

The GraftLink technique continues to be one of the fastest growing ACL reconstruction techniques performed worldwide and now has 7 years of clinical history more than 100,000 procedures performed. The clinical benefits of the GraftLink technique — including single-hamstring harvest, larger graft diameter, minimally invasive sockets, and strong, adjustable cortical fixation on the femur and tibia — are now supported in a number of biomechanical and clinical studies. The following document summarizes available articles that provide support for successful outcomes with the GraftLink technique.

Noonan BC,
Bachmaier S,
Wijdicks CA,
Bedi A

Biomechanical Strength

[Intraoperative preconditioning of fixed and adjustable loop suspensory anterior cruciate ligament reconstruction with tibial screw fixation – an in vitro biomechanical evaluation using a porcine model.](#) *Arthroscopy*. 2018;34(9):2668-2674. doi:10.1016/j.arthro.2018.04.014.

- Biomechanical evaluation of 3 ACLR techniques using suspensory femoral fixation and interference screw tibial fixation. The groups were: group 1: adjustable loop (ALD) and screw, group 2: preconditioned adjustable loop (ALD) and screw, and group 3: continuous loop (CLD) and screw.
- Surgical placement of an interference screw imparted a time-zero laxity of 0.53 mm and loss of tension (62%).
- The operating characteristics of the TightRope[®] implant allow for restoration of screw-induced graft slackening and optimizing tension. This was not possible with a fixed-loop device (Endobutton[™]). Total elongation varied across groups, with group 2 (preconditioned ALD) showing the least elongation (group 1: 2.22 ± 0.52, group 2: 0.65 ± 0.29, and group 3: 1.79 ± 0.28).
- ACLR with femoral TightRope fixation and intraoperative preconditioning allows for the restoration of time-zero screw-imparted slack and leads to significantly reduced cyclic elongation in accordance with native ACL function.

Smith PA,
Piepenbrink M,
Smith SK,
Bachmaier S,
Bedi A,
Wijdicks CA

[Adjustable- versus fixed-loop devices for femoral fixation in ACL reconstruction: an in vitro full-construct biomechanical study of surgical technique-based tibial fixation and graft preparation.](#) *Orthop J Sports Med*. 2018;6(4):2325967118768743. doi:10.1177/2325967118768743.

- This was first study to test biomechanical strength of the entire graft construct with an expanded cycling protocol.
- The largest pull-to-failure force was observed for the TightRope implant/GraftLink construct, which was statistically significantly different than all other devices.
- The ACL TightRope implant is the only device that was effectively retensioned.
- Elongation with the ACL TightRope implant construct was comparable to fixed-loop devices.
- GraftMax[™] button (ConMed) exceeded maximum elongation limits for ACL reconstruction.
- Ultrabutton[‡] (S&N) adjustable fixation device lost the greatest amount of force during cycling.

Smith PA,
DeBerardino TM

[Tibial fixation properties of a continuous-loop ACL hamstring graft construct with suspensory fixation in porcine bone.](#) *J Knee Surg*. 2015;28(6):506-512. doi:10.1055/s-0034-1394167.

- All-inside GraftLink continuous-loop soft-tissue graft with TightRope suspensory fixation provided adequate strength for tibial fixation in ACL reconstruction and is superior to interference screw fixation.

Johnson J,
Smith S,
LaPrade C,
Turnbull T,
LaPrade R,
Wijdicks C

[A biomechanical comparison of femoral cortical suspension devices for soft tissue anterior cruciate ligament reconstruction under high loads.](#) *Am J Sports Med*. 2015;43(1):154-160. doi:10.1177/0363546514553779.

- TightRope implant with retensioning increases the ultimate strength (1020 N), reduces the cyclic displacement to 1.81 ± 0.51 mm, and is placed in the sub-2 mm category with fixed-loop devices.

Benea H,
d'Astorg H,
Klouche S,
Bauer T,
Tomoaia G,
Hardy P

Clinical Results

Pain evaluation after all-inside anterior cruciate ligament reconstruction and short term functional results of a prospective randomized study. *Knee*. 2014;21(1):102-106. doi:10.1016/j.knee.2013.09.006.

- The results show that postoperative pain, knee stability, range of motion, and transplant positioning were slightly better using the all-inside technique.
- The all-inside technique can be considered a “reliable procedure with very good results for pain, stability, and knee function.” It is a promising option for minimally invasive ACL reconstruction.

Blackman AJ,
Stuart MJ

All-inside anterior cruciate ligament reconstruction. *J Knee Surg*. 2014;27(5):347-352. doi:10.1055/s-0034-1381960.

- Reports suggest similar results in the early postoperative period when compared with traditional techniques
- All-inside techniques offer the advantages of improved cosmesis, less postoperative pain, decreased bone removal, and gracilis preservation.

Schurz M,
Tiefenboeck TM,
Winnisch M,
et al

Clinical and functional outcome of all-inside anterior cruciate ligament reconstruction at a minimum of 2 years' follow-up. *Arthroscopy*. 2016;32(2):332-337. doi:10.1016/j.arthro.2015.08.014.

