordingly for the subsequent steps, therefore showing the yellow plane at the same location as the blue plane. Crosscheck the result of the resection using the displayed numbers with respect to the bone landmarks as well as with respect to the calculated final stability outcome.

Art. no. 53204 Knee Plane Tool – Bone Verification Plate, Small
Art. no. 53201 Knee Plane Tool – Tracking Array
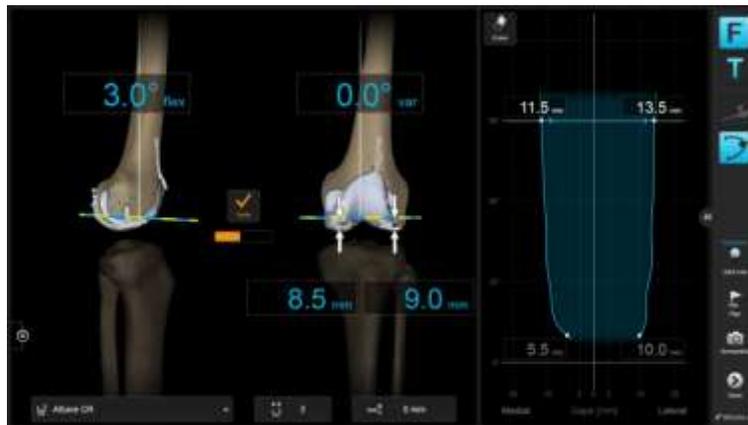
Anterior Femoral Resection

Following the distal femoral resection, femoral implant rotation is defined by the anterior femoral resection. Attach the navigation plane tool into the anterior cutting slot of the 4-in-1 cutting block for the appropriate implant size, and place the resection block on the resected distal femur. The software will automatically show the information required for anterior resection navigation. The target resection plane for the implant is displayed in white. It is already placed according to the selected rotation reference. The other rotation references can be displayed by pressing the (+) button next to the selected main rotation reference. By selecting either of the two other rotation references, the according landmark will be used as the main rotation reference. Rotate the cutting block, such that the desired rotation to your selected rotation reference is achieved. Cross-check with the other two rotation references as well as with the soft tissue information on the right if necessary.

Place the cutting block at the appropriate AP position by looking at the shift from the registered anterior cortex area, or simply verify the position using a conventional tool to avoid notching.

Art. no. 53203 Knee Plane Tool – Bone Verification Plate
Art. no. 53201 Knee Plane Tool – Tracking Array

Assess the predicted post-operative gap values in the stability graph on the right hand side of the screen. In case of substantial gap inequality, you may alter the cutting block position. AP shift will result in increasing/decreasing the flexion gap. Internal/external rotation of the 4-in-1 block will help creating a rectangular flexion gap. If internal/external rotation of more than 3-5° is needed to equalize medial and lateral flexion spaces you might want to consider whether osteophyte removal might still be incomplete or if additional soft tissue releases are needed.

You may want to use a tensioning device in flexion, to make sure the software is using most up to date information about the ligament situation and to visualize changes in alignment. Simply apply tension to the joint while both tibial and femoral reference arrays are visible to the computer to update the gap information.

Once the desired position of the cutting block is achieved, pin it securely in place and perform the anterior resection.

Cut Verification

After performing the cut, verify the resected surface by placing the cutting block adapter on the resection. Hold the plane tool still and the software records the resections plane position, updating the stability graph.

Alternatively press the "Verify" button on screen to verify the cut.

Art. no. 53204 Knee Plane Tool – Verification Plate, Small
Art. no. 53201 Knee Plane Tool – Tracking Array

Tibial Resection

While in a full femur first technique the anterior resection follows directly after the distal femoral resection, it is recommended to perform the tibial resection before the anterior femoral cut. This will allow better removal of osteophytes and balancing of the leg in extension using a fixed spacer block. The software automatically switches to the tibial navigation information, as soon as the resection block with the plane tools is close to the proximal tibia. The current position of the cutting plane is shown as a blue plane. The standard plan, based on the implant manufacturer specifications, is shown as a white plane; however, always adjust the resection to the specific patient anatomy and current gap and alignment information.

