The Effect of Different Interference Fit on Micromotions and Opening in a Cementless Femoral TKA Component

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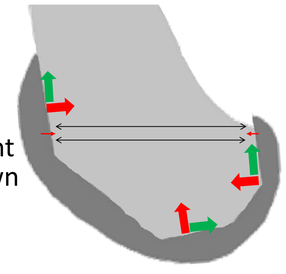
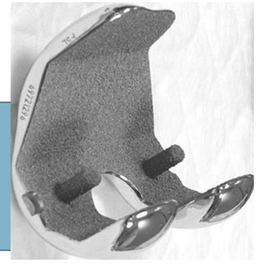
Introduction



- The effect of interference fit on primary stability of a press-fit femoral total knee arthroplasty (TKA) is still not well understood.
- The primary stability is measured as the amount of relative displacement between the implant and the bone under physiological loads, also known as micromotions.
  - < 50 µm bone ingrowth
  - > 150 µm fibrous tissue formation
- A good primary stability can ensure a better long-term fixation and can reduce the risk of implant loosening.

Greater interference fit or thicker implant coating

Better fixation? More bone damage?

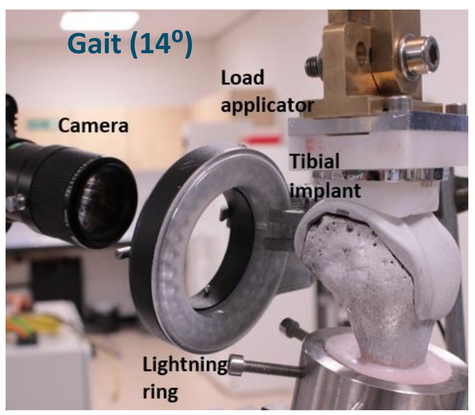


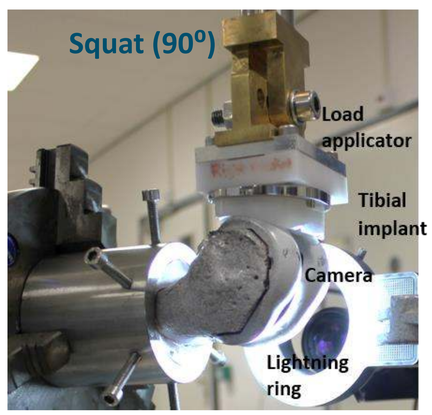
Objective

Investigate the primary stability of a femoral TKA component with a standard coating of 350µm, and compared it against a novel, thicker coating of 700µm in experiments in cadaver bones.

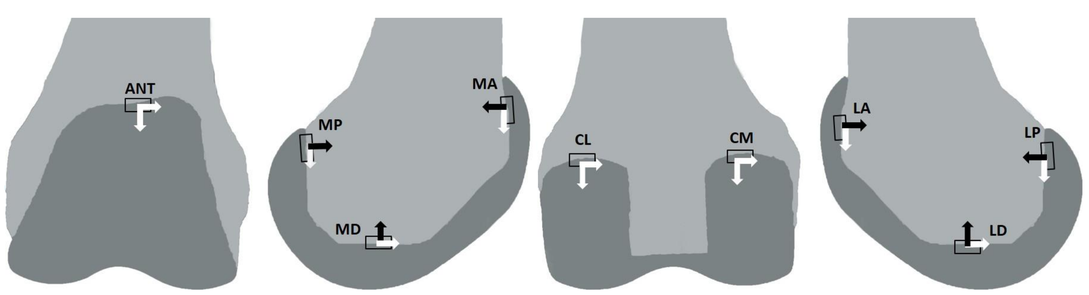
Digital Image Correlation (DIC)

- Six pairs of knees aged 47-60 years (average 55).
- Two cementless e.motion® femoral components (Aesculap, B. Braun, Tuttlingen, Germany) with the same design, but with a different coating thickness (350 vs 700 µm).
- Experimental setup using a force-controlled load at 100N/s for two loading conditions



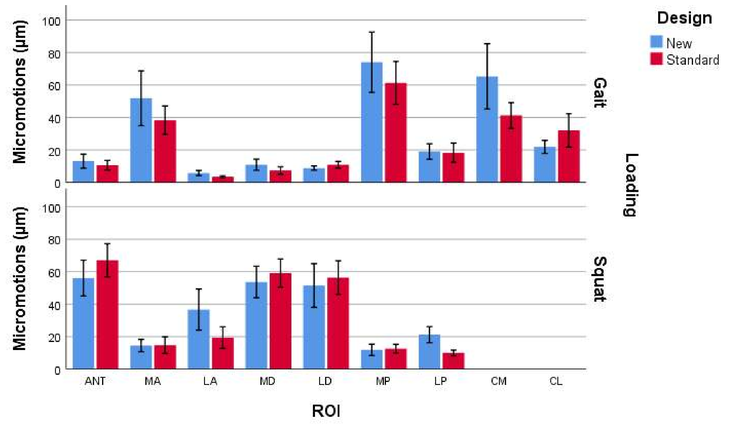


- The Regions of interest (ROIs) defined at the bone-implant interface are the anterior flange (ANT); the anterior, distal, and posterior region of the medial (MA, MD, MP) and lateral (LA, LD, LP) views; and the medial and lateral condyles (CM, CL)
- Micromotions are parallel to interface (white arrows), and opening/closing perpendicular (black arrows).



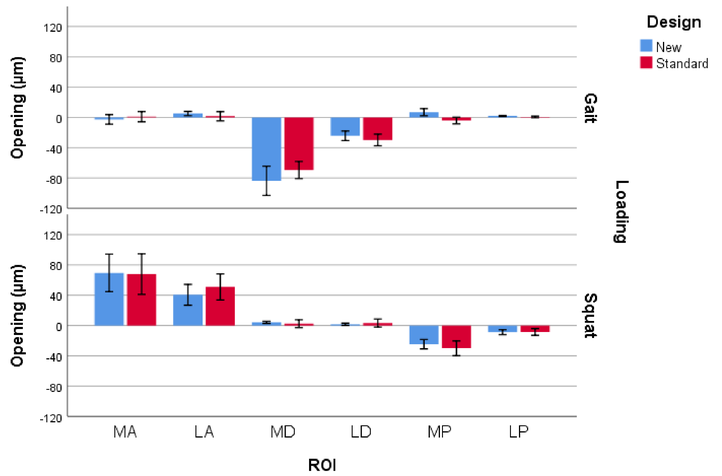
Micromotions

- General Linear Models (GLMs) were defined with design, loading, and ROI as independent variables. Specimens were considered as a random factor.
- During gait the highest micromotions were found in the posterior condyles (CM, MP), for squat the largest micromotions were in the anterior flange (ANT).



Opening/closing

- Opening was noticed anteriorly (MA, LA) for squat, while closing was presented distally (MD, LD) for gait.



Discussion and Conclusion

- No significant difference was found between the standard and novel coating implants for micromotions (P=0.374) nor opening/closing (P=0.9).
- A ticker coating had no influence on the primary stability of a press-fit femoral TKA component.
- Abrasion and damage of the underlying trabecular bone during implantation may explain these findings.
- Results suggest that there is an interference threshold beyond which fixation does not further improve.

Conclusion

This study shows that an increased interference fit does not reduce implant-bone micromotions of femoral TKA components. A possible explanation for this findings may be an increase in bone damage during implantation with a thicker coating, which may be revealed in further analysis of the deformed bone surfaces.

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