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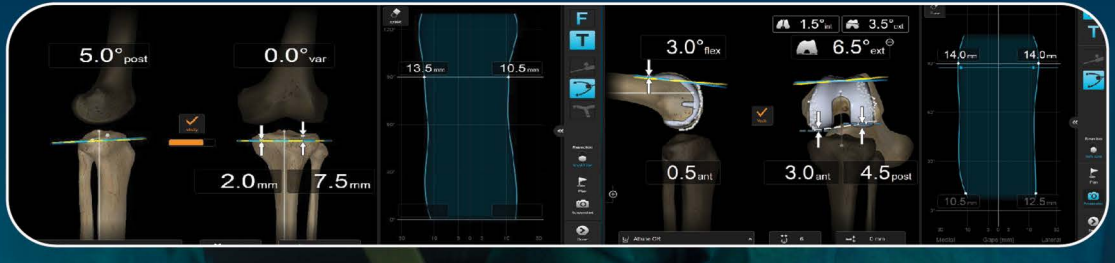
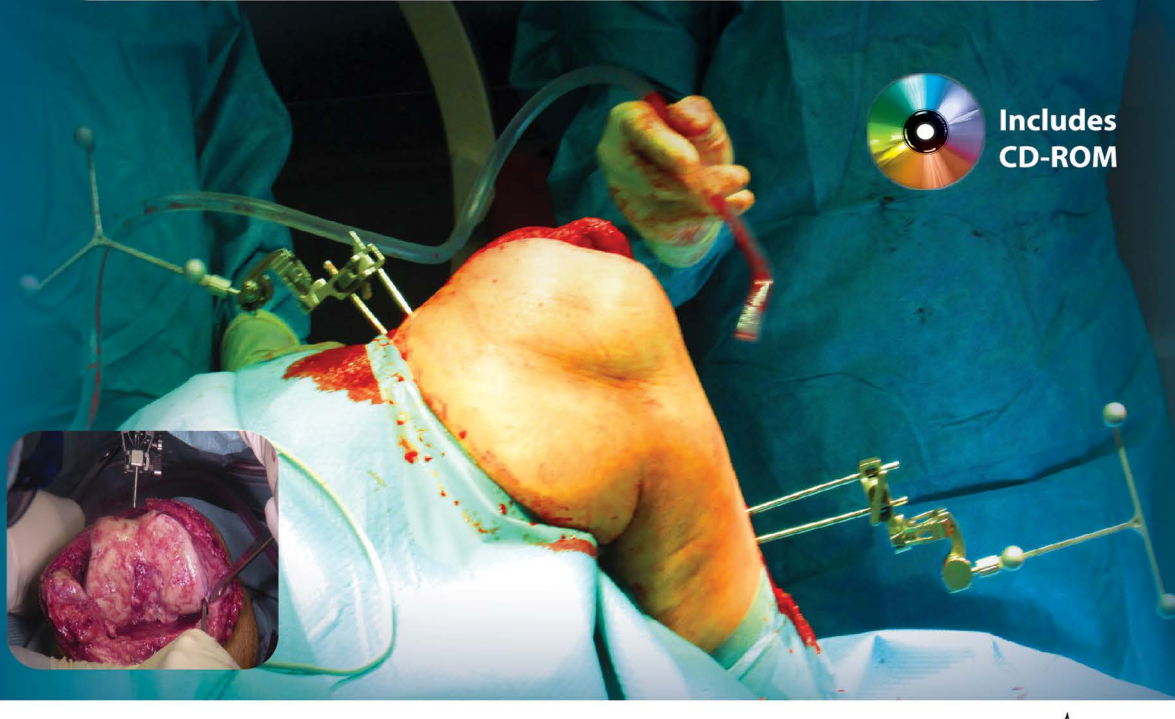
Total KNEE ARTHROPLASTY 2.0

What CAS can add to the Surgery





Includes CD-ROM

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Foreword
David F Dalury

JAYPEE

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2

CHAPTER

Digital Planning for Total Knee Replacement

EARLY STEPS FOR DIGITAL PLANNING

1. In the first step, standardized, digital X-rays of the knee are opened. For that, we should have a long leg anteroposterior (AP) view, including hip and ankle joint. The orientation and rotation of the leg needs to be standardized according to the recommendation from the literature. The more difficult image is the lateral view. Both femoral condyles should appear as one.

