All Inside Meniscus Repair in 2018

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Disclosures

Depuy Mitek Sports Medicine – Speaker / Education
Smith & Nephew - Consultant
Meniscus repair timeline

1883 – Thomas Annadale
  ◦ “An operation for displaced semilunar cartilage” (1885)

1948 – John Fairbanks reported on the changes to the knee joint following meniscectomy

Late 1960’s Robert Jackson brought the arthroscope from Japan to North America

1962 – Wantanabe preformed the first arthroscopic meniscectomy

1971 – Richard O’Connor introduced the operative arthroscope

1980’s – Multitude of basic science studies indicating meniscus function, blood supply and potential for repair

1990’s – Meniscus allograft replacements gained popularity

1990’s – All-inside meniscus repair devices introduced
Meniscectomy decreases the contact area by 75%, increases peak contact stress by 235% and allow for increased anterior translation of femur on tibia – Arthritis!!

Increased shear and compressive loads -> Arthritis!!
Vertical Tear Pattern

“The optimal repair technique should be determined on an individual basis by surgeon preference and familiarity”

- JBJS Current Concepts Review: Meniscus Repair, July 2017

![Diagram of repair techniques: Inside Out, All Inside Anchor Based, All Inside Suture Passing]
“The Gold Standard”

Inside-out repair has long been regarded the gold standard of repair techniques

- Repair under direct visualization with accessory postero-medial or postero-lateral incision
- Problems with this technique:
  - Accessory incision with risk to saphenous vein and peroneal nerve
  - Technically demanding
  - Typically requires more assistance
  - Longer OR times
Systematic Review of modern all-inside vs inside-out techniques

- 27 articles, 2 level 1, 4 level 3, and 21 level 4 studies
- Evaluated failure rates, functional outcomes, complications
- Conclusion of study: No difference in any category between the two techniques
Inside-Out Versus All-Inside Repair of Isolated Meniscal Tears

An Updated Systematic Review

Yale A. Fillingham,† MD, Jonathan C. Riboh,† MD, Brandon J. Erickson,† MD, Bernard R. Bach Jr,† MD, and Adam B. Yanke,† MD

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

Failure Rate:

- “Clinical Failure Rate”: I-O 11%, A-I 10%
- “Anatomic Failure Rate”: I-O 13%, A-I 16%

Outcome Scores:

- Lysholm score: I-O 88.0, A-I 90.4
- Tegner score: I-O 5.3, A-I 6.3

Complications: I-O 5.1%, A-I 4.6%
2005 Haas et al.
42 meniscal repairs
follow up ave 24 months
- 5 clinical failures >
overall success 88%
- 80% success isolated repair
- 92% success with ACL
- Outcome scores improved

2008 Barber et al.
41 meniscal repairs
follow up ave 30 mths
- 7 clinical failures >
overall success rate 83%
- Outcome scores improved

Success rates: 80-92%
Outcome of All-Inside Second-Generation Meniscal Repair
Minimum Five-Year Follow-up

Ljiljana Bogunovic, MD, Lisa M. Kruse, MD, Amanda K. Haas, MA, Laura J. Huston, MS, and Rick W. Wright, MD
Investigation performed at the Department of Orthopaedic Surgery, Washington University School of Medicine, St. Louis, Missouri

2014

75 patients – failure defined as repeat surgery for resection or revision repair
12 failures (16%) > 84% success rate
12% isolated meniscus, 18% with ACL
Average time to failure in both groups was approximately 48 months
Expanding Indications

Vertical peripheral zone (red) or red/white zone tears

✔️

Radial tears?

Horizontal cleavage tears?

Root tears?
Radial Tears
Tibiofemoral contact pressures in radial tears of the meniscus treated with all-inside repair, inside-out repair and partial meniscectomy

Alan L. Zhang *, Stephanie L. Miller, Dezba G. Coughlin, Jeffrey C. Lotz, Brian T. Feeley

Department of Orthopaedic Surgery, University of California — San Francisco, San Francisco, CA, United States

Repair restored compartment to the normal state after radial tear

Peak Pressure

![Graph showing peak pressures at different flexion angles.]

