

# Meniscus Repair Scientific Update



An increase in published orthopedic literature regarding meniscus function, pathology, and repair is leading to increased understanding of the importance of meniscal preservation. The meniscus is a fibrocartilaginous structure in each compartment of the knee that aids with dispersing compressive forces. Multiple pathologies, such as direct trauma, overuse, previous injury, and increased age, can lead to meniscus damage.

Advancements in technology and innovation have produced better techniques and instrumentation for meniscus repair. This document summarizes published studies that describe the meniscus anatomy, biomechanical data, surgical techniques, and clinical data.

Gilat R,  
Agar G,  
Shohat N,  
Dahan M,  
Beer Y,  
Lindner D

Malinowski K,  
Góralczyk A,  
Hermanowicz K,  
LaPrade RF

## All-Inside Meniscus Repair

About 10 years ago, the standard for meniscus surgery was to resect all the damaged tissue from the joint, causing more damage to the knee. Studies show that meniscus repair is crucial to maintaining the well-being of the whole knee joint. An all-inside technique seems to allow for the most anatomic repair with the greatest preservation of surrounding soft tissues. Below are recent studies demonstrating the advantages of all-inside meniscus repair.

[Avoiding injury to the popliteal neurovascular bundle in all-inside suturing of the posterior horn of the lateral meniscus: an a magnetic resonance imaging assessment of portal selection and safety.](#) *Arthroscopy*. 2020;36(2):492-498. doi:10.1016/j.arthro.2019.08.041

- This study assessed the risk of injury to the popliteal neurovascular bundle (PNVB) while suturing the posterior horn of the lateral meniscus (PHLM).
- All-inside suturing of the PHLM was simulated using magnetic resonance imaging of 60 knees.
- Of 1200 measurements performed, the simulated suturing trajectory transected the PNVB 28% of the time.
- All-inside suturing of the PHLM at 0 mm from the PCL is safer with a more lateral portal. Beyond 3 mm from the PCL, a more medial portal carries a lower risk to PNVB.

[Tips and pearls for all-inside medial meniscus repair.](#) *Arthrosc Tech*. 2019;8(2):e131-e139. doi:10.1016/j.eats.2018.10.009

- The medial meniscus is one of the most commonly injured structures in the knee, and management of meniscus tears is a key issue for whole knee joint well-being.
- An all-inside technique seems to allow for the most anatomic repair with the greatest preservation of surrounding soft tissues.
- Study shows that there are no technical limitations for all-inside meniscal repairs with nonabsorbable sutures.

Uchida R,  
Horibe S,  
Shiozaki Y,  
Shino K

[All-inside suture repair for isolated radial tears at the midbody of the lateral meniscus.](#)

*Arthrosc Tech.* 2019;8(12):e1451-e1456. doi:10.1016/j.eats.2019.07.032

- In young athletes, radial tear of the midbody on the lateral meniscus is most common.
- Meniscectomy has been considered a first-line treatment for this type of tear; however, this may lead to degenerative changes.
- An easier and less invasive treatment option is a meniscocapsular suture technique or an all-inside suture repair technique.

Phillips M,  
Rönblad E,  
Lopez-Rengstig L,  
et al

[Meniscus repair with simultaneous ACL reconstruction demonstrated similar clinical outcomes as isolated ACL repair: a result not seen with meniscus resection.](#)

*Knee Surg Sports Traumatol Arthrosc.* 2018;26(8):2270-2277. doi:10.1007/s00167-018-4862-1

- This was a retrospective study comparing knee injury and osteoarthritis outcome scores and EuroQoL-5D subscale scores at two-year follow-up for patients who had an ACL reconstruction and simultaneous meniscal treatment.
- ACL reconstruction with meniscus resection resulted in worse clinical outcomes when compared to ACL reconstruction with meniscus repair.
- Meniscus repair may provide greater clinical outcomes compared to meniscus resection when treating a repairable meniscal tear that presents along with an ACL tear.

Rothermel SD,  
Smuin D,  
Dhawan A

[Are outcomes after meniscal repair age dependent? a systematic review.](#)

*Arthroscopy.* 2018;34(3):979-987. doi:10.1016/j.arthro.2017.08.287

- This was an analysis of previously published data comparing patients younger than 40 years and older than 40 years undergoing meniscus repair.
- Results reveal that no significant difference exists when evaluating failure rate for meniscus repair.

Marchetti DC,  
Phelps BM,  
Dahl KD,  
et al

[A contact pressure analysis comparing an all-inside and inside-out surgical repair technique for bucket-handle medial meniscus tears.](#)

*Arthroscopy.* 2017;33(10):1840-1848. doi:10.1016/j.arthro.2017.04.013

- Meniscal tears are the most commonly treated knee injury.
- No significant differences were observed between the inside-out and all-inside repair techniques at any flexion angle for contact area, mean contact pressure, and peak contact pressure.
- Both all-inside and inside-out repair techniques may adequately decrease the likelihood of cartilage degeneration.