   The programme and planning procedure is started with the selection of the procedure.

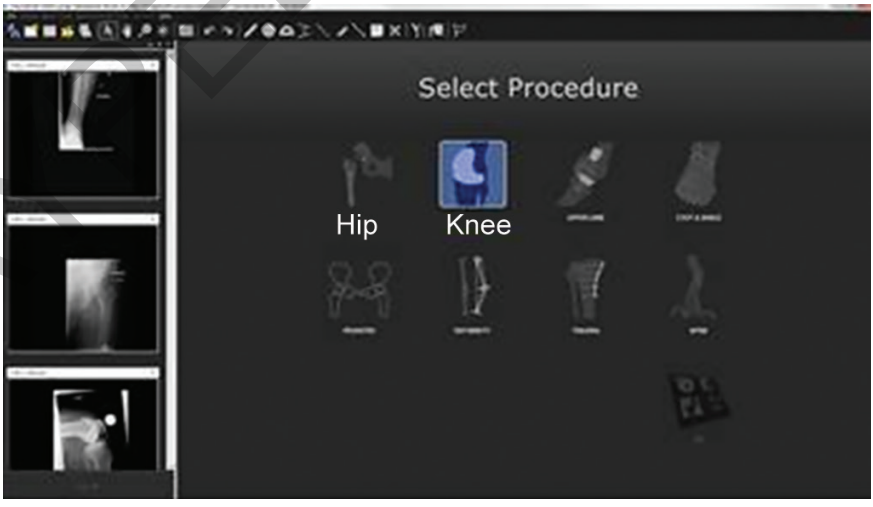

Figure 2.1: Procedure selection for total knee replacement (TKR)

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2. After that the calibration is performed. This is necessary to know precisely the distances and angles in the knee. For that a defined metal structure is placed close to the knee in both planes. In our Hospital a 1 € coin is used. The calibration is performed to the known size of this coin.



Figure 2.2: Calibration

3. The third step is marking 13 different anatomical landmarks starting from hip center, followed by femoral shaft markers to the knee joint ending at the center of the ankle joint. With those anatomical landmarks, the algorithm then can calculate different relevant parameters. To find the landmarks more easily and with a high precision a zoomed image of the area of interest is shown in the upper left corner of the screen.

That are the 13 anatomical points that have to be taken for registration:

Mark at the

1. Center of the left/right head
2. Dot on the left/right medial proximal femoral outer cortex
3. Dot on the left/right lateral proximal femoral outer cortex
4. Dot on the left/right medial distal femoral outer cortex
5. Dot on the left/right lateral distal femoral outer cortex
6. Most convex point of the left/right medial femoral condyle
7. Most convex point of the left/right lateral femoral condyle
8. Most concave point of the left/right medial femoral plateau
9. Most concave point of the left/right lateral femoral plateau
10. Dot on the left/right medial tibial outer cortex
11. Dot on the left/right lateral tibial outer cortex
12. The most medial point of the left/right tibial plafond
13. The most lateral point of the left/right tibial plafond

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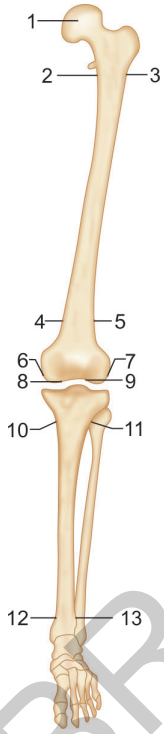

Figure 2.3: Landmarks to assess the limb

4. The computer now defines the mechanical axis and anatomical axis of the femur. In this case, the angle is 8.3°. Further it shows the entire limb axis. In this case, a varus axis of 1° could be found. Based on the landmarks, the computer also suggest the proximal tibia cut and the distal femoral cut.

