Bicruciate Retaining TKA: A Better Knee?

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Disclosure

• Consultant with Intellectual Property (royalties)
• Smith and Nephew
Surface Replacement


- Gunston's Polycentric
- Unicondylar
- Duocondylar
Keep both cruciates
Support for preserving ACL

• **Biomechanical studies:**

  • **Bicruciate-retaining TKA demonstrates similar kinematics as nl knee:** (Stiehl et al, J Arth 2000)
    - Gradual posterior femoral rollback
    - Limited tibial AP translation with flexion
  
  • **PCL-retaining TKA has similar kinematics as ACLD knee:** (Stiehl et al, J Arth 2000)
    - Tibia significantly anterior in full extension
    - Progressive tibial AP translation with flexion
    - Paradoxical anterior slide of femoral condyles w/ exaggerated medial condyle AP translation on deep knee bend
  
  • **Pattern of IR of tibia during gait and deep knee flexion:** (Dennis et al, Clin Orth Rel Res, 2004; Patil et al, JBJS 2005)
    - Normal knee = bicruciate-retaining
    - Reversed pattern in PCL-retaining
  
  • **Posterior stabilized TKA produces condylar lift-off** (Dennis et al, JBJS 2001)
    - Associated w/ minimal tibial IR
Support for preserving ACL

**Functional outcomes:**

- Normal kinematics with stair climbing:
  - bicruciate-retaining > PCL-retaining
  (Andriacchi et al, JBJS Am 1982; Pritchett, J Arth 1996)

- In pts w/bilat TKA, bicruciate-retaining knee “felt better”
  than PCL-retaining or posterior stabilized knee
  (Pritchett, J Arth 1996; Pritchett, JBJS Br 2004)
  - 89% preferred bicruciate-retaining knee
  - More normal, more stable, stronger on stairs, fewer clunks/clicks/pops
Support for preserving ACL

• Long-term follow-up in 163 patients at 10 years post-op: (Cloutier et al, JBJS 1999)
  • 89% normal AP stability
  • 90% normal mediolateral stability
  • Survival rate w/revision as end point: 95%
  • No revisions were performed due to posteromedial wear of tibial component
    • Even partly degenerated ACL remains functional
Why did the old ACL retaining TKA’s Fail?

- Twenty retrieved bi-cruciate knee implants (BioPro, Port Huron, MI, and Geomedic, Howmedica, Rutherford, NJ)

- Sixteen Ti-6Al-4V tibial trays with four fixation screw holes and two pegs

- Two cast CoCr with three fixation screw holes

- Two one-piece all-poly tibial components

Tibial Failure

Insert Dissociation

Two out of sixteen BioPro inserts were disassociated anteriorly, resulting in metal-metal articulation, thus removing a section of the posterior aspect of the titanium trays.

Gamma in Air Polyethylene Delamination

• All poly inserts, except two, showed signs of severe delamination and wear due to gamma irradiation in air sterilization
  • The max. oxidation index was 3.6 - 4.2 using FT-IR
• For reference, the oxidation index for a 6 year old XL-PE and 10 year old C-PE, both sterilized by EtO, was measured to be less than 0.02

ModernACL Retaining TKA

Rolston L, Moore C. Conversion of Lateral UKA to ACL Retaining TKA. The Knee 2010

- 141 XP TKA’s
- 3 year survivorship 88 per cent
- Revisions were for isolated tibial loosening (5/19), anterior cruciate ligament (ACL) impingement (3/19), pain (4/19), unknown reasons (3/19), femoral and tibial loosening (2/19), ACL deficiency (1/19), and arthrofibrosis (1/19)
Journey XR Design Goals

- Bicruciate retaining tibial baseplate
- Tibial baseplate strength equivalent to current TKA implants
- CR femoral component
- Physiologic joint line
- Bone cuts perpendicular to mechanical axis
- Minimal rotational constraint
- Insert options and technique to balance flexion and extension gaps
Tibial tray fatigue strength of nearly 2.5-times the recommended minimum strength

Fixation 8% higher than short keel design and 47% lower than long keel design

CR Femoral Component
Neutral and upsloped inserts
The joint line is aligned in (physiologic, anatomic, and kinematic) varus. Bone cuts are perpendicular to mechanical axis.
Rotationally unconstrained
Early Clinical and Patient-reported Results of a Bi-cruciate Retaining Posterior-stabilized Guided Motion Knee Device: Six-month Results of a Prospective Multicenter Study of 149 Primary TKAs

- 1 year follow up
- KOOS Pain score improved from 48.74 pre-operative to 74.71 post op
- KOOS Symptoms improved from 49.5 to 69.5
- KOOS Activities of Daily Living improved from 55.8 to 81.8
- KOOS Sport and Recreation improved from 25.0 to 60.4
- KOOS Quality of Life improved from 26.2 to 62.4
- EQ-5D-3L utility score improved from 0.66 to 0.85
- There was one device revision among 149 TKAs for postoperative periprosthetic tibia fracture.
Goals of TKA

• Pain relief
• Durability

...and now they want

• better function

McCalden RW, Hart GP, MacDonald SJ, Naudie DD, Howard JH. Clinical Results and Survivorship of the GENESIS II Total Knee Arthroplasty at a Minimum of 15 Years. J Arthroplasty 2017
What's more important to you?

• Durability – so you don’t have to go through this operation again

• OR

• Functionality – so you can ski, bike, hike on hillsides, play tennis, and be active
Indications?

- Just past indications for Uni (patellofemoral, lateral OA)
- Good bone stock
- Intact ACL
- No deformity
Summary

• Bicruciate Retaining TKA feasible
• More normal kinematics
• Prior ACL Retaining TKA’s failed from wear, fracture, loosening, stiffness
• Early results with modern materials and instrumentation favorable, but long term results not established
Thank You