The tibial resection height displayed by the software is simply based on measurements from the cutting plane to the registered tibial plateau points.
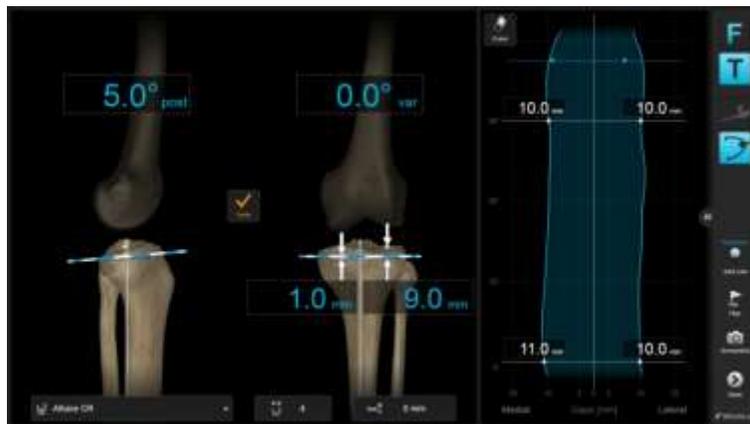
Due to bone defects, the anatomy of the tibial plateau, and in particular natural tibial slope, this reference point might or might not lead to the desired resection height.

You can crosscheck the resection height using the conventional stylus or using the pointer. Slide the pointer tip over the tibial plateau surface to check resection height at any point of the plateau.

Art. no. 53202 Knee Plane Tool - Cutting Block Adapter
Art. no. 53201 Knee Plane Tool – Tracking Array

Placement of Cutting Block & Resection

Once the cutting block is placed at the desired position, put the first pin while constantly checking for changes in alignment during drilling. Focus on slope alignment and resection height first since the first pin fixes this degree of freedom. Place the second pin, focusing on varus/valgus position and correct possible alignment deviations. If necessary, put additional oblique pins and perform resection.
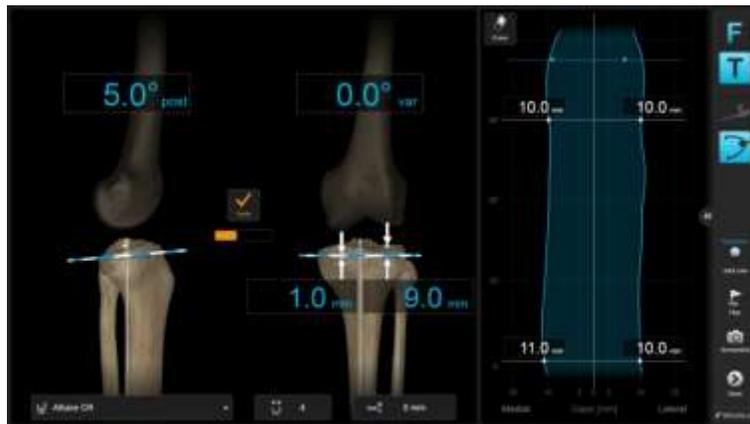
Cut Verification

After performing the resection, place the Plane Tool on the resected bone surface to record the final cut position.

Art. no. 53202 Knee Plane Tool – Cutting Block Adapter
Art. no. 53204 Knee Plane Tool – Verification Plate, Small
Art. no. 53201 Knee Plane Tool – Tracking Array

Trialing & Closure

After insertion of the trial components and the insert, clear the information in the stability graph by pressing the "erase" button. Record the final stability and alignment situation for case documentation.

You may want to select the tibial insert thickness currently used to make the graph reflect the actual situation.