Moatshe G,  
Cinque ME,  
Godin JA,  
Vap AR,  
Chahla J,  
LaPrade RF

[Comparable outcomes after bucket-handle meniscal repair and vertical meniscal repair can be achieved at a minimum 2 years' follow-up.](#)

*Am J Sports Med.* 2017;45(13):3104-3110. doi:10.1177/0363546517719244

- This was a comparison of outcomes following bucket-handle repairs and vertical meniscal repairs using a stacked vertical suturing technique.
- Patients experience improved results and low failure rates with the repair of bucket-handle tears using a stacked vertical suture technique.
- Improved results and low failure rates were achieved using the same surgical technique to address vertical meniscus tears.



Beamer BS,  
Walley KC,  
Okajima S,  
et al

[Changes in contact area in meniscus horizontal cleavage tears subjected to repair and resection.](#) *Arthroscopy*. 2017;33(3):617-624. doi:10.1016/j.arthro.2016.09.004

- This study compared tibiofemoral contact pressure and contact area with a horizontal cleavage tear versus meniscal repair, partial meniscectomy, and subtotal meniscectomy.
- Horizontal cleavage tears increased contact pressure 70%.
- Circumferential suture repair restored peak contact pressures and areas to within 15% of baseline.
- Partial and subtotal meniscectomy significantly reduced contact area and increased contact pressure.

Steadman JR,  
Matheny LM,  
Singleton SB,  
et al

[Meniscus suture repair: minimum 10-year outcomes in patients younger than 40 years compared with patients 40 and older.](#) *Am J Sports Med*. 2015;43(9):2222-2227. doi:10.1177/0363546515591260

- This study compared meniscus repair failure rates and functional outcomes between patients under 40 years of age and those who were older than 40 years at the time of the procedure.
- Repair failure rate was not different between the two groups.
- Lysholm, Tegner, and patient satisfaction scores were evaluated and demonstrated patients in both groups had high function and high patient satisfaction an average of 16 years following meniscus repair.

Beamer BS,  
Masoudi A,  
Walley KC,  
et al

[Analysis of a new all-inside versus inside-out technique for repairing radial meniscal tears.](#) *Arthroscopy*. 2015;31(2):293-298. doi:10.1016/j.arthro.2014.08.011

- The purpose of the study was to compare gap formation, strength, and stiffness for all-inside compared to inside-out suturing techniques.
- All-inside repairs resulted in significantly lower displacement and higher load-to-failure strength.
- The failure mode for all-inside repairs was suture breakage (suture failure) compared to tissue pull-through (tissue failure) in inside-out repairs.
- The significance of the study is that the biomechanical properties of a vertical all-inside technique are superior to that of a horizontal inside-out technique.

Kurzweil PR,  
Lynch NM,  
Coleman S,  
Kearney B

[Repair of horizontal meniscus tears: a systematic review.](#) *Arthroscopy*. 2014;30(11):1513-1519. doi:10.1016/j.arthro.2014.05.038

- This was a review of published outcomes of repaired horizontal cleavage tears and tested the hypothesis that surgically repaired horizontal cleavage tears have an unacceptably low rate of success.
- Nine previously published articles totaling 98 repairs of horizontal tears met inclusion criteria.
- The 76% success rate for horizontal repairs disproved the hypothesis and supported repair of horizontal cleavage tears.
- There was a 68% success rate for vertical tears.
- There was an 84% success rate for bucket-handle tears.



Toman CV,  
Dunn WR,  
Spindler KP,  
et al

[Success of meniscal repair at anterior cruciate ligament reconstruction.](#) *Am J Sports Med.* 2009;37(6):1111-1115. doi:10.1177/0363546509337010

- This was a MOON (Multicenter Orthopedic Outcomes Network) case study examining meniscal repair with ACL reconstruction success at two-year follow-up.
- There is an estimated 90% clinical success rate of meniscal repair at two-year follow-up when the meniscus is repaired at the time of an ACL reconstruction.
- “Meniscal repair is a successful procedure in conjunction with anterior cruciate ligament reconstruction.”

### Inside-Out and Outside-In Meniscus Repair

Although all-inside meniscus repair has evolved significantly and has gained in popularity, inside-out and outside-in repairs are still a convenient and reproducible repair option. Today’s devices address most tear patterns and the ability to deliver flat suture with small needles. See the studies below for current technique demonstrations and study results.

Cinque ME,  
DePhillipo NN,  
Moatshe G,  
et al

[Clinical outcomes of inside-out meniscal repair according to anatomic zone of the meniscal tear.](#) *Orthop J Sports Med.* 2019;7(7):2325967119860806. doi:10.1177/2325967119860806

- This study examined the outcomes of inside-out repair in all three meniscal vascularity zones.
- Patients who underwent inside-out meniscus repair demonstrated significant improvements on subjective outcome measures at a two-year follow-up, regardless of the meniscal tear zone.
- Inside-out meniscal repair is suitable for potentially reparable meniscus tears in all three vascular zones.

Rosso C,  
Kovtun K,  
Dow W,  
et al

[Comparison of all-inside meniscal repair devices with matched inside-out suture repair.](#) *Am J Sports Med.* 2011;39(12):2634-2639. doi:10.1177/0363546511424723

- This was a comparison of all-inside meniscal repairs to inside-out repairs to determine biomechanical differences.
- All-inside repairs demonstrated significantly higher initial displacement than the other methods
- Inside-out repairs demonstrated the highest load-to-failure and were significantly higher than the all-inside devices.
- Inside-out suture repairs offer surgeons the best overall biomechanical characteristics.