Prosthetic Anterior Cruciate Ligament Reconstruction: A Prospective Study

5-7 Year Results

Franklin E. Mirrer, MD
Richard J. Mason, MD
Kenneth J. Rogers, MS, ATC
Joseph S. Torg, MD
Joe Torg Center For Athletic Trauma

MCP Hahnemann University
219 North Broad St.
Philadelphia, PA
Introduction

- Over 100,000 new ACL injuries occur each year in the U.S.
- Ideal graft remains elusive
- Autogenous
  - Patella tendon vs. Hamstring
- Allograft
  - Cost, disease transmission, shortages
Introduction

◆ Synthetic Grafts
◆ Pros
  – Avoids negative factors associated with autografts and allografts
◆ Cons
  – High failure rates reported
  – Functional results deteriorate with time
Introduction

- Good outcomes noted in our patients reconstructed with braided UHMWPE graft who had chronic isolated ACL insufficiency
  - Smith & Nephew Richards, Memphis, TN
Purpose

- Prospectively evaluate the long-term results of this synthetic graft reconstruction
- Identify factors related to the graft’s success or failure
- Compare our results to overall results for this graft
Materials & Methods: Study Group

- 9 patients with symptomatic ACL insufficiency reconstructed between May 1991 & Feb. 1993
  - 8 chronic (> 26 weeks)
  - 1 subchronic (3-26 weeks)
- Avg age 32 (range 19 - 43)
- Right knee in 4, Left in 5
Materials & Methods: Study Group

- 7 of 9 had prior surgery on reconstructed knee
  - 3 prior medial meniscectomies (2 partial, 1 subtotal)
  - 4 diagnostic arthroscopies (2 with debridement of ACL remnant)
- Evaluation of joint surfaces done at time of reconstruction
# Mechanism of Injury

<table>
<thead>
<tr>
<th>Mechanism</th>
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<tbody>
<tr>
<td>Basketball</td>
<td>3</td>
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<tr>
<td>Racquetball</td>
<td>1</td>
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<tr>
<td>Football</td>
<td>1</td>
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<td>Soccer</td>
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<td>Field Hockey</td>
<td>1</td>
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<td>Karate</td>
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<td>PED vs. MVA</td>
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Surgical Procedure

- Anterior cruciate ligament reconstruction
- Synthetic Graft: Braided ultra-high molecular weight polyethylene (UHMWPE)
  - Smith & Nephew Richards (no longer manufactured)
Surgical Procedure

- **Graft placement**
  - Standard tibial tunnel placement
  - Graft routed “over the top” of the lateral femoral condyle
    - through distal lateral thigh incision

- **Graft fixation**
  - Secured on femoral and tibial side with screw and washer
Associated Operative Findings

Medial Meniscal tears: 3/9
Lateral meniscal tears: 4/9
Medial compartment cartilage degeneration:
  Mild - 2
  Moderate – 3
  Severe - 1
Postoperative Course

- All underwent aggressive rehabilitation
  - Early ROM, strengthening
  - Progressive return to general athletic activity
  - Sports specific activity by 4 months
- All returned to desired level of activity by 6 months
Materials & Methods: Data Collection

- All patients evaluated at 1 year post op
- 8 of 9 evaluated at 5-7 years (range 63 - 84 mos.)
  - 7 returned for exam
  - 1 phone interview
  - 1 lost to f/u at 18 mos.
**Materials & Methods: Data Collection**

- **Objective Evaluation**
  - Lysholm Knee Score
  - Tegner Activity Scale
  - Lachman, Pivot Shift
  - KT 1000, Cybex
Results

Lysholm Knee Scoring Scale (normal knee=100)

- Preoperative mean Lysholm knee score: 73/100
- One year post op score: 94/100
- 5-7 year post op score: 93/100
Results

- **Tegner Activity Scale**
  - Preoperative mean: 4.2 (lowest level recreational sports)
  - One year post op = 5-7 year post op: 6.3 (Highest level recreational / some competitive sports)
Objective Analysis

- **Lachman Exam (grade 1-3)**
  - Preoperative mean: 2.2
  - One year post op: 0.3
  - 5-7 years post op: 0.7
Objective Analysis

- Pivot Shift Exam (grade 1-3)
  - Preoperative mean: 1.9
  - One year post op: 0.0
  - 5-7 years post op: 0.6
Objective Analysis

- **KT-1000 Arthrometer Testing**
  - Mean preoperative maximal manual displacement between affected and unaffected knees
    - 6.3 mm
  - 1 year post op: 0.8mm
  - 5-7 years post op: 2.5mm
Objective Analysis

• Cybex Testing
  • Peak Quadraceps Torque difference between affected and unaffected limbs
    • 10% at 1 year post op
    • 7% at 5-7 years post op
  • Peak Hamstring torque- no significant difference between limbs
**Complications**

- No graft ruptures nor failures
- No persistent effusions nor other major complications related to the graft
- 2 patients with tender medial hardware
  
  - This did not change objective result
Discussion

- Advantages of a Synthetic Graft
  - No donor site morbidity
  - No disease transmission
  - Does not require revascularization
    - Allows earlier aggressive rehab and return to sport
Synthetic Graft Results

◆ Most series have reported a high number of complications
  • Graft Failure (Rupture)
  • Objective increases in laxity
  • Recurrent effusions

◆ Complication and failure rates increase over time
Synthetic Graft Results

Smith & Nephew Richards UHMWPE Lig
- Manufacturer’s study: 112 pts, 2-5 year f/u
  - 33.1% Complication Rate
    - Synovitis / Effusion 22
    - Device Rupture 15
    - Bursitis over screw 9
    - Failure of Fixation 3
    - Infection 3
Synthetic Graft Results

- **Gore-Tex Ligament**
  - Mosely et al
    - 57 pts, 4 year f/u: 18% failure rate
  - Karzel et al
    - 61 pts, 4 year f/u: 17% failure rate
Synthetic Graft Results

- **Stryker Dacron Ligament**
  - Gillquist et al
    - 70 pts, 5 year f/u: 23% failure rate
  - Wilk & Richmond
    - 84 pts, 2 year f/u: 20% failure rate
    - 5 year f/u: 37.5% failure rate
    - ***Only 10% failure rate noted in grafts placed in “over the top” position on femur***
Synthetic Ligament Placement

- Montgomery et al – CORR 1988
  - Evaluated Dacron Graft Wear
    - Noted increased abrasion and fatigue wear at interface of graft with femoral tunnel
    - Site of graft rupture
Synthetic Ligament Placement

Fleming et al – Cadaveric Study (JOR, 1992)
- Compared “over the top” (OTT) and femoral tunnel (FT) placement
- Findings:
  - No significant difference in AP Laxity
  - Higher tensile stress in FT graft at knee flexion >90
  - Increased graft tensioning caused overconstraint and graft stress in the FT position >> OTT position
- Conclusion: OTT placement optimal for lifespan of prosthetic graft
Comparing Our Results With Overall Experience

- No failures at 5-7 year F/U
- No recurrent effusions
- Minimal deterioration in subjective and objective knee function over time
- All grafts placed in the OTT position vs. standard FT
Conclusions

1. Graft failure and functional deterioration did not occur in our study group over 5-7 years.

2. Our results are consistent with decreased graft stress with OTT placement vs. a FT position.

3. Successful long term results with minimal complications are possible with a synthetic ACL graft.
Thank You
**Synthetic Graft Breakdown**

- Graft cycling against bone surface
- Most common site of observed rupture and wear:
  - Femoral Tunnel – Graft Interface