

Navigated planning for revision total knee replacement

JENNY JY

Center for Orthopedic and Hand Surgery, University Hospital, Strasbourg, France

jean-yves.jenny@chru-strasbourg.fr

Introduction: Revision total knee replacement (TKR) is a challenging procedure, especially because most of the standard bony and ligamentous landmarks used during primary TKR are lost due to the index implantation. One might also assume that the conventional instruments, which rely on visual or anatomical alignments or intra- or extra-medullary rods, are associated with significant higher variation of the leg axis correction, especially in cases with significant bone loss which prevents to control the exact location of the usual, relevant landmarks. Furthermore, assessment of the ligamentous balance is also more difficult than during primary TKR, leading to a frequent use of constrained prostheses with long stem extension. We demonstrated previously that the use of a standard navigation system was able to increase the accuracy of the bone resection and of the prosthesis implantation during TKR in comparison to conventional revision. We wanted to develop a new version of the navigation software dedicated to revision, allowing not only to control the orientation of the bone resection, but also to assess the ligamentous balance, the direction of the stem extensions and the need for defect filling with exact measurements of the height of the defect. The goal of this development was to allow the surgeon performing a virtual planning of the reconstruction before any additional resection in order to choose the best compromise of reconstruction.

Materials & Methods: We modified the standard navigation system to adapt it to the specific requirements of a revision TKR. The kinematic registration process is performed with the index prosthesis in place, even if loose. The standard anatomic registration is performed on the index prosthesis left in place. Some additional landmarks must be palpated: the expected level of the joint space with the expected correction from the existing joint space, the deepest part of the bone defects on the proximal tibia, the distal femur and the posterior femoral condyles. The gap measurement is performed in a standard way. All information are summarized on a planning screen, where it is possible to virtually modify all parameters: coronal and sagittal orientation of the bone cuts, height of the bone cuts and their position in comparison to the expected joint level, size of the femoral component with the necessity of either an additional resection or defect filling, ligamentous balancing. The software displays on line the influence of any modification on all relevant parameters. It is then possible to choose the best compromise of reconstruction, and to adapt precisely the revision implant to the bone situation.

Results: We are using this new software routinely for any revision TKR for 3 years. Kinematic and anatomic registration was possible in all cases. The assessment of the ligamentous balance allowed us to choose the right reconstruction system, with a constraint adapted to the real soft tissue situation, avoiding too constrained implants with unnecessary stem extension. The reconstruction of bone defects was facilitated with hand-sized bone allografts or metallic augments of appropriate thickness, avoiding an extensive cementation and providing an effective joint fixation, without the need for too long stem extension.

Conclusion: The dedicated software allows a more comprehensive joint and bone reconstruction during revision TKR.