

PERCUTANEOUS 2-PIN FIXATION FRAMES FOR COMPUTER-ASSISTED TOTAL KNEE ARTHROPLASTY: SAFETY AND STABILITY

Stephen B. Murphy MD

*Center for Computer Assisted and Reconstructive Surgery
New England Baptist Bone and Joint Institute
New England Baptist Hospital and Harvard Medical School*

INTRODUCTION:

Surgical navigation of total knee arthroplasty has the potential to decrease morbidity and to improve both short and long-term outcomes. Critical technical issues such as alignment, ligament balancing, and component sizing are efficiently and directly addressed by computer-assisted TKA. Further, microembolism from air, fat, or bone marrow may be dramatically reduced by the elimination of intramedullary alignment guides. However, navigation requires the use of skeletal reference frames, affixed to the femur and tibia, which pose potential risks. Variation in practice exists between frames affixed percutaneously or through the primary incision and frames fixed with a single pin or two pins. The current study documents the experience of performing computer-assisted TKR using 2-pin, percutaneously fixed reference frames.

MATERIALS and METHODS:

137 consecutive total knee arthroplasties were performed with computer-assistance by the same surgeon using the same implants (Genesis II, Smith-Nephew, Memphis, TN). 70 procedures were performed using fluoroscopic navigation (Medtronic ION system) and 67 procedures were performed using image-free methods (BrainLAB CT-free knee). Each procedure was performed by affixing reference frames percutaneously to the femur and tibia using 2-pin fixators. The most recent 121 procedures all had 4mm pins placed in the tibia after pre-drilling of the near cortex, and 5mm pins placed in the femur. Pins were spaced at least 30mm apart. Hip and ankle data were acquired prior to elevating the tourniquet. Alignment and ligament balance were assessed and all bone cuts were tracked using navigation. Post-operatively, limb alignment was assessed on full limb standing films.

RESULTS:

Of the 548 pins percutaneously placed, one tibial pin that was not pre-drilled became infected, requiring antibiotic treatment. The tip of one 3mm fixation pin broke on insertion and was left in situ. No 4mm or 5mm pins have broken. One femoral frame shifted and required re-registration. One tibial frame shifted after all of the components had been implanted. Both shifted at the fixator-frame junction. No pins loosened. There were no vascular or nerve injuries and no post-operative fractures. Alignment on the 111 limbs that have had full length films show femoral component alignment of 0.4 degrees of varus (SD 1.0), tibial component alignment of 0.8 degrees of valgus (SD 1.2), and overall alignment of 0.4 degrees of valgus (SD 1.0).

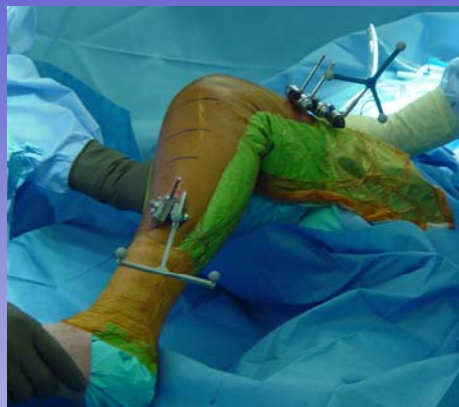


Image 1 (left): 2-pin fixators placed percutaneously, away from the primary incision.



Image 2 (above): Computer-assisted, minimally invasive Total Knee Arthroplasty near the completion of the procedure. Note that the reference frames do not interfere with the surgical field.

Image 3 (right): Full length radiograph showing implant and limb alignment following total knee arthroplasty using computer-assisted techniques.



CONCLUSION:

Two pin fixators placed percutaneously in the femur and tibia are safe and stable. 4mm pins in the tibial diaphysis require pre-drilling of the near cortex to prevent thermal injury to the skin. Percutaneous fixation facilitates minimally invasive techniques, where there is no place for the frames in the primary surgical field.