Hip Labral Reconstruction

59th Annual Edward T. Smith Orthopaedic Lectureship
University of Texas Health Science Center at Houston
November 5th, 2015

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Disclosure

- I have the following financial relationships to disclose:
  - Consultant: Arthrex, Stryker

Over the past couple decades, we’ve learned to love the labrum
**Acetabular Labrum**

- We’ve learned to appreciate it biomechanically
  - Decreases rate of compression of articular cartilage
  - Decreases friction on articular cartilage
  - Manages and prevents egress of fluid from the hip joint
  - Increases contact area of joint
  - Decreases contact pressure on articular cartilage
  - Improves stability of the hip joint

**The Labrum**

- “The labrum acts like a seal that prevents fluid loss from the joint and protects the articular cartilage”
- “The cartilage layers compress approximately 40% quicker if the labrum is removed.”

**Articular cartilage friction increases in hip joints after the removal of acetabular labrum**

- “Resistance to rotation, which reflects articular cartilage friction in an intact hip was significantly increased following focal labrectomy at 1–3 BW loading, and following complete labrectomy at all load levels.”
- “The acetabular labrum appears to maintain a low friction environment, possibly by sealing the joint from fluid exudation.”
  - *Journal of Biomechanics, 2011*
Labral Histology

Fig 2. Photomicrograph of labrum attachment (B) to bony acetabulum (D) and transition zone (C) between labrum and articular cartilage (A). Tidemark zone is visible (E) (Stain, hematoxylin and eosin; magnification, x10).


The low permeability of healthy meniscus and labrum limit articular cartilage consolidation and maintain fluid load support in the knee and hip

Joseph M. Huemer,*, Dennis R. Carter,*, Nicholas J. Giori

• Finite element models used for knee and hip with varying degrees of fibrocartilage permeability relative to articular cartilage
  o Normal labral and meniscal fibrocartilage 6X less permeable than articular cartilage
  o Degeneration and tearing lead to increased permeability
• “Increasing the fibrocartilage permeability relative to that of articular cartilage gave a consolidation rate and loss of fluid load support comparable to that predicted by meniscectomy or labrectomy”
• “An intact low-permeability fibrocartilage is important for limiting fluid exudation from articular cartilage in the hip and knee.”


Acetabular Labrum

• We’ve learned to appreciate it clinically as well
Labral Repair

- Open dislocation with pincer and CAM bone resection
  - Group I: Labral resection (20 patients)
    - 2 years
    - 28% excellent/48% good/20% moderate/4% poor
  - Group II: Labral repair (32 patients)
    - 2 years
    - 80% excellent/14% good/6% moderate
    - Significantly more osteoarthritis in Group I than Group II.
      - P=0.009


Labral Repair

- Larson et al. Arthroscopy 2009
  - Arthroscopic approach with pincer or combined pincer and CAM type impingement.
    - Mean age 31 y/o(I)/27 y/o(II)
    - Group I(36 patients) mean f/u 21.4 months
      - Labral debridement
        - HHS 88.9
        - 66.7% excellent
    - Group II(39 patients) mean f/u 16.5 months
      - Labral repair
        - HHS 94.3
        - 89.7% excellent

Labral Repair

- Larson et al. AJSM 2012
  - Arthroscopic approach with pincer or combined pincer and CAM type impingement.
    - Mean age 31 y/o(I)/27 y/o(II)
    - Group I(34 patients) mean f/u 3.5 yrs
    - Labral debridement
      - HHS 88.9
      - 68% good to excellent
    - Group II(39 patients) mean f/u 16.5 months
      - Labral repair
      - HHS 94.3
      - 92% good to excellent
  - Repair patients significantly better HHS, SF-12, VAS
Would you repair this?

Should we repair this?

The Labrum: A Cruel Mistress

"Within the labrum, pain-associated free nerve ending expression was located predominantly at its base, decreasing in the periphery."

Haversath et al. JBJS-Br 2013.
What we know

• Labrum is important for hip health
• Repairing a labrum is better than cutting it out
• Bad labral tissue doesn’t really function well
• Repairing bad tissue doesn’t really work very well
• The labrum has pain fibers

What if we took it out and reconstructed it with something else (without pain fibers)?