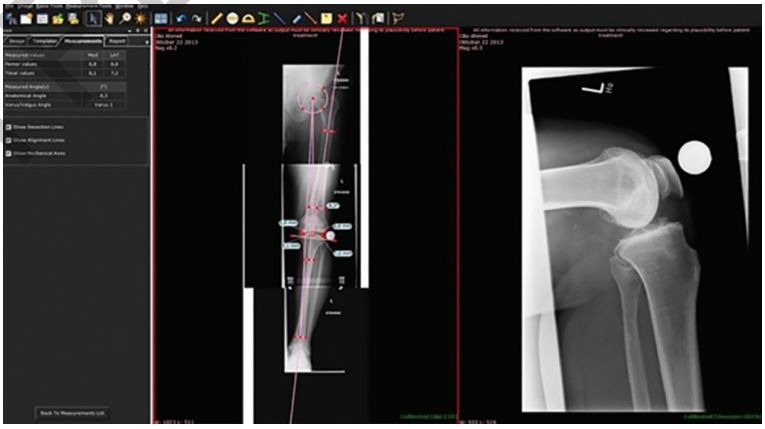

Figure 2.4: Mechanical and anatomical axis

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5. In the next step, the investigator defines the type of implant he wants to use and then places the defined implant into the image. For tibia planning, the anteroposterior view is used first, the lateral view second. The different sizes can be tested and finally the best fitting is defined as the definite size.



Figure 2.5: Tibial templating

6. After tibia planning, the femoral implant is positioned. For this planning, especially the lateral view is important. The template of the femoral implant should match the sagittal diameter as well as the anterior and posterior off-set. The flexion of the femoral component has a big impact on the size. So, a neutral to slightly flexed position should be chosen. Anterior notching is minimized with a slight flexion of the implant while extension increases the risk.



Figure 2.6: Femoral templating

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After defining the femoral component size and position, the planning is done and finally stored into the digital map of the patient. Due to that the planning can be opened at any time and any computer in the hospital for demonstrating as well as for the surgery.

