DISCLOSURE

- Consultant
  - Zimmer
  - Sanofi Biosurgical
- Research Support
  - DePuy Orthopaedics
  - Baxter
- Royalties
  - DePuy Orthopaedics
“When you find yourself in a hole, stop digging.”  Will Rogers
Revision TKA: Principles of Management

“Insanity: Doing the same thing over and over again and expecting different results.”

Albert Einstein
1. Preoperative Planning
2. Exposure
3. Implant Removal
4. Reconstruction
5. Soft Tissue Balance
6. Manage Bone Defects
7. Extensor Mechanism
8. Implantation
9. Closure
10. Rehabilitation
PREOPERATIVE PLANNING

- Establish Diagnosis
- Christopher Columbus Surgery
  - Don’t know where you’re going
  - Don’t know where you are when you get there
  - Don’t know where you’ve been once you’ve left
- If you don’t know what is wrong, you are unlikely to fix it
Painful TKA

• Extrinsic Causes
  – Referred pain
    • Spine
    • Pelvis
    • Hip
  – Soft-Tissue irritation
    • Bursitis
    • Tendinitis
  – CRPS
  – Neuroma
  – Vascular claudication
  – Fracture

• Intrinsic Causes
  – Infection
  – Aseptic loosening
  – Instability
  – Malalignment
  – Wear/Osteolysis
  – Soft-Tissue impingement
    • Clunk
    • Overhang
  – Extensor mechanism dysfunction
    • Maltracking
    • Impingement
    • Insufficiency

INSALL AWARD PAPER:
Why Are Total Knee Arthroplasties Failing Today?

• 212 Revision TKA, 203 Patients
• 9/97—10/00
• 55.6% < 2 years
  – 50% related to instability, malalignment, or malposition, and failure of fixation
  – 16.9% Loosening
    • Uncemented Femurs
    • Surface Cementing of Tibias

<table>
<thead>
<tr>
<th>Reasons for Revision Surgery</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Polyethylene wear</td>
<td>26.0</td>
</tr>
<tr>
<td>Loosening</td>
<td>24.1</td>
</tr>
<tr>
<td>Instability</td>
<td>21.2</td>
</tr>
<tr>
<td>Infection</td>
<td>17.5</td>
</tr>
<tr>
<td>Arthrofibrosis</td>
<td>14.6</td>
</tr>
<tr>
<td>Malalignment or malpositioned</td>
<td>11.8</td>
</tr>
<tr>
<td>Extensor mechanism deficiency</td>
<td>6.6</td>
</tr>
<tr>
<td>Avascular necrosis patella</td>
<td>4.2</td>
</tr>
<tr>
<td>Periprosthetic fracture</td>
<td>2.8</td>
</tr>
<tr>
<td>Isolated patellar resurfacing</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Early Failures in Total Knee Arthroplasty

- 440 Revision TKA
  - 1986-1999
  - 279 (63%) within 5 Years
- “If all [TKAs were] cemented...and balanced carefully, ...early revisions would have...decreased by...40%, and...overall failures... by 25%.”
- “Special care must be given to the soft tissue...to avoid early revision for instability.”

Fig 1. Failures of early total knee arthroplasty by diagnosis are shown.

Why TKAs Fail

• AAHKS 2012
  – Dalury et al
    • Instability 16%
    • Malposition/Malalignment 2.7%
    • Pain/Stiffness/Dislocation 9.7%
  – Schroer, et al
    • Instability 21%
    • Malalignment 8%
    • Failure within 5 years 61%

– Factors under surgeon control: > 30%
PREOPERATIVE PLANNING

• History
  – Previous implants
  – Infection

• Physical Examination
  – General (Hip/Spine/N/V)
  – Incisions
  – Extensor mechanism
  – ROM
  – Instability

• X-Rays
  – Long Film
  – Full Knee Series
  – Fluoro?
PREOPERATIVE PLANNING

• Nuclear Scanning
  – Bone Scan
  – WBC Scan
  – Sulfur Colloid

• Cross Sectional Imaging
  – CT Scan
    • Osteolysis
    • Rotation
  – MRI (MARS)
PREOPERATIVE PLANNING

• RULE OUT INFECTION IN EVERY REVISION
  – ESR
  – CRP
  – CBC?
  – Aspiration
    • Cell Count
    • Differential
    • Gram Stain
    • Cultures
  – Maintain High Index of Suspicion
    • Cell count >1100
    • Polys > 60%
    • Intraoperative Specimens
      – Gram Stain +/- ??
      – Fluid analysis
      – Frozen section
      – Permanent section
      – Cultures
EXPOSURE

- Incision
  - Most lateral
  - Most recently used
  - Respect blood supply
  - > 2yrs use best incision
EXPOSURE

- Arthrotomy
  - Medial Parapatellar
  - Quad Snip
  - V-Y Quadricepsplasty
  - TTO

- Debridement
  - Synovectomy
  - Gutters
  - Polyethylene removal
  - Progressive patellar subluxation/eversion
IMPLANT REMOVAL

- **Preserve Bone**
  - Implant-cement interface
- **Patience**
  - Don’t extract until free
- **Adequate Instruments**
RECONSTRUCTION

• Now What???
• Don’t Panic!!!
“The operating room is no place to think!”

