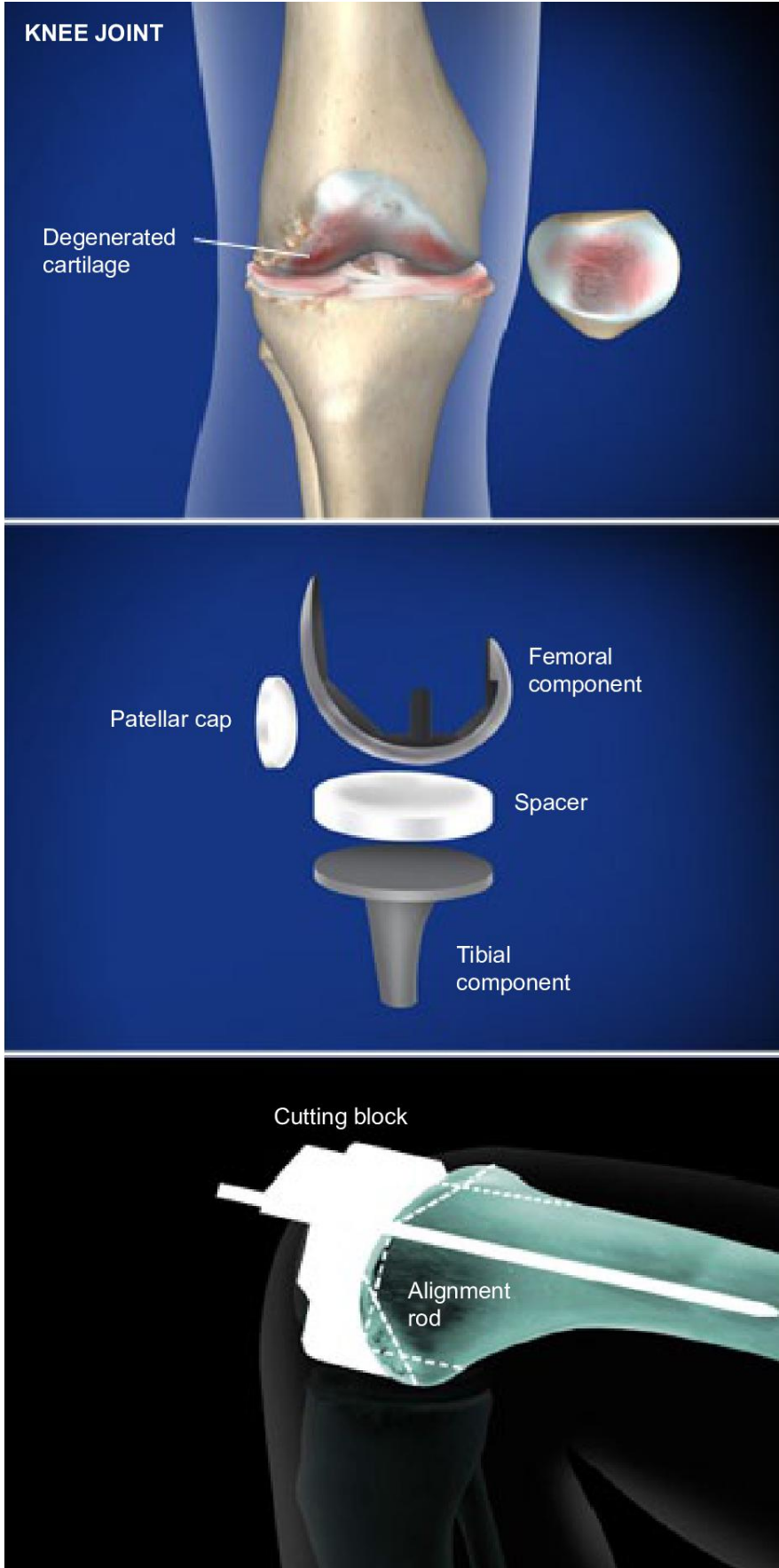




## Total Knee Replacement (Computer-Assisted Robotic Knee Replacement)



### Overview

This procedure replaces degenerated cartilage in the knee joint with implants to restore function and eliminate pain. The surgeon plans and performs the surgery with the aid of robotic instruments and a computer guidance system.