To store the alignment, bring the leg in full extension without applying stress, then lift the fully extended leg approximately 10 cm. The software will interpret the lifting gesture and store the alignment.
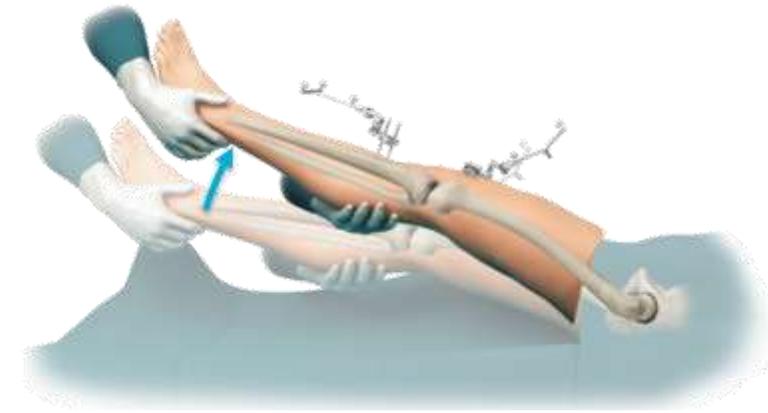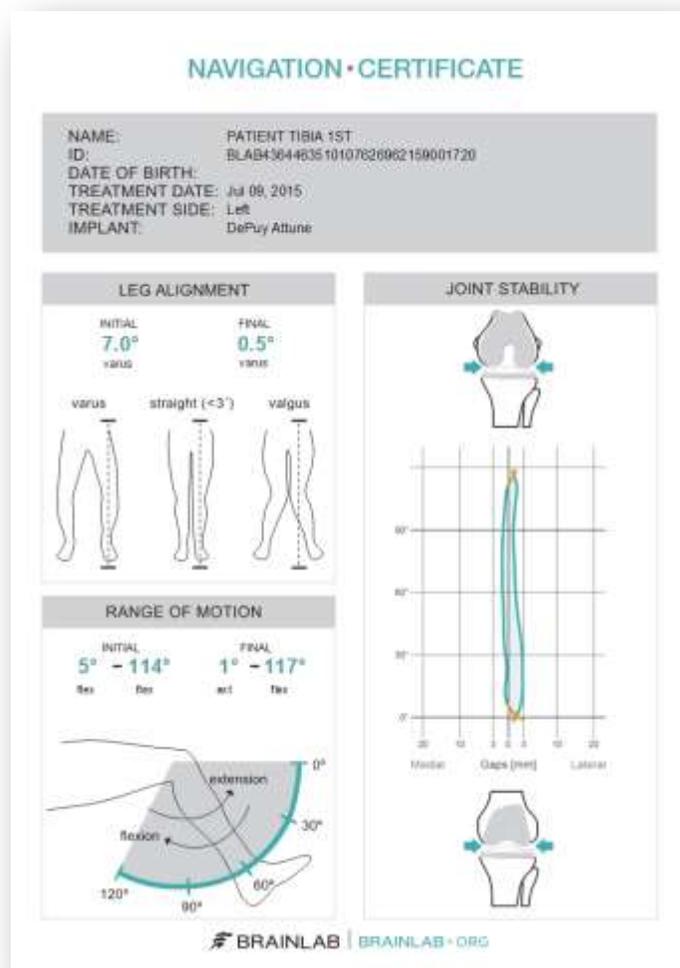

Alternatively, pressing the "Store" button on screen.

Close the knee in layers using the surgeon's preferred technique.

Patient Report

After finishing the procedure, press the "Done" button to access the patient report. This report contains information in a simplified language for printing it for the patient.

Additional data, in particular for research purpose, can found in the PDF attachment which can be reached via the paperclip in the PDF file.

Appendix

Femur First Balanced Technique Overview (Distal Cut 1st)

1	Perform tibial and femoral registration

2	Use the plane tool with the distal cutting block to position the distal cutting block
	- Adjust femoral flexion angle.
	  a. Femoral Flexion should be between 0° and 3° depending on patient anatomy
	  b. If flexion gap predicted is too large, try to increase femoral flexion angle, which closes the flexions gap.
	- Adjust distal resection level to make extension gap equal to flexion gap. Increase resection to open extension gap. Decrease resection to close extension gap
	- Pin the block and perform resection

3	Verify distal femoral resection
4	Use the plane tool with the tibial cutting block to position the tibial cutting block - Watch out for potential fixed flexion deformities. Converging lines in the graph in extension might indicate tight posterior capsule. Consider conservative tibial resection if full extension cannot be reached before tibial resection - Pin the block and perform resection
5	Verify tibial resection
6	Use a fixed spacer block to record stability in full extension while applying varus/valgus stress

7	Place the cutting block adapter in the anterior cutting slot of AP resection block and navigate the block using the onscreen data
	- Adjust the flexion gap to match the extension gap. The options are:
	  a. Change femoral component size suggested if necessary. Upsizing the femoral component will close the flexion gap. Downsizing will open the flexion gap.
	  b. Adjust AP position of anterior cut to equalize flexion and extension gap. When shifting posteriorly, double check for notching using conventional instruments
	- Adjust femoral rotation to create symmetric flexion space
	  a. Femoral rotation should be adjusted to equalize medial and lateral gaps. Crosscheck that rotation is not too far from what anatomic landmarks suggest (3...5° int/ext. rotation max)
	  b. If in anatomically neutral rotation the medial and lateral gaps are unequal, basically there are three options:
	    I. Adjust bone cuts away from anatomical landmarks, towards what gaps dictate. Consider patellar tracking.
	    II. Apply (additional) soft tissue releases. Make sure to remove all osteophytes. Consider the effect of the particular release for the extension gap – do not over release!
	    III. Accept a certain remaining instability. In particular on the lateral side, a slightly larger gap is common in natural knees
	  In most cases, it might be a combination of the three above mentioned options.
	- Pin the block & perform resection