--Maurice Muller
RECONSTRUCTION

- Establish a Tibial Platform
- Fill the Flexion Space
- Fill the Extension Space

**Ignore bone and soft tissue deficiency at this point**
KINEMATICS

• Reestablish Tibial Platform
  – Affects flexion and extension equally
  – Cannot be used to adjust either

• Balance the Flexion Space
  – Femoral Component Size
    • Size to tension ligaments, not to fit bone
  – Femoral Component Rotation
    • Posterolateral augments
  – Joint Line Restoration

• Stabilize Knee in Extension
  – Distal femoral augmentation
RECONSTRUCTION

• Know Implant System
• Fully Integrated System
  – Versatility
  – Customization
  – Continuum of Options
    – Sizing
    – Augmentation
    – Fixation
    – Constraint
**SOFT TISSUE BALANCE**

- Soft Tissue Balance—Gaps

<table>
<thead>
<tr>
<th>Flexion</th>
<th>Tight</th>
<th>Ok</th>
<th>Loose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tight</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ok</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Loose</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

Date: 1/10/2013
ARTICULAR CONSTRAINT

- Determine the level of constraint necessary based on the competence of the soft tissue
  - Flexion (Sagittal) Stability
    - Height of post necessary to stabilize jumping distance
  - Extension Stability (Varus-Valgus)
    - Collateral balance and competence
# Articular Constraint

## Revision TKA Defect to Prostheses Match

<table>
<thead>
<tr>
<th>Bone defects</th>
<th>Soft tissue laxity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stable</td>
</tr>
<tr>
<td>T1/F1</td>
<td>Non-stabilized or stabilized</td>
</tr>
<tr>
<td>T2/F2</td>
<td>Stabilized or VVC</td>
</tr>
<tr>
<td>T3/F3</td>
<td>Hinge</td>
</tr>
</tbody>
</table>
• Fixation determined by:
  - Degree of bone loss
  - Established Kinematics
  - Degree of constraint
  - Options
    • Stems
      - Cemented
      - Cementless-Filling
    • Sleeves/Cones
    • Augments
    • Bone Graft
• Tracking
• Reconstructive Options
  – No revision
    • Acceptable geometry
  – Resurfacing
    • Inset
    • Standard
  – Patelloplasty*
  – Gull Wing Osteotomy
• Substitution/Augmentation
  – Allograft reconstruction

• **Cementation**
  - Don’t cement cementless stems
    • No cement in the canal
  - Carefully cement cemented stems
    • Cement restrictor
    • Cement Gun?
      - Canal Fill
      - Pressurization

• **Mind Tibial rotation**
POSTOPERATIVE CARE

- Closure
- CPM/Rehabilitation/Mobilization
  - Bracing if necessary
- DVT Prophylaxis
- Blood Management
- Wound Management
- Medical Management
- Disposition
- Post discharge follow up
• Revision TKA is complex, but can be simplified by systematically dividing it into its sequential component parts
  – Not just a repeat of the primary procedure
• Fundamentally, a soft tissue procedure
  – Understand the pathology of the soft tissue envelope
  – Design the revision to enable the components to support and balance the soft tissue envelope surrounding the knee
1. Preoperative Planning
   - Establish the diagnosis
2. Exposure
3. Implant Removal
4. Reconstruction
   - Tibial Platform
   - Flexion Space
   - Extension Space
5. Soft Tissue Balance
   - Stability
     - Coronal
     - Sagittal
   - Constraint
6. Manage Bone Defects
   - Fixation
7. Extensor Mechanism
8. Implantation
9. Closure
10. Rehabilitation
THANK YOU!!

תודה רבה!!
KINEMATICS

• Resist the urge to address fixation before re-establishing an appropriately balanced knee in flexion and extension

• Choosing implants, especially the femur, according to remaining bone will inevitably result in an undersized malrotated femur, implants which are not coupled, and a knee which is impossible to balance
  – TKA is a soft tissue procedure, reshaping bones to support the soft tissues

• Utilizing the femoral component to adjust and balance flexion and extension gaps against a stable tibial foundation links the tibia to the femur in partnership, and acknowledges the altered status of the revision soft tissue envelope
Revision TKA: Preoperative Planning

• History
  – Previous implants
  – Infection
• Physical Examination
  – General (Hip/Spine/N/V)
  – Incisions
  – Extensor mechanism
  – ROM
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  – Bone Scan
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  – Sulfur Colloid
• Cross Sectional Imaging
  – CT Scan
    • Osteolysis
    • Rotation
  – MRI (MARS)
ESTABLISH THE DIAGNOSIS

• Understanding the cause of failure of the primary TKA is critical to success during the revision
  – Unlikely to improve a painful TKA without a diagnosis
    • 59% poor or fair results (Mont et al. CORR 1996)

“Often, the problem with poor reconstruction is failure to establish a conceptual framework with which to understand the problem arthroplasty.”

Kelly Vince, JOA 2003