- All-inside ACL reconstruction using the GraftLink® technique leads to improved functional outcomes in active patients at a minimum follow-up of 2 years.
- No difference was noted in stability between the ACL-reconstructed and contralateral normal knee at 2 years.

Nawabi DH,
McCarthy M,
Graziano J,
et al

Return to play and clinical outcomes after all-inside, anterior cruciate ligament reconstruction in skeletally immature athletes. *Orthop J Sports Med*. 2014;2(7)(suppl 2):2325967114S00038. doi:10.1177/2325967114S00038.

- An all-inside, physeal-sparing ACL reconstruction technique using hamstring autograft demonstrates excellent subjective and objective clinical outcomes in skeletally immature athletes without growth disturbance.

Lubowitz JH,
Schwartzberg R,
Smith P

Cortical suspensory button versus aperture interference screw fixation for knee anterior cruciate ligament soft-tissue allograft: a prospective, randomized controlled trial. *Arthroscopy*. 2015;31(9):1733-1739. doi:10.1016/j.arthro.2015.03.006.

- Suspensory fixation in sockets exhibited excellent knee stability, pain, and functional scores. Radiographs did not show significant tunnel widening of suspensory fixation versus interference screw fixation.

Lopes R,
Klouche S,
Odri G,
Grimaud O,
Lanternier H,
Hardy P

Does retrograde tibial tunnel drilling decrease subchondral bone lesions during ACL reconstruction? A prospective trial comparing retrograde to antegrade technique. *Knee*. 2016;23(1):111-115. doi:10.1016/j.knee.2015.09.010.

- Retrograde drilling (FlipCutter® reamer) of the tibia resulted in less bone edema, and subsequent pain, than the antegrade drilling with standard cannulated reamers.

Lubowitz JH,
Schwartzberg R,
Smith P

Randomized controlled trial comparing all-inside anterior cruciate ligament reconstruction technique with anterior cruciate ligament reconstruction with a full tibial tunnel. *Arthroscopy*. 2013;29(7):1195-1200. doi:10.1016/j.arthro.2013.04.009.

- All-inside ACL reconstruction resulted in less postoperative pain and similar clinical outcomes than a full tunnel technique.

Yasen SK,
Borton ZM,
Eyre-Brook AI,
Wilson AJ

Clinical outcomes of anatomic, all-inside, anterior cruciate ligament (ACL) reconstruction. *Knee*. 2017;24(1):55-62. doi:10.1016/j.knee.2016.09.007.

- Two-year outcomes of 108 patients treated with ACL reconstruction using the GraftLink® technique (FlipCutter® reamer, ACL TightRope® implant, and quadrupled semitendinosus autograft).
- The GraftLink technique demonstrated good medium-term subjective and objective outcomes with low complication and failure rates.

Graft Incorporation and Histology

Suspensory versus interference screw fixation for arthroscopic anterior cruciate ligament reconstruction in a translational large-animal model. *Arthroscopy*. 2016;32(6):1086-1097. doi:10.1016/j.arthro.2015.11.026.

- Histologic assessments showed significantly better graft incorporation with the GraftLink ACL technique compared with grafts using interference screw fixation in tunnels.
- Biomechanical strength of the GraftLink technique trended higher than that of the interference screw group.
- All GraftLink constructs were intact at 12 weeks; one interference screw construct failed and led to knee laxity.

Benefits of Single-Hamstring Harvest

Influence of medial hamstring tendon harvest on knee flexor strength after anterior cruciate ligament reconstruction. A detailed evaluation with comparison of single- and double-tendon harvest. *Am J Sports Med*. 2003;31(4):522-529. doi:10.1177/03635465030310040801.

- Single-hamstring harvest led to significantly less loss of flexion strength compared to harvest of both hamstring tendons.

Hamstring anterior cruciate ligament reconstruction: is it necessary to sacrifice the gracilis? *Arthroscopy*. 2005;21(3):275-280. doi:10.1016/j.arthro.2004.10.016.

- Harvest of a single-hamstring graft led to improved internal and external rotational torque postoperatively compared to harvest of 2 hamstring tendons.

Posterior single-incision semitendinosus harvest for a quadrupled anterior cruciate ligament graft construct: determination of graft length and diameter based on patient sex, height, weight, and body mass index. *Arthroscopy*. 2015;31(4):684-690. doi:10.1016/j.arthro.2014.10.013.

- Harvesting the semitendinosus from a single posterior incision allowed for a quadrupled graft of desired length and diameter (8 mm or greater) in 95% of cases.

Smith PA,
Stannard JP,
Pfeiffer FM,
Kuroki K,
Bozynski CC,
Cook JL

Tashiro T,
Kurosawa H,
Kawakami A,
Hikita A,
Fukui N

Gobbi A,
Domzalski M,
Pascual J,
Zanazzo M

Nuelle CW,
Cook JL,
Gallizzi MA,
Smith PA

*Endobutton is a registered trademark of Smith & Nephew.

†GraftMax is a registered trademark of ConMed.

‡UltraButton is a registered trademark of Smith & Nephew.

