

Internal/Brace[™] Technique in Cruciate Ligament Reconstruction

A review of the design rationale, techniques, and outcomes



Multiple peer-reviewed published studies have shown that the *Internal/Brace*[™] technique for ACL augmentation is associated with lower graft retear rates at 2 and 5 years in young, athletic, high-risk patients.¹⁻⁴

In the setting of ACL reconstruction (ACLR), the *Internal/Brace* procedure helps protect against various modes of failure, including creep and irreversible stretch, traumatic tearing, and slippage of the tendon-bone interface.^{5,6} The *Internal/Brace* technique may also help protect small and vulnerable hamstring ACLR grafts from these modes of failure.^{5,6}

Use the *Internal/Brace* procedure to augment collateral ligament repairs and reconstructions and provide improved biomechanics, including greater stiffness and maximum load.⁷ Anatomic repair with augmentation may allow for early treatment using native tissues while still providing a biomechanical environment conducive to early rehabilitation and motion.⁸ Compared to reconstruction techniques, there are several additional benefits of augmenting collateral ligament repairs including smaller drill holes and implants, no harvest-site morbidity with allograft, and no risk of tunnel convergence in multiligament procedures.

In Vivo Studies: Clinical Outcomes

[Reduced incidence of revision anterior cruciate ligament reconstruction with internal brace augmentation.](#) *Orthop J Sports Med.* 2023;11(7):23259671231178026. doi:10.1177/23259671231178026

- Revision rates and patient-reported outcomes were evaluated in patients who underwent primary ACLR with or without the *Internal/Brace* technique.
- In this level III retrospective study, 200 patients who underwent primary ACLR with either a quadriceps tendon (QT), bone-patellar tendon-bone (BTB), or hamstring tendon (HT) autograft were matched in a 1-to-1 cohort of patients who were treated with the *Internal/Brace* technique and patients who were not.
- Patients between 13 and 39 years old with a minimum 2-year follow-up were included.

Takeaway

Patients who received an ACLR using the *Internal/