PCL Reconstruction: Transtibial Tunnel Surgical Technique Using Achilles Tendon Allograft

Surgical Technique and Results
What Has Worked for Me

Gregory C. Fanelli, M.D.
115 Woodbine Lane
Danville, PA 17822-5212
570-271-6700
gregorycfanelli@gmail.com
Disclosure

• Royalties:
  – Springer
    • PCL Textbooks
    • Multiple Ligament Injured Knee Textbooks

• Stock options: None

• Consultant:
  – Biomet Sports Medicine
    • PCL ACL Instrumentation System
    • Speaker
  – Conmed
    • Speaker

• Research support: None

• Educational support: None

• Other support: None
PCL Injuries In Trauma Patients: Part II
G. Fanelli, C. Edson, 1995
Arthroscopy Vol. 11, No 5, 1995

- Acute Knee Injuries: 222
- PCL Tears: 85 (38.3%)
- Multiple Trauma Related: 48 (56.5%)
- Sports Related: 28 (32.9%)
- PCL/Multiple Ligaments: 82 (96.5%)
- PCL/Isolated: 3 (3.5%)
- Combined ACL/PCL: 39 (45.9%)
- PCL/PLC: 35 (41.2%)
- ACL/PCL (% total): 17.6%
Conclusions

- Associated ligament instabilities
  - Missed or failed PLI reconstruction
    - Sekiya, AJSM, 2005
  - Don’t forget posteromedial reconstruction
    - Robinson, AJSM, 2006
- Varus osseous malalignment
- Incorrect tunnel placement
Graft Selection

Fulkerson, *Arthroscopy*, 1995

Lee, *Arthroscopy*, 2004
Patient Positioning \ Set Up

ACL/PCL Reconstruction

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Equipment, Accessory Incisions, Accessory Portals

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PCL Anatomy

• 38 mm x 13 mm.
  – Larger insertion sites
• Three main components:
  – Anterolateral
  – Posteromedial
  – Meniscofemoral ligaments
• Tensioning patterns:
  – Anterolateral increases with flexion
  – Posteromedial increases with extension
• *Functional insertion sites*
PCL Reconstruction Tibial Tunnel

Normal PCL

Failed PCL Reconstruction

Successful PCL Reconstruction

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PCL Reconstruction Tibial Tunnel

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Protect the neurovascular structures!

PCL Reconstruction Transtibial Technique
PCL Reconstruction Femoral Tunnel

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PCL Reconstruction Femoral Tunnel

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Double Femoral Tunnel-Double Bundle Surgical Technique

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Double Femoral Tunnel-Double Bundle Surgical Technique

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Double Femoral Tunnel-Double Bundle Surgical Technique
Double Femoral Tunnel-Double Bundle Surgical Technique

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Tensioning and Fixation

- **Graft tensioning**
  - Graft tensioning boot
  - MLIK set 0° (PCL and ACL)
  - Full Arc Dynamic Tensioning

- **Final fixation flexion angle**
  - PCL DB and SB 70°- 90°
  - ACL 20 - 30°

- **Full ROM**

- **Lateral and medial sides (30°)**

- **Primary fixation**
  - Resorbable interference screw
  - Aperture opening

- **Back-up fixation**
  - Button
  - Spiked ligament washer

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Mechanical Graft Tensioning
Post Operative Rehabilitation Program

- Full extension long leg brace
- Crutch ambulation
  - NWB 3-5 weeks
- Progressive ROM
  - POW # 3-10
- Progressive weight bearing
  - POW # 3-10
- Progressive ROM, strength, proprioceptive skills training
- Sports / heavy work in 12 months
  - Strength, ROM, proprioceptive skills
- Functional brace (may protect collateral ligament complex)
- Must observe carefully and individualize
  - Get a “feel for the personality of the knee”
  - ROM under anesthesia