### The Importance of Proper Alignment

Artificial knees use a tibial component, a femoral component, a spacer that fits between these pieces, and a small cap that will cover the rear of the patella. For successful knee replacement surgery, these components must be precisely aligned within the joint. Even a small misalignment can throw off the patient's balance and weight distribution. This can cause the components to fail.

### Traditional Knee Replacement Surgery

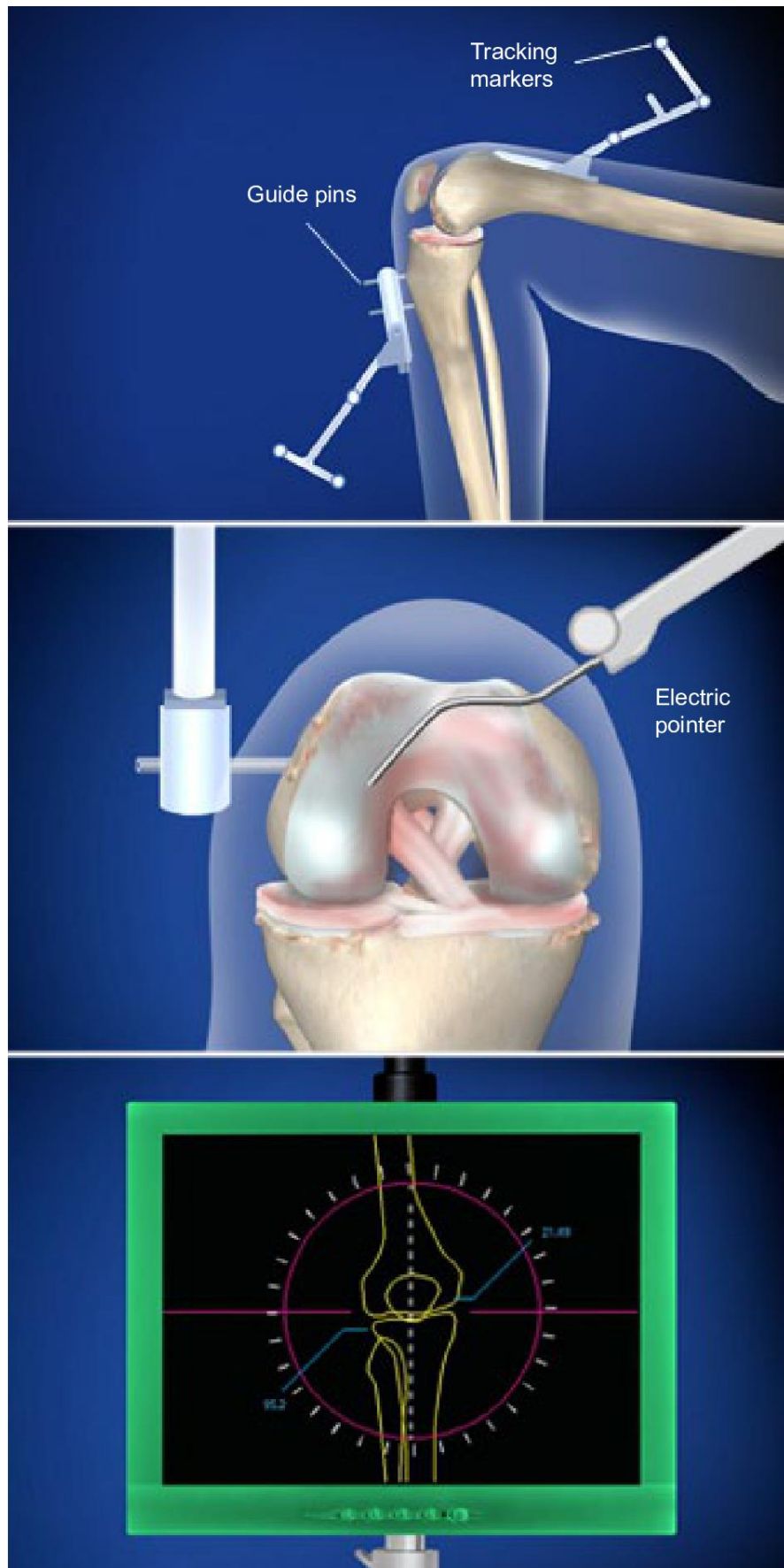
In traditional knee replacement surgery, alignment is determined by hand. To trim and shape the bones, the surgeon uses guides, called cutting blocks, attached to long alignment rods inserted into the bones of the leg.

