LIMB ALIGNMENT FOLLOWING COMPUTER-ASSISTED TOTAL KNEE ARTHROPLASTY

Stephen Murphy, MD and Rahul Deshmukh, MD

Center for Computer Assisted and Reconstructive Surgery
New England Baptist Bone and Joint Institute
Tufts University School of Medicine
Harvard Medical School, Boston, MA

***INTRODUCTION*:**
Surgical navigation of total knee arthroplasty (TKA) has the potential to improve both short and long-term outcomes and decrease morbidity following primary TKA. Common problems that can be improved or eliminated by surgical navigation include:

- **Improper alignment of the femur or tibia**
- **Improper sizing of the femur leading to notching or overstuffing of the patello-femoral joint**
- **Malrotation of the components which can lead to excessive wear and patellar maltracking**
- **Elevation of the joint line, leading to patella baja and/or PCL imbalance**
- **Improper ligament balancing in flexion and extension**
- **Bone marrow and fat embolism syndrome**

The purpose of the current study is to document the technique and clinical experience of image-guided, computer-assisted TKA and the resulting post-operative alignment of the limbs.

***MATERIALS AND METHODS*:**
Sixty-nine consecutive total knee arthroplasties were performed in 58 patients using image-guided computer-assisted total knee arthroplasty (Smith-Nephew knee navigational software and instruments, Medtronics Fluoronav software and ION hardware). The procedure was performed by affixing reference frames percutaneously to the femur and tibia, acquiring biplane fluoroscopic images of the hip, elevating the tourniquet, and exposing the knee (*Image 1*). The distal femoral and tibial landmarks were then directly digitized to establish the coordinate systems. Pre-operative motion and alignment were determined (*Image 2*). The femoral and tibial preparation instruments were tracked using surgical navigation and post-operative alignment, motion, and stability were measured. Alignment on long-leg radiographs were measured in 59 of the 69 limbs thus far.

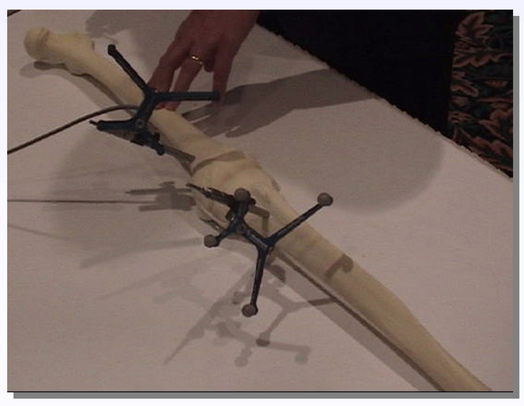


Image 1
Model of attached femoral and tibial frames

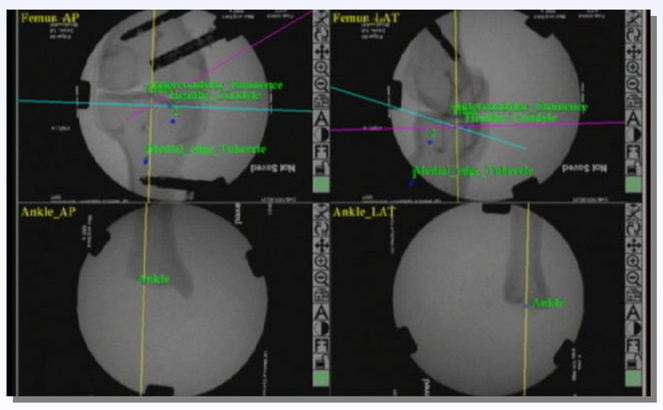
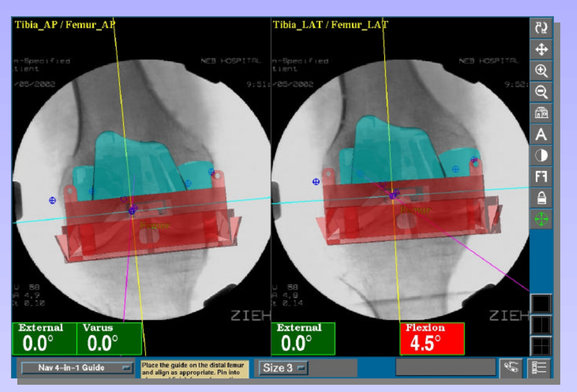


Image 2
Determine landmarks, axis and rotation

***RESULTS*:**
Radiographic alignment of the femoral mechanical axis averaged 0.2 degrees of valgus (range: 2 degree of valgus to 2 degree of varus). Tibial alignment averaged 0.5 degrees of valgus (range: 3 degrees of valgus to 2 degree of varus). One femoral reference frame moved during surgery and required reregistration. One pin site out of 276 percutaneous pins used was treated for a local infection (0.4%).

The system repeatedly documented that the cutting plane actually achieved is often several degrees different than the desired plane that the cutting block was placed in. Navigation allowed for the elimination of small cumulative errors that would ordinarily occur during traditional TKA surgery.



Images 3-a and 3-b
Femoral (3a) and tibial (3b) intra-operative surgical navigation. Determination of flexion/extension gaps, varus/valgus position, component rotation and resection depth.

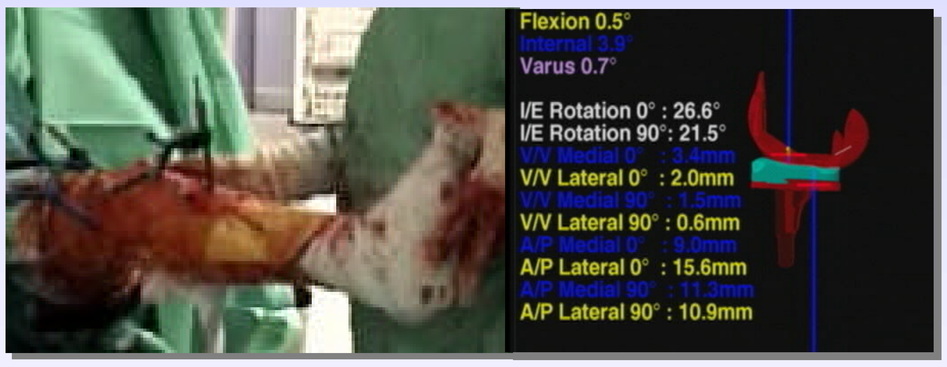


Image 4
Calculate knee motion and ligamentous stability

***CONCLUSION*:**
Intra-operative surgical navigation can eliminate the use of intra-medullary alignment guides while improving alignment accuracy of total knee arthroplasty alignment.

***ACKNOLWEDGEMENTS*:**
Dan McCombs, Crista Smothers, Chris Lyons, Jody Stallings and Scott Elliott, Smith & Nephew SNT Division.
Gordon Goodchild, Medtronics SNT.