

MAKO ROBOTIC-ARM-ASSISTED TOTAL KNEE REPLACEMENT

A personalized, data-guided approach to treating severe knee arthritis

THE GOAL

Relieve arthritis pain and improve everyday function using a knee replacement planned for your anatomy and guided by real-time information during surgery.

What is MAKO?

MAKO is a robotic-arm-assisted system used by your surgeon during total knee arthroplasty. Before surgery, a CT scan is used to create a 3D model of your knee. Your surgeon plans implant size and position, then uses the system's guidance and tactile boundaries during the operation. **Your surgeon remains in control at every step**—the robot does not operate on its own.

1. SCAN	2. PLAN	3. GUIDE
A CT scan creates a 3D model of your unique knee anatomy.	Your surgeon plans implant position and can refine the plan during surgery.	The robotic arm provides tactile boundaries and real-time feedback as your surgeon prepares the bone.

Potential advantages compared with conventional manual instrumentation

- **More personalized 3D planning:** A CT-based model helps the surgeon assess your bone shape and plan implant size, alignment and position in three dimensions—not just from standard two-dimensional images.
- **Precise execution of the surgical plan:** The system's AccuStop™ haptic technology creates a virtual boundary that provides tactile resistance, helping the surgeon stay within the planned bone-preparation area.
- **Real-time assessment of knee balance:** The surgeon can evaluate motion and soft-tissue tension during the operation and adjust the plan when appropriate, with the goal of a stable, well-balanced knee.
- **Potentially less disruption to surrounding tissues:** Studies comparing MAKO with conventional cutting guides have reported less iatrogenic bone and soft-tissue injury in some settings. Protecting the surrounding structures may help recovery.
- **Potential benefits during early recovery:** Some comparative studies report lower early pain, reduced need for opioid pain medicine, earlier achievement of rehabilitation milestones, or shorter hospital stays. Results are not identical for every patient.
- **A data-guided, reproducible workflow:** Planning, intraoperative measurements and guided bone preparation give the surgeon additional information to support decisions and reduce variability in implant placement.

Illustrations and official MAKO information

Stryker's patient website shows the CT scan → 3D plan → robotic-arm-guided bone preparation process, including MAKO system images. Visit [Stryker's official MAKO Total Knee patient page](#). This handout summarizes the technology; it does not reproduce Stryker's copyrighted images.

WHAT THIS MAY MEAN FOR YOU

The objective is a carefully planned knee replacement—with the potential for a more predictable operation and a smoother early recovery.

What the research suggests

Accuracy: Clinical studies generally show MAKO can improve accuracy and precision of implant placement relative to the preoperative plan compared with conventional manual techniques.

Pain and medication: Some studies report lower postoperative pain scores and less need for pain medication, including opioids. This is a potential advantage, not a guarantee.

Early recovery: Some studies report earlier rehabilitation milestones or shorter hospital stays. Recovery also depends on overall health, pain-control strategy, home support and participation in physical therapy.

Implant longevity: Registry data published by Stryker report improved six-year survivorship for specific MAKO/Triathlon implant groups compared with manual surgery. This finding is specific to those groups and should not be interpreted as proof that every robotic knee replacement lasts longer.

MAKO versus conventional total knee replacement

Feature	MAKO robotic-arm-assisted	Conventional manual instrumentation
Preoperative planning	CT-based 3D model and patient-specific plan	Typically uses standard imaging and alignment guides
Bone preparation	Surgeon-guided robotic arm with haptic boundaries	Surgeon uses manual cutting guides and instruments
Intraoperative feedback	Real-time data can help assess alignment, motion and balance	Assessment relies on the surgeon's usual instruments and techniques
Clinical outcomes	May improve precision and some early outcomes in studies	A well-established procedure with excellent outcomes for many patients

Important things to know

- MAKO is a tool used by the surgeon—not a fully autonomous robot.
- A CT scan is required for the MAKO planning process and involves a small amount of radiation.
- Robotic assistance does not eliminate the usual risks of knee replacement, such as infection, blood clots, stiffness, persistent pain, fracture, implant wear or the possibility of future revision surgery.
- No technology can guarantee a pain-free knee, a particular range of motion, faster return to activities or longer implant survival. Surgical experience, implant choice, rehabilitation and patient factors remain important.
- Conventional total knee replacement is also an effective, established operation. The best approach depends on your anatomy, goals, medical history and your surgeon's judgment.

Bottom line

MAKO adds 3D CT-based planning, robotic-arm guidance and real-time information to a procedure that already works well for many patients. Its strongest established advantage is more accurate execution of the surgical plan; research also suggests potential early recovery benefits, while the size and durability of those benefits continue to be studied.

Selected sources

- Stryker. [Mako Total Knee: technology and reported outcomes](#).
- Stryker. [MAKO Total Knee Replacement: patient information](#).
- Stryker. [MAKO Total Knee Arthroplasty: Clinical Summary](#).

- Kayani B, et al. Iatrogenic Bone and Soft Tissue Trauma in Robotic-Arm Assisted TKA Compared With Conventional Jig-Based TKA. *J Arthroplasty*. 2018;33(8):2496–2501.
- MAKO CT-based robotic arm-assisted system is a reliable procedure for total knee arthroplasty: a systematic review. *PubMed*. 2020. [Abstract](#).

This educational handout is intended to support—not replace—a discussion with your orthopedic surgeon. Evidence and outcomes can vary by patient, surgeon, implant and study design.