### Traditional Knee Replacement Surgery (Continued)

These instruments are not precise. The alignment rods can be inserted incorrectly. A loose fit can allow them to shift out of position. This results in misaligned cuts. And because the rods are pushed so deeply into the bones, they can force cells, fat and proteins from the bone marrow into the small veins of the leg. This can increase the risk of a dangerous thrombosis or embolism.



## Total Knee Replacement (Computer-Assisted Robotic Knee Replacement)



### Computer-Assisted Robotic Surgery

Computer-assisted robotic surgery eliminates these issues. Instead of imprecise cutting blocks and alignment rods, the surgeon uses sophisticated, less-invasive hardware tracked wirelessly in 3D space by a computer system. The computer guides the surgeon through the entire procedure, ensuring precision and accuracy.

### Preparation

In preparation for computer-assisted robotic knee replacement, the patient is positioned and anesthesia is administered. The surgeon places two small guide pins into the front of the tibia.

### 3D Tracking

The surgeon attaches tracking markers to the tibial pins. Through an incision, the surgeon puts two more pins with tracking markers in the femur. The surgeon guides the leg through a series of motions. A computer tracks the position of the markers in 3D space.

### Modeling the Leg and Knee Joint

The patella is moved out of the way. The surgeon uses an electronic pointer to measure the lower leg and trace the contours of the joint's surface. When this is done, the surgeon will have a detailed, accurate, moveable computer-3D model of the entire leg.