Results
AA PCL/PLC Reconstruction
2-10 Year Follow-Up

• Study type: case series
• 41 chronic PCL/PLC reconstructions
  – 3 months to 20 years
  – Follow-up rate 41/53 (77.4%)
• 31 M, 10 F, 24 L, 17 R
• Surgical Technique
  – PCL AA, SFT, SB, TTT
    • FF-ATAL 41
  – PLC BTT, PLC shift, primary repair.
    • CBTT 24
    • SBTT 17
AA PCL/PLC Reconstruction
2-10 Year Follow-Up Results

- **Posterior Drawer-Tibial Step Off**
  - Normal 29/41 (70%)
  - Grade 1 11/41 (27%)
  - Grade 2 1/41 (3%)

- **Biomet Tensioning Boot**
  - 12/41 (29.3%)
  - Normal 11/12 (91.7%)
  - Grade 1 1/12 (8.3%)

Effect of Graft Tensioning Boot: PCL Reconstruction
Combined PCL PLC reconstruction with ATAL and BFTT: 2-10 year follow-up.  

- 41 arthroscopic PCL PLC reconstructions
- PCL: 41 fresh frozen Achilles tendon allografts
- PLC: BFT transfer, PL capsular shift, primary repair
  - CBTT 24
  - SBTT 17
- ERTFA-Dial Test
  - $I < N$ 29/41 (71%)
  - $I = N$ 11/41 (27%)
  - $I > N$ 1/29 (2%)
- 30˚ Varus
  - Normal 40/41 (97%)
  - Grade 1 1/41 (3%)
MLIK Reconstruction Results

- Fanelli, Edson, Giannotti. AA combined ACL PCL reconstruction. *Arthroscopy*, 1996
- Fanelli, Edson. AA assisted combined ACL PCL reconstruction. 2-10 year results. *Arthroscopy*, 2002
  - No graft tensioning boot
  - Tensioning boot utilized
Outcomes: What To Expect Long Term

• Autograft-allograft, acute-chronic
  – No statistically significant difference
    • KT 1000, stress x-ray, HSS, Lysholm, Tegner

• Mechanical graft tensioning boot (Biomet)
  – Without boot 46% normal posterior drawer
  – With boot 87-92% normal posterior drawer
  – PLI and PMI corrected in both series

• SB vs DB PCL Reconstruction
  – No statistically significant difference
    • Static stability (stress x-ray [2.56mm and 2.36 mm], KT 1000)
    • Return to pre-injury level of function (73 to 84%)

• Long term results MLIK
  – 60% return to pre-injury level of function (Tegner)
    • 93% same or one Tegner grade lower level of activity
  – 23 to 30% rate of degenerative joint disease
  – Static stability retained
    • Physical examination, KT 1000, stress x-ray
    • 18 to 22 years post op

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Summary

- Identify and treat all pathology (PLI, PMI, alignment)
- Strong graft material
- Accurate tunnel placement
- Anatomic graft insertion sites
- Minimize graft bending
  - Preserve PCL tibial remnant
- Mechanical graft tensioning boot
- Primary and back-up fixation
- Appropriate postoperative rehabilitation program
- Successful results SB and DB PCL reconstruction
  - No statistically significant difference
  - Stress x-ray
  - KT 1000
  - Knee ligament rating scales
  - Patient satisfaction
  - DB PCLR indications
    - Hyperextension
    - Revision PCLR
Gregory C. Fanelli, M.D.
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Danville, PA 17822-5212
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gregorycfanelli@gmail.com
### Single vs. Double Bundle PCL Reconstruction

**Return to Pre-Injury Level of Function**

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<thead>
<tr>
<th></th>
<th>Single Bundle</th>
<th>Double Bundle</th>
<th>P Value</th>
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<tbody>
<tr>
<td><strong>Overall Group</strong></td>
<td>34/45</td>
<td>30/45</td>
<td>0.358</td>
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<tr>
<td><strong>PCL Collateral Ligament Group</strong></td>
<td>20/23</td>
<td>15/18</td>
<td>0.756</td>
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<tr>
<td><strong>Bi-cruciate Group</strong></td>
<td>17/22</td>
<td>21/25</td>
<td>0.572</td>
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No SS difference