Biomechanical Data

Labral Reconstruction With Iliotibial Band Autografts and Semitendinosus Allografts Improves Hip Joint Contact Area and Contact Pressure

An In Vitro Analysis

Simon Lee,* MPH, Thomas H. Wuertz,* MD, MS; Elizabeth Sheehan,†* MD, Frank M. McCormick,* MD, Michael J. Bata,‡* MD, Merc J. Phillippon,* MD, and Shane J. Nho,*† MD, MS

Investigation performed at Rush University Medical Center, Chicago, Illinois, USA

Labral Reconstruction With Iliotibial Band Autografts and Semitendinosus Allografts Improves Hip Joint Contact Area and Contact Pressure

- 10 fresh-frozen cadaveric hips
- Piezoresistive load sensors measured:
  - Contact area
  - Contact pressure
  - Peak force
- 3 states:
  - Native intact labrum
  - Segmental labral resection (11-3 o'clock)
  - Labral reconstruction with either ITB autografts or Semi-T allografts (mean graft length 42.2 mm)
  - No mention of side-to-side sutures

![Image of labral reconstruction]

“Segmental anterosuperior labral resection results in significantly decreased contact areas and increased contact pressures, while labral reconstruction partially restores time-zero acetabular contact areas and pressures as compared with the resected state.”

“Although labral reconstruction improved the measured biomechanical properties as compared with the resected state, some of those properties remained significantly different compared with the native intact labrum.”

Biomechanical Data

The hip fluid seal—Part I: the effect of an acetabular labral tear, repair, resection, and reconstruction on hip fluid pressurization

Marc J. Philippon · Jeffrey J. Nipple · Kevin J. Campbell · Grant J. Durman · Kyle S. Jansson · Robert F. LaPrade · Cory A. Wigdicks

The hip fluid seal—Part II: The effect of an acetabular labral tear, repair, resection, and reconstruction on hip stability to distraction

Jeffrey J. Nipple · Marc J. Philippon · Kevin J. Campbell · Grant J. Durman · Kyle S. Jansson · Robert F. LaPrade · Cory A. Wigdicks

Knee Surg Sports Traumatol Arthrosc 2014
Biomechanical Data

- Examined effect on fluid pressurization (fluid seal) under load (Part 1) and with stability to distraction (Part 2) in 8 cadaveric specimens with:
  - Intact labrum
  - Tear (3.5 cm in length)
  - Repair (looped vs. through)
  - Partial resection (3.5 cm antero-superior)
  - Complete resection
  - Reconstruction ITB autograft 3.5 cm with side to side suture to native labrum

Biomechanical Data

- Part 1: “Labral repair (through type) and labral reconstruction resulted in improvements in intra-articular fluid pressurization, compared with labral tear and partial labral resection conditions.”

- Labral reconstruction outperformed labral repair in improving fluid pressurization and maintaining it over time

Biomechanical Data

- Part 2: “Partial labral resection significantly decreased the distractive strength of the hip fluid seal."

- “Labral reconstruction significantly improved distractive stability, compared to partial labral resection.”
Personal Experience

- Disappointed with my own non-reconstruction revision hip experience in practice
- Similarly disappointed in stretching indications for repair
- Began in revisions
- Transitioned to doing more primary reconstructions

Technique evolved substantially with longer and longer grafts showing better and better results
  - More stability
  - Elimination of pain generators
  - No weak junction points
- January 2014 developed a robust infrastructure for data collection on current technique

Labral Recon Technique
Arthroscopic Circumferential Acetabular Labral Reconstruction using Fascia Lata Allograft; One-Year Patient-Reported Outcomes

Andrew B. Wolff, MD
Geoffrey W. Hogan, BA
Alexandra M. Napoli, BS
Washington Orthopaedics and Sports Medicine, Washington DC

Materials and Methods

- Retrospective review of prospectively collected data
- Single surgeon
Materials and Methods