0 2 4 6 8 10
Pressure (MPa)

0 8 15 30
Flexion Angle (Degrees)

Intact  Radial Tear  Meniscectomy  Inside-out  All-inside

2015
6 studies included

All showed improvement in patient reported outcome measures

- Lysholm: 61.3-73.7 -> 86.9-95.6
- IKDC: 57 -> 81.6-92

No difference between inside-out vs all-inside repairs

- Inside-out: Lysholm 86.9 – 94.2; IKDC 81.6 – 92
- All-Inside: Lysholm 94 – 95.6; IKDC 90
Repair Techniques

All inside

Inside-Out (I/O)

All-inside Horizontal Construct

Inside-out Horizontal Construct

Mason-Allen Construct

Figure-of-8 plus Horizontal Construct
Repair Techniques

<table>
<thead>
<tr>
<th></th>
<th>Maximum Failure Load, N</th>
<th>Stiffness, N/mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>477 ± 144</td>
<td>37 ± 13</td>
</tr>
<tr>
<td>Inside-out horizontal</td>
<td>64 ± 20</td>
<td>8 ± 2</td>
</tr>
<tr>
<td>All-inside horizontal</td>
<td>75 ± 16</td>
<td>12 ± 3</td>
</tr>
<tr>
<td>Mason-Allen construct</td>
<td>86 ± 19</td>
<td>11 ± 2</td>
</tr>
<tr>
<td>Figure-of-8 plus horizontal</td>
<td>113 ± 22</td>
<td>11 ± 3</td>
</tr>
</tbody>
</table>

*Results are reported as mean ± SD.*
Repair Techniques

ALL inside repair seems better biomechanically.
Repair Techniques

![Images of repaired tissues]

![Chart showing comparison of repair techniques]

- Crosstap
- Hashtag
- Cross

Graphs indicate differences in displacement after cyclic loading and load to failure.
Radial Tear Repairs

All-inside tied knot and figure of 8 with horizontal mattress –

Beware, All repair methods much weaker than native mensicus -> Slow down your rehab!

111N / 113N respectively vs normal (477N)
New Techniques for radial repairs??

Repair of a complete radial tear in the midbody of the medial meniscus using a novel crisscross suture transtibial tunnel surgical technique: a case report

Evan W. James · Christopher M. LaPrade · John A. Feigin · Robert F. LaPrade

2015
Horizontal Tears
Horizontal Tears

Up to 1/3 of all meniscal tears

Biomechanical study evaluating lamina resection

- Single leaflet resection:
  - contact area by 59%
  - peak pressure 19%
  - Mean pressure 55%

- Double Leaflet excision did not change these values  ➔ No benefit from single leaflet excision!

Repair or leave alone!

Binfield, Injury 1993
Metcalf, AJSM 2004

Hamear 2007
Horizontal Repairs

Horizontal tears often found in degenerative conditions (up to 85%)

Much better results with repair than expected-

Repair of Horizontal Meniscus Tears: A Systematic Review

Peter R. Kurzweil, M.D., Nancy M. Lynch, M.D., Sheldon Coleman, M.D., and Brian Kearney, Ph.D.
98 horizontal repairs
  ◦ Reoperation used as “failure”
  ◦ 21/98 required reoperation ➔ 77.8% success rate

Conclusion: Acceptable repair rates can be achieved
  ◦ Some repairs with older implants (darts)
Don’t Forget - Marrow Venting

Outcomes After Biologically Augmented Isolated Meniscal Repair With Marrow Venting Are Comparable With Those After Meniscal Repair With Concomitant Anterior Cruciate Ligament Reconstruction

Chase S. Dean,* MD, Jorge Chahla,* MD, Lauren M. Matheny,* MPH, Justin J. Mitchell,* MD, and Robert F. LaPrade,†† MD, PhD
Investigation performed at the Center for Outcomes-Based Orthopaedic Research, Steadman Philippon Research Institute, Vail, Colorado, USA

AJSM 2017

Healing rate equivalent to repair with ACL
Root Repairs . . .

Stay Tuned!!
Thank you!