8	Verify anterior resection
9	Perform implant trialing - Erase the stability graph - Re-record the stability graph with the trial implants in the joint - Adjust insert thickness if necessary

Joint Line Mode

By pressing the 'Joint Line' button you can switch to joint line mode for femoral resections. Instead of resection heights the software displays the joint line shift for the selected implant component during femur navigation.

Note: Resections are calculated perpendicular to the cuts. Joint line values are the distance between the most distal implant point to the most distal condyle surface point in femur axis direction.

When the femur component is flexed resection plus distal implant thickness may not equal the joint line shift!

Settings

Some application settings, including sound volume controls, can be accessed from the menu drawer on the right part of the screen.

Clip-On Remote

The use of the optional disposable clip-on remote control can be enabled for registration of the anatomic landmarks in Settings. When turned on, hold the tip to the indicated landmark and press the 'Control' button. The remote control reacts upon pressing the button, not upon releasing. If the tip moves during registration, the point is not acquired.

Art. no. 53153 Disposable Clip-On Remote Control (20 pcs)
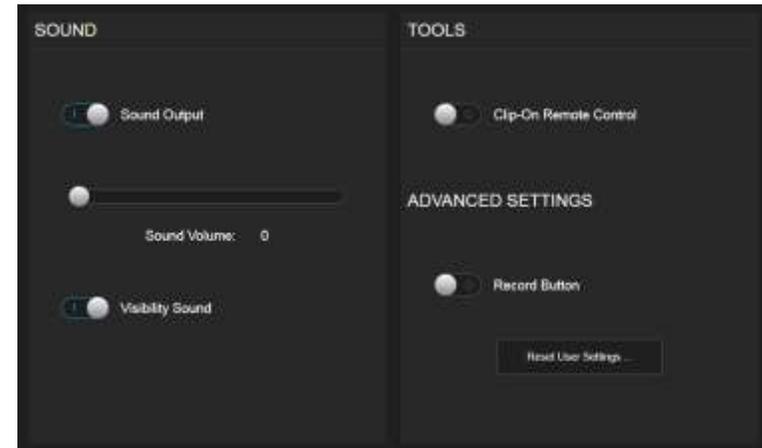
Article list

Pointer

Number	Name	Image
53101	Pointer Angled For Hip/Knee	
53109	Pointer Straight For Knee	

Arrays and fixation

Number	Name	Image
52410	Reference Array T-Geometry X-Press	
52411	Reference Array Y-Geometry X-Press	
41866-77	Universal Cutting Block Adapter	

52429	Bone Fixator 2-Pin, Flip Flop, X-Press (for two pin fixation)	
54932	Pindriver Adapter For AO Coupling (for 3,2mm pins)	
52421/ 52422/ 52423	Bone Fixator 1-Pin Size S/M/L (for one pin fixation)	

Plane Tool

Number	Name	Image
53201	Knee Plane Tool – Tracking Array	
53202	Knee Plane Tool – Cutting Block Adapter	
53203	Knee Plane Tool – Bone Verification Plate	

Number	Name	Image
53204	Knee Plane Tool – Bone Verification Plate Small	

Clip-On Remote Control & Footswitch

Alternatively to pointer tip pivoting the Clip-On Remote Control
or the Footswitch can be used to trigger landmark acquisition.

Number	Name	Image
18460	Footswitch	
53153	Disposable Clip-On Remote Control (20 pcs)	

Disposables

Number	Name
54922	Disposable Schanz Screw 3.2 mm x 100mm (10pcs)
54922	Disposable Schanz Screw 4.0 mm x 125mm (10pcs)
54909	Disposable Schanz Screw (AO) 5mm X 175mm (10 pcs)
18071-50	Disposable Sterile Monitor Drapes 40 pcs
41774/ 41773	Disposable Marker Spheres 270 pcs or 90 pcs

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