- 46 patients consecutive patients undergoing circumferential labral reconstruction (RECON)
  - Moderate to severe labral damage
  - Included patients with
    - Segmental defects
    - Failed repairs
    - Failed debridements
    - Severe pincer deformities
    - Ossified labra
    - Intercalated os acetabuli/acetabular rim fractures
- 61 patients consecutive patients undergoing labral repair (REPAIR)
  - Minimal to moderate labral damage

Materials and Methods

- Intraobserver reliability assessment performed to assess accuracy of complexity of tear determination
- Groups compared using two-tailed, unequal sample size and unequal variance independent sample Student’s t-test with regards to continuous demographic and 1-year outcome data
- Pearson’s chi-squared test employed for categorical data
- P-value of less than 0.05 determined to be statistically significant

Results

- Follow-up obtained for 41 of 44 eligible RECON patients, for 91% follow-up rate
  - One RECON patient excluded after subsequent THA
  - One RECON patient excluded after core muscle injury procedure
- Follow-up obtained for 51 of 60 eligible REPAIR patients for 85% follow-up rate
  - One REPAIR patient excluded after subsequent THA
Mean age in RECON cohort (42.55 yrs) was significantly higher than in REPAIR cohort (30.36 yrs) (P=0.0000028)
Cohort Comparison

- Severity of labral damage evaluated in separate sidearm study of 20 patient videos not involved in current study
- Videos were evaluated by surgeon one week apart
- Kappa value = 0.66 indicating moderately good reliability

Results

- No significant difference between RECON and REPAIR for HOS-SSS, mHHS, IHOT-12, or SF-12 (Power > 0.9)
- RECON cohort showed improved outcomes for Pain VAS, HOS-ADL, mHHS, and IHOT-12 when compared to REPAIR cohort

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Repairs Mean ± Std Err</th>
<th>Reconstructions Mean ± Std Err</th>
<th>P-value</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain VAS</td>
<td>-1.31 ± 0.33</td>
<td>-2.74 ± 0.39</td>
<td>0.116</td>
<td>0.651</td>
</tr>
<tr>
<td>HOS-ADL</td>
<td>10.84 ± 2.30</td>
<td>14.50 ± 2.33</td>
<td>0.002</td>
<td>0.902</td>
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<tr>
<td>HOS-SSS</td>
<td>28.71 ± 4.25</td>
<td>27.19 ± 4.04</td>
<td>0.813</td>
<td>0.944</td>
</tr>
<tr>
<td>mHHS</td>
<td>10.59 ± 2.53</td>
<td>19.24 ± 3.31</td>
<td>0.523</td>
<td>0.984</td>
</tr>
<tr>
<td>IHOT-12</td>
<td>26.81 ± 3.44</td>
<td>28.09 ± 4.52</td>
<td>0.822</td>
<td>0.984</td>
</tr>
<tr>
<td>SF-12</td>
<td>9.52 ± 1.40</td>
<td>9.03 ± 1.72</td>
<td>0.928</td>
<td>0.985</td>
</tr>
</tbody>
</table>
Conclusions

• Patient demographics were significantly less favorable in patients undergoing reconstruction:
  o 12 yrs older
  o 35% revisions in RECON group vs. 3.9% revisions in REPAIR group
  o More severe labral damage or defect

Conclusions

• Short term results of Circumferential Labral Reconstruction approximate those of patients undergoing labral repair for more modest labral damage at one-year follow-up.

Conclusions

• Circumferential labral reconstruction may be a viable option for treatment for patients with moderate or severe labral damage

• More data with longer follow-up needed
Preliminary Pain and Function After Labral Reconstruction During Femoroacetabular Impingement Surgery

Justin A. Walker MD, Michael Pagnotta MD, Robert T. Trousdale MD, Rachel J. Sierra MD

- 20 hips in 19 patients open surgical dislocation for FAI (3 also had reverse PAO)
- Ligamentum Teres or ITB Autograft
- Minimum 1 year f/u; mean 26.4 months
- 3 converted to THA (Outerbridge 4, 3 and 1 at index procedure)
- 15 of 17 who did not undergo THA reported improvement
  - Average UCLA score 8.5

