

Tibial Design Considerations in Unicompartmental Knee Arthroplasty



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TKA
68%

HTO
9%

Knee Surgery

UKA
12%

Men Tx (incl. CMI)
11%



Tibial Design Considerations in UKA

- Fixed-bearing vs mobile-bearing design
- Clinical results: Literature
- Conclusion



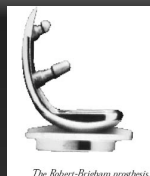
Implant types: Fixed-bearing vs Mobile-bearing Design

- Fixed-bearing Design
 - Metal-backed
 - All polyethylene
- Mobile-bearing Design



Fixed-bearing Designs

- Metal backing
 - 1980s (eg Robert-Brigham)
 - More even distribution of stress
 - Modular
 - Disadvantage: Thinner polyethylene liner or larger tibial cut is needed



The Robert-Brigham prosthesis



Mobile meniscal bearing Designs

- Oxford (Biomet)
 - Fully congruent (ie constant radius)
 - Uncaptured straight track
- LCS (Depuy)
 - Dovetail radial track → reducing dislocation risk
- Purpose: optimize congruency → minimizing point tibial contact forces and stress at implant fixation interface



Minimise wear by increasing contact area without increasing constraint

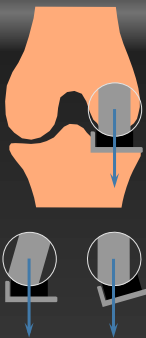
- Mobile bearing design
- Spherical femoral articulating surface
- Flat polished CoCr tibial plate
- Bearings designed to reduce anterior impingement



Anatomy - Spherical condyles



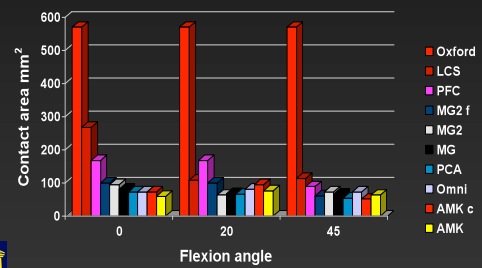
Spherical condyles



- Alignment of femoral and tibial component less critical

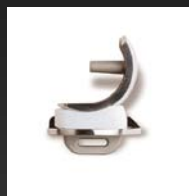


Contact Area



Improve function by allowing rollback and working with soft tissues

- Meniscal bearing design.
- Movement of bearing dictated by ACL & PCL.



The results



Fixed-bearing Designs

- Metal-backed vs All-poly:
 - No difference in clinical results or migration at short term
 - Long-term undetermined

Hylldahl HC, Regnér L, Carlsson L, Kärrholm J, Weidenhielm L: Does metal backing improve fixation of tibial component in unicompartmental knee arthroplasty? A randomized radiostereometric analysis. *J Arthroplasty* 2001;16:174-179.



Clinical results: Fixed-bearing

- Berger et al 2005:
 - Modular fixed-bearing, metal-backed
 - Thinnest polyethylene 5.7mm
 - 96% survival at minimum 10 year follow up (average 12 years)

Berger RA, Meneghini RM, Jacobs JJ, Sheinkop MB, Dell Valle CJ, Rosenberg AG, Galante JO: Results of unicompartmental knee arthroplasty at a minimum of 10 years follow-up. *J Bone Joint Surg Am* 2005;87:999-2006.



Clinical results: Mobile bearing

- Price et al 2005:
 - Oxford meniscal-bearing
 - Thinnest polyethylene 3.5mm
 - No degradation in outcome with thinner PE
 - 93% survival at 15 year in 439 knees
 - Congruency and resulting decrease in contact stress may obviate need for thicker (> 6mm) inserts → supports surgical principle of minimizing tibial bone cut thickness



Price AJ, Waite JC, Svard U: Longterm clinical results of the medial Oxford unicompartmental knee arthroplasty. *Clin Orthop Relat Res* 2005;435:171-180.



Results summary: Mobile bearing

- Goodfellow99.1% survival at 9 years.
- O'Connor0.026mm/year penetration rate.
(A 4mm bearing will take 152 years to wear through!)
- Svård94.6% survival at 10 years.
- Swedish knee register. .89% survival at 6 years.
(Results adversely affected by two centres.)

Exceptional results subject to good technique!



Clinical results: Mobile vs Fixed-bearing

- Emerson et al 2002:
 - Retrospective review, 2 time periods
 - Loosening and revision
 - Oxford mobile bearing 99% survival
 - Robert-Brigham fixed-bearing (J&J) 93% survival

Emerson RH Jr, Hansborough T, Reitman RD, Rosenfeldt W, Higgins LL: Comparison of a mobile with a fixed bearing unicompartmental knee implant. *Clin Orthop Relat Res* 2002;404:62-70.



Clinical results: Mobile vs Fixed-bearing

- Confalonieri et al 2004:
 - Prospective RCT
 - AMC mobile bearing (Alphanorm)
 - Allegretto fixed-bearing (Centerpulse)
 - No statistical difference at 5.7 years

Confalonieri N, Manzotti A, Pullen C: Comparison of a mobile with a fixed bearing unicompartmental knee prosthesis: A prospective randomized trial using a dedicated outcome score. *Knee* 2004;11:357-362.



Clinical results: Mobile vs Fixed-bearing

- Lewold et al 1995:
 - Swedish multicenter survival study
 - Oxford mobile bearing vs Marmor fixed-bearing
 - 6 year revision rate Oxford more than twice than Marmor
 - ✓ Most common: PE dislocation in Oxford (especially early in learning curve)

Lewold S, Goodman S, Knutson K, Robertsson O, Lidgren L: Oxford meniscal bearing knee versus the Marmor knee in unicompartmental arthroplasty for arthrosis. A Swedish multicenter survival study. *J Arthroplasty* 1995;10:722-731.



Clinical results: Mobile vs Fixed-bearing

- Smith et al. 2009: Meta-analysis
 - Clinical, radiological and kinematic outcomes
 - No significant difference
 - Only 5 of 737 studies met inclusion criteria
 - (4 medial UKA, 1 lateral UKA)

Smith TO, Hing CB, Davies L, Donell ST: Fixed versus mobile bearing unicompartmental knee replacement: A meta-analysis. *J Orthop Traumatol Surg Res* 2009;95:599-605



Clinical results: Mobile vs Fixed-bearing

- Primary reasons for revision:
 - Fixed bearing: tibial component failure
 - Mobile bearing: progressive arthritis lateral compartment

Emerson RH Jr, Hansborough T, Reitman RD, Rosenfeldt W, Higgins LL: Comparison of a mobile with a fixed bearing unicompartmental knee implant. *Clin Orthop Relat Res* 2002;404:62-70.

Price AJ, Waite JC, Svard U: Longterm clinical results of the medial Oxford unicompartmental knee arthroplasty. *Clin Orthop Relat Res* 2005;435:171-180.



Conclusion

- Survival rates between 90 and 98% at 10 years
- Fixed- vs mobile-bearing:
 - Overall comparative data remain mixed
 - Larger, long-term follow-up studies may be needed to determine any true difference

- Patient Selection
- Surgical technique & experience!!



Thank you for your attention!!!

