No relevant financial disclosures.
Single Bundle Transtibial ACLR Restoration of Native Footprint

What Do We Know - Literature

- ACLR Techniques
  - Fail to Reproduce Anatomy³-⁵

- Anatomy Replication
  - Improves Clinical Outcomes¹-²
    - Femoral Tunnel Position
    - Tibial Tunnel Position

Native ACL Footprint

- Femoral Insertion\(^{3-4}\)
  - Anteromedial Bundle
    - Deep to Shallow: 25.9-26.4
    - High to Low: 17.8-25.3
  - Posterolateral Bundle
    - Deep to Shallow: 32.3-34.8
    - High to Low: 42.1-47.6

- Poor Reliability\(^{5}\)

Goal of Single Bundle ACLR

- Replicate Function of Both Bundles of ACL
  - Anatomical Femoral Footprint
    - Between Anatomical Insertion of AM and PL Bundles
Single Bundle Transtibial ACLR
Restoration of Native Footprint

Inclusion/Exclusion Criteria

- **ACL Reconstruction**
  - Cohort Study
    - 1995-2017 - Cohort
    - Single Surgeon (KDP)
      - 39 Patients (24 male/15 female)
        - 38.4 ± 9.9 Years
  - Allograft BPTB
    - LifeNet (Virginia Beach, VA)
    - Musculoskeletal Transplant Foundation (Edison, NJ)
  - Autograft BPTB
  - MRI/CT Scan
    - Post Operative

- **Exclusion**
  - Patients <16 Years of Age
  - Revision Surgery
  - No Osteochondral Grafting
  - Multiligamentous Injuries
Single Bundle Transtibial ACLR

Surgical Technique

Transtibial

- Notchplasty - 100%
  - Enhance Visualization
  - Optimize Tunnel Placement
- 10-mm Reamer
  - 9-mm if <5’4” or BMI <20
  - Cancellous Reamings Collected
- Tibial Guide
  - Linvatec Paramax Guide
  - Non-Eccentric Reaming - By Hand
  - Chamfer Tibial Surface
- Femoral Guide
  - Arthrex 7-mm (Gold) With 10-mm Badger Reamer
  - Arthrex 6-mm (Green) With 9-mm Badger Reamer
Single Bundle Transtibial ACLR
Anatomic Footprint
Femoral and Tibial Tunnels

- **Computed Tomography Analysis**
  - GE Light Speed 64-Slice Scanner
  - Slice Thickness 2.5 mm
  - Musculoskeletal-Trained Radiologists

- **Computer 3D Reconstruction**
  - Reconstructed to 0.625 mm
  - Assessment
    - Program
      - Osirix (Mac)
    - Ratio Identification
      - Compare to Norms
        - Cadavers
    - Identify ACL Footprint

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Current Study - Tibial
- Anteroposterior Position
  - Forsythe AM Bundle
    - p<0.001
  - Forsythe PL Bundle
    - p=0.49
- Medial-Lateral Position
  - Forsythe AM Bundle
    - p=0.063
  - Forsythe PL Bundle
    - p=0.073

Single Bundle Transtibial ACLR
- Recreates Posterolateral Bundle

Single Bundle Transtibial ACLR
Anatomic Footprint
Results - Femoral Assessment

- Current Study - Femoral
  - Posterior-Anterior Position
    - Forsythe AM Bundle
      - p=0.05
    - Forsythe PL Bundle
      - P<0.001
  - Proximal-Distal Position
    - Forsythe AM Bundle
      - p=0.0002
    - Forsythe PL Bundle
      - P<0.001

- Single Bundle Transtibial ACLR
  - Recreates Anteromedial Bundle

Single Bundle Transtibial ACLR
Anatomic Footprint

Summary

- Single Bundle Transtibial ACLR
  - Anatomical Restoration
    - ACLR Matches A Combined Ligament
      - Femoral
        - Anteromedial Bundle
          - PA Position - 28.6±4.4%
          - PD Position - 39.8±9.0%
      - Tibial
        - Posterolateral Bundle
          - AP Position - 47.9±6.0%
          - ML Position - 47.3±2.0%

- Creation of a Mixed Bundle

153 Patients

Autograft vs. Allograft
- No Difference in Clinical Outcomes
  - Tegner (p=0.485)
  - Lysholm (p=0.970)
  - IKDC (p=0.660)
- No Difference in KT-1000
  - 30 Lbs
    - Age As A Co-Variate
      - Involved Side p=0.926
      - Uninvolved Side p=0.445
  - Manual Maximum
    - Age As A Co-Variate
      - Involved Side p=0.490
      - Uninvolved Side p=0.196
  - Side-to-Side Difference
    - 30 lbs p=0.508
    - Manual Max p=0.111

Significance p<0.05
Single Bundle Transtibial ACLR

Anatomic Footprint

Clinical Implications

- Single Bundle Transtibial ACLR
  - 153 Patients
    - Overall Failure Rate 6.3% (N=7)
      - Traumatic (N=3)
      - Atraumatic (N=1)
      - Unknown (N=3)
        - Allograft 6.25% (N=5)
          - Kraeutler (2013) 12.7%
        - Autograft 6.25% (N=2)
          - Kraeutler (2013) 4.3%

Single Bundle Transtibial ACLR
Anatomic Footprint
Future Investigation

- Anatomic Footprint
  - Does Combined Ligament Restore Stability?
    - AP and Rotatory Directions
      - Cadaveric Biomechanical Study
  - Does Position Correlate with
    - Survivorship?
    - Chondral Damage?
      - Lateral or Medial Compartment Deterioration