Arthroscopic Labral Reconstruction in the Hip Using Iliotibial Band Autograft: Technique and Early Outcomes


- Retrospective review of 47 patients undergoing labral reconstruction with ITB autograft
  - Damaged labrum debrided to smallest possible reconstruction area
  - Segment of missing labrum most often between 5-7 cm in length
  - 49% were revisions

- Favorable outcomes obtained at mean 18 month
  - Mean mHHS improvement of 23 (pre-op 62; post-op 85)
  - Median patient satisfaction 8 out of 10

- 4 hips (9%) progressed to THA

Acetabular labral reconstruction with an iliotibial band autograft: outcome and survivorship analysis at minimum 3-year follow-up.


- Retrospective review of 76 patients undergoing labral reconstruction with ITB autograft
  - Damaged labrum debrided to smallest possible reconstruction area
  - Segment of missing labrum most often between 5-7 cm in length
  - 49% were revisions

- Favorable outcomes obtained at mean 49 month follow up for 49 hips
  - Mean mHHS improvement of 24
  - Mean HOS-ADL improvement of 12
  - Mean HOS-SSS improvement of 26

- 18 hips (23.6%) progressed to THA
  - Of these 9 had ≤2 mm joint space at time of reconstruction
Arthroscopic Hip Labral Reconstruction With a Gracilis Autograft Versus Labral Refixation

2-Year Minimum Outcomes
Dien K. Matsuda, MD, and Rachel J. Burdette, MA, MS

- 8 patients in recon group compared to 46 in refixation group
- All Tonnis Grade 0 or 1
- None were revision
- 2-3 cm segmental overlapping grafts
- Recon group NAHS improved 50.5
- Refix group NAHS improved 22.5
- But Recon group started lower

Arthroscopic Labral Reconstruction Is Superior to Segmental Resection for Irreparable Labral Tears in the Hip

A Matched-Pair Controlled Study
With Minimum 2-Year Follow-up
Benjamin G. Davis, MD, Yuksel F. Bilbao, MD, Christina E. Brels, MA, Anthony P. Younge, MD, Timothy J. James, MA, and C. Richard Mathis, MD

- Matched 11 Recon cases with 22 segmental resection cases according to pre-op NAHS and gender
- Size of resection defect and/or graft not reported
- All had Tonnis grade 0 or 1
- 6 of 11 in Recon group were revisions; 5 of 22 in Resection group
- No conversions to THA in either group

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- All had Tonnis grade 0 or 1
- 6 of 11 in Recon group were revisions; 5 of 22 in Resection group
- No conversions to THA in either group
Summary

• We have a lot of really good reasons to love the labrum

Summary

• Biomechanical data suggest labrum is useful
  o Decreases rate of compression of articular cartilage
  o Decreases friction on articular cartilage
  o Manages and prevents egress of fluid from the hip joint
  o Increases contact area of joint
  o Decreases contact pressure on articular cartilage
  o Improves stability of the hip joint
Summary

The labrum also can be a pain generator.

Summary

Taking the labrum out and leaving it out is a bad idea.

Summary

Biomechanical studies suggest that the beneficial properties of the labrum are at least partially restored by labral reconstruction.
Summary

• Clinical outcome data, while somewhat sparse, demonstrate proof of concept
• Generally good results in a difficult patient population
  • High proportion of revisions in most series
  • All series indications were for irreparable or missing labral tissue
• Poor outcomes in patients with significant chondral disease

Future Directions

Where are we going?
Future Directions

Labral Reconstruction is here to stay.

Future Directions

- With reproducible techniques, indications will expand to include not only segmental defects but also:
  - Revision cases
    - Labral retears
    - Labrums that have failed to heal
    - With pain of unclear origin
  - Questionable labral tissue in primary cases
    - Moderate to severe damage
    - Hypoplastic/keelved labra
    - Severe Pincer deformities / Coxa profunda
    - Many acetabular rim fracture/intercalated os acetabuli

Future Directions

The need for further investigation is clear.
Thank You