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# An alternative technique of restricted kinematic alignment of the femur and gap balanced alignment of the tibia using computer aided navigation

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**N. D. Clement,**
**T. Calliess,**
**B. Christen,**
**D. J. Deehan**

*Freeman Hospital, Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle upon Tyne, UK*

The kinematic axis of the tibiofemoral joint[1] and the patellofemoral joint[2] passes through the distal femur. Therefore, when utilizing a single radii prosthesis it would seem optimal to align femoral component to the kinematic axes for the distal femur. Kinematic alignment would dictate that the tibial should also be aligned according to the patient's morphology with true measured resection.[3] An alternative method would be to align the tibia component using intraoperative computer-aided gap balancing; the kinematically aligned femur is used as the fixed reference to create rectangular joint spaces firstly in extension then in flexion, which can be finetuned using tibial slope. The advent of computer navigation and robotic assisted knee surgery allows the surgeon to be precise within±1° and control the final alignment.[4] An additional advantage of robotic assisted surgery is that there is less damage to the soft tissue envelope,[5] which may help replicate knee kinematics, reduce postoperative pain, and improve early functional outcomes.[6,7]

The authors describe a new technique of restricted kinematic alignment of the femoral component and using computer-aided gap balancing to align the tibial component. The femur is positioned using measured resection to maintain the centre of rotation of the knee matching the medial and lateral joint lines/contours and the trochlear groove (within±3° of the mechanical axis). Tibial resection is then dictated by the femoral prosthesis (gap balanced) aiming for equal extension and flexion gaps medially and laterally, allowing for a degree of varus or valgus to within±3° of the mechanical axis, which should not influence implant survival.[8,9] The authors feel it is key to restore the isometric medial compartment balance/gap in extension and flexion, but some laxity (increased gap) can be tolerated in the lateral compartment, for which there is evidence of improved patient outcomes.[10]

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**Author information:**
- N. D. Clement, MD, PhD, FRCS Ed (Tr & Orth), Consultant Orthopaedic Surgeon, Royal Infirmary Edinburgh, Edinburgh, UK.

Correspondence should be sent to Nicholas D Clement; email: Nick.clement@doctors.org.uk

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- T. Calliess, MD, Consultant Orthopaedic Surgeon
- B. Christen, MD, MHA, Consultant Orthopaedic Surgeon
  articon, Specialist Practice for Joint Surgery, Bern, Switzerland.
- D. J. Deehan, MD, MSc, FRCS (Tr & Orth), DSc, Professor of Orthopaedics, Freeman Hospital, Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle upon Tyne, UK.


**Author contributions:**
- N. D. Clement: Conceptualized and wrote the manuscript.
- T. Calliess: Conceptualized and wrote the manuscript.
- B. Christen: Conceptualized and wrote the manuscript.
- D. J. Deehan: Conceptualized and wrote the manuscript.


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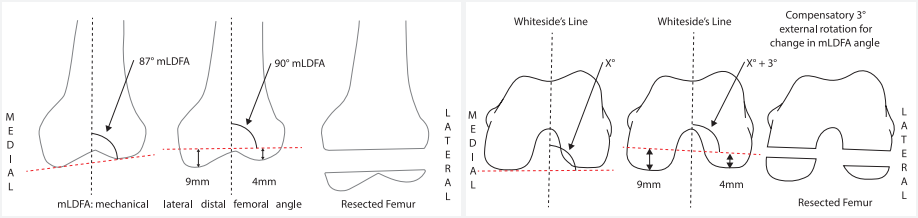
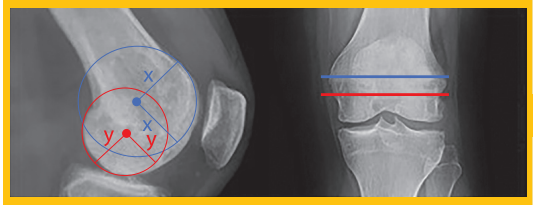
# An alternative technique of restricted kinematic alignment of the femur and gap balanced alignment of the tibia using computer aided navigation

Nick Clement[1], Tilman Calliess[2], Bernhard Christen[2], David Deehan[3]
1 Royal Infirmary of Edinburgh, UK. 2 articon Specialists for Joint Surgery, Bern. 3 Freeman Hospital, UK.

Traditional mechanical alignment of the distal femoral component using a measured resection technique results in unequal medial and lateral bone resection




BLUE = kinematic axis of patellofemoral joint



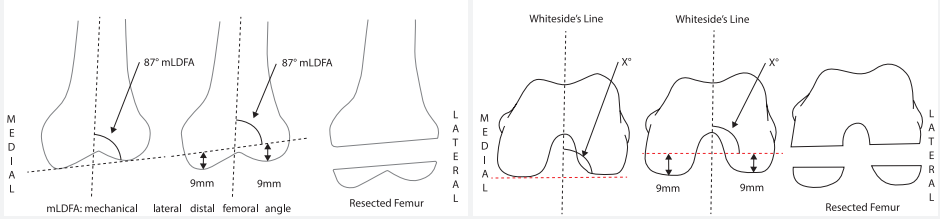

RED = kinematic axis of tibiofemoral joint

Unequal bone resection of the distal femur when aligning the femoral component will not restore the kinematic axes of the knee

Alternatively

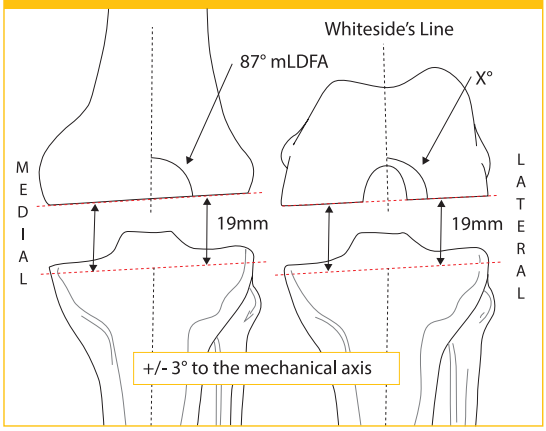
Restricted kinematic alignment of the femur may be more reliable in restoring the kinematic axes of the knee

## 1. Restricted kinematic alignment of the femoral component




Restricted (+/-3° to the mechanical axis) kinematic alignment of the distal femoral component using a measured resection technique results in equal medial and lateral bone resection

## 2. Restricted gap balanced alignment of the tibial component




## Image-based navigation illustrating equal bone resection of femur and gap balanced tibial component