### Selecting the Implants

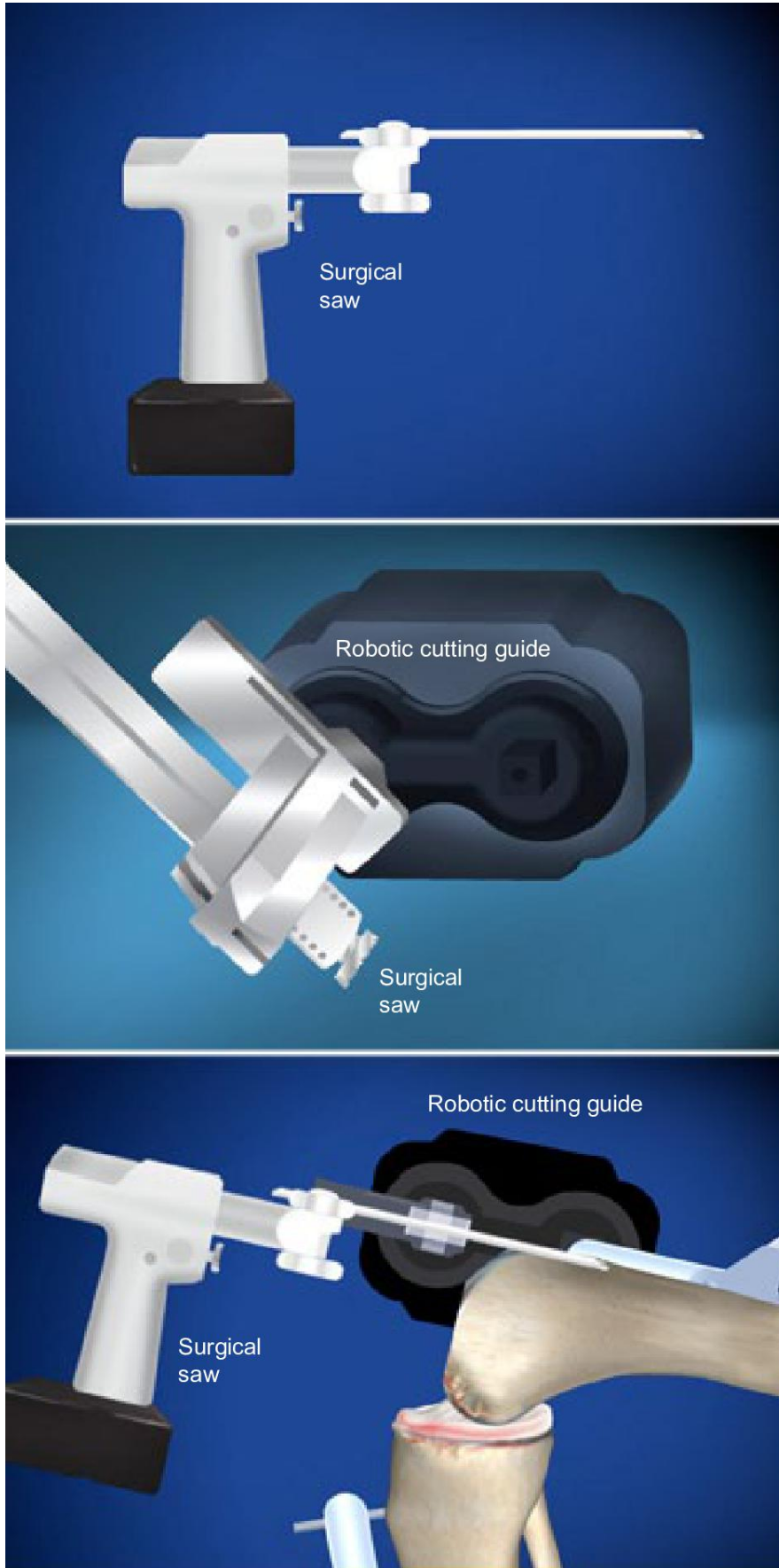
Once the computer has built this model, it automatically determines the angles of the cuts needed. The computer also sets the size and position of each of the implant's components. The surgeon bends and flexes the virtual leg on the computer screen to verify that the reconstructed joint will work properly.

### Reshaping the Femur

The surgeon uses a handheld surgical saw to reshape the end of the femur. The saw is equipped with a precision cutting edge and is aligned with the aid of a robotic cutting guide. The guide contains a slot that holds the saw at the proper angle during each cut.



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### Reshaping the Femur (Continued)

The cutting guide is attached to the femur pins. Once in position, the surgeon carefully inserts the saw blade and trims the femur. When the cut is complete, the guide repositions itself for the next cut and the process continues. Five cuts are needed to prepare the femur for the femoral component.

### Reshaping the Tibia

The surgeon attaches another cutting guide to the tibia pins. The surgeon carefully turns a series of screws to align this guide. The computer shows the direction and amount that each screw must be turned, and prompts the surgeon when alignment is correct. The surgeon makes a single cut to prepare for the tibial component.