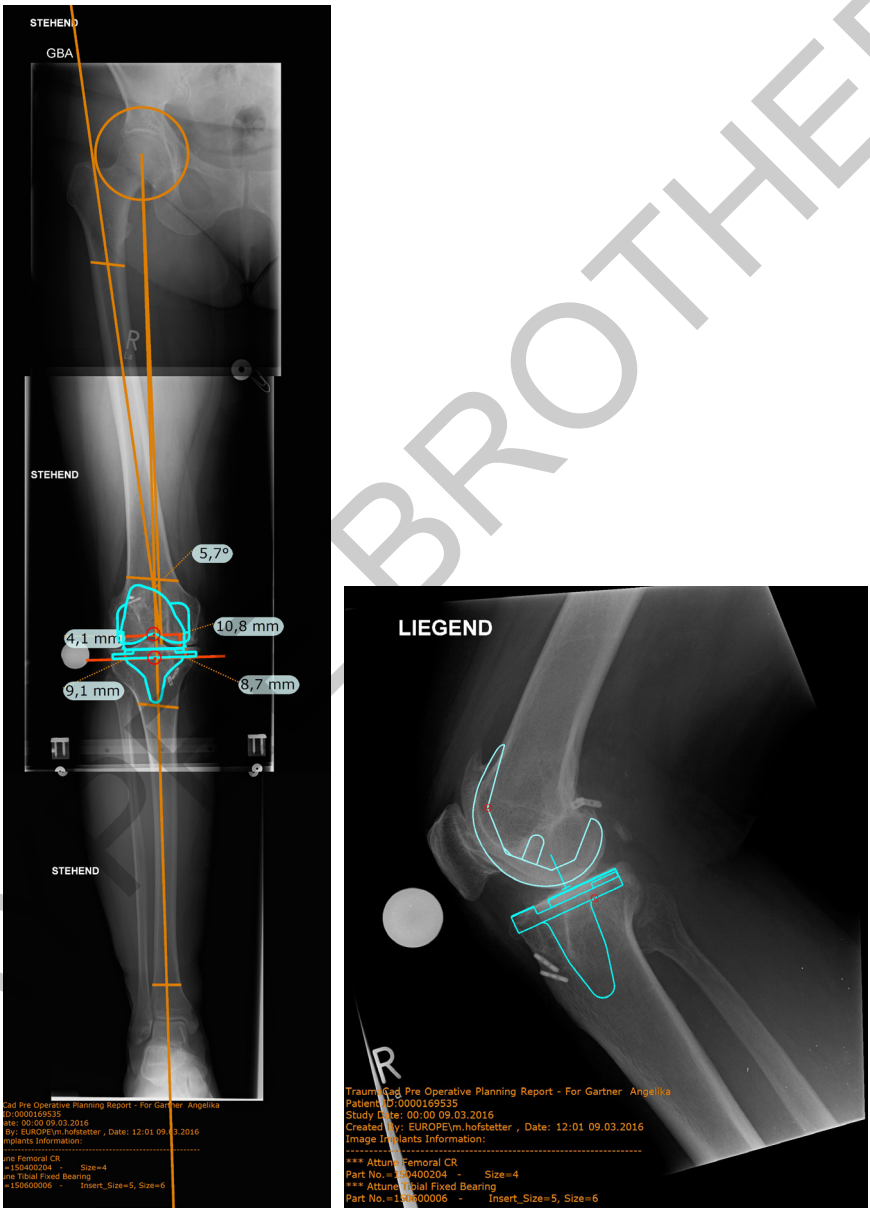

Figure 2.7: Final digital templating

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Progress is constant, change is permanent. Change should be before progress.

Total Knee replacement has become a well-established procedure worldwide now. Ideas of computer navigation are doubted by the students of old TKA school of thought. The authors would remember it like this people do find new ideas strange…Wright Brothers went through this when they spoke about AEROPLANES…rest was history. The authors here have tried to combine the tips and pearls about Total Knee Replacement and computer-assisted surgery. They have spoken about the basics of knee replacement, starting right from anatomy to knee dynamics. The authors have further discussed about different approaches to the Knee joint based on various deformities. Subsequently they have carefully delineated the role of navigation at each step of knee replacement.

The authors have also highlighted how navigation is the next stage in achieving as well-balanced and well-aligned knee.

Accompanying Videos will further enhance the understanding about navigation knee replacement.



Prof. Heiko Graichen is Medical Head of Asklepios Clinic in the county of Schwandorf (Germany), and Medical Board Member, Orthopaedic Surgery of Asklepios and Adjacent Professor at University of New York. He is a world renowned Surgeon with qualification on Joint replacement, sports medicine and special orthopedic surgery. His research work has received numerous works globally further, he was an executive board member of Deutsche Gesellschaft Fur Biomechanik (2004-2006), member in DGOOC, AGA, DVSE, GOTS, Associate editor (The Knee), he was in th editorial board of Clinical Biomechanics (2008), J Orthpedics (2013). He has reviewed J. Biomechanics, J. Shoulder Elbow Surgery, Clin Orthop. relat. Research and J. Orthop Res. He has published more than 65 Pubmed listed articles (Impact Factor > 100) and more than 350 talks on national and international conferences.



Dr. Apurv Mehra is the founder of Vidya Jeevan orthopedics centre. He is world renowned computer navigation joint replacement surgeon and specialist in sports medicine. He is one of the most sought after surgeon due to his ethical practice. He is also the founder of Medmiracle the online support system for Medical students. He is rated as ONE of the Best and most respected Faculties in the Medical World. His message is simple, powerful and practical. In his more than eleven years of teaching, Dr Apurv Mehra's (Ortho Dhoom Dhadaka) lectures have not only helped many students achieve top ranks in entrance exams but also many of them, having being influenced by him, have chosen Orthopedics as their career. His Book 'Orthopedics Quick Review', has been labelled as Magic Book of Orthopedics. His New Releases MOM-Mehra's Orthopedics for MCI, Review of Pediatrics has received overwhelming response across the globe.

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