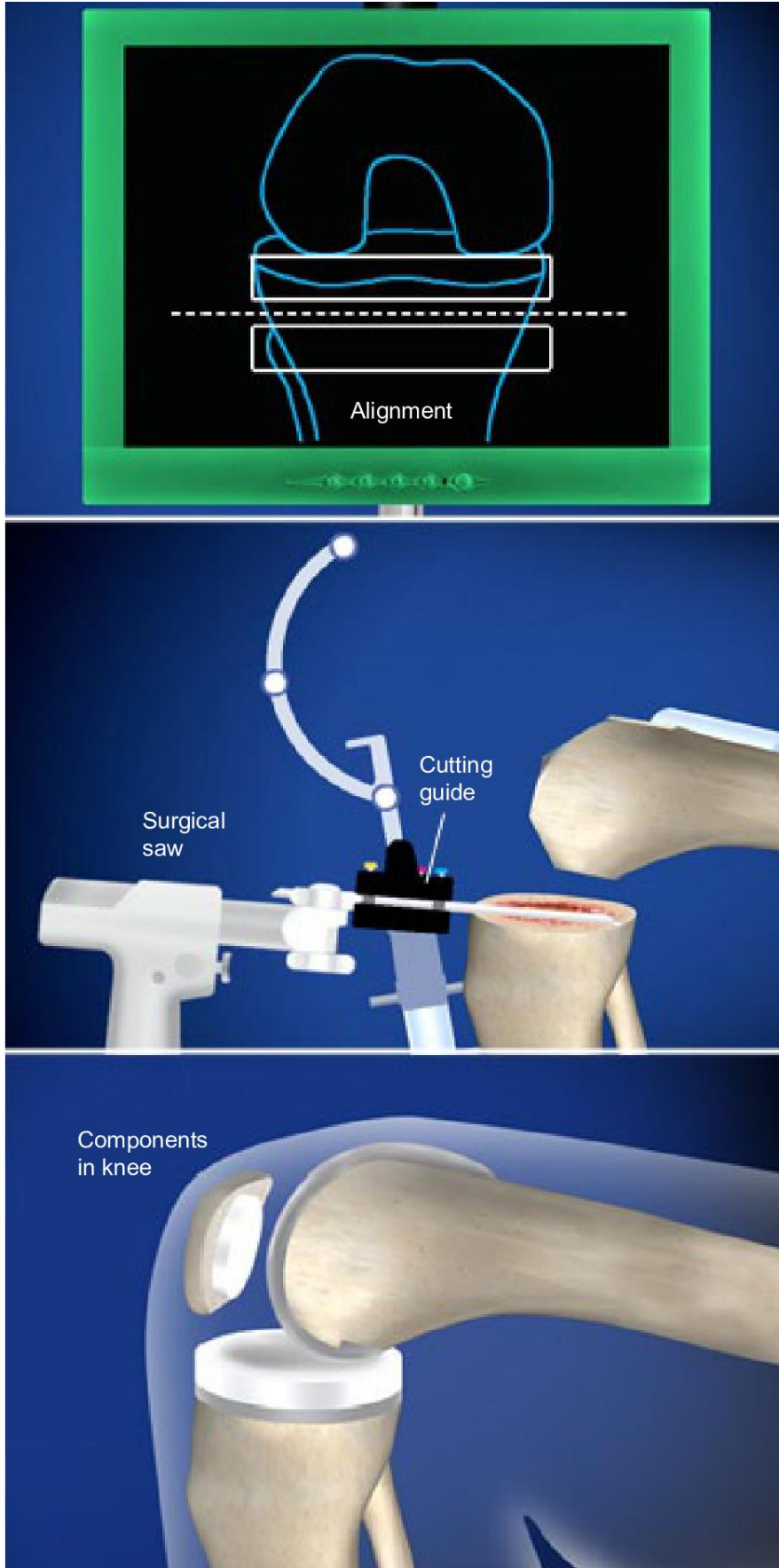
### Assembling the Joint

Once the preparation is complete, the surgeon inserts the components securely into the knee. The surgeon trims off the back of the patella and places on the cap to help the patella glide smoothly across the components. The surgeon flexes and extends the knee to make sure the joint is working properly, and then removes the anchor pins.





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### End of Procedure and Aftercare

When the procedure is complete, the incision is closed and bandaged. The patient is monitored for a short time in a recovery area and is then released. Physical therapy will be needed. The patient will use crutches or a walker for a short time while the knee heals, and can then progress to bearing full weight on the joint. Most patients fully recover within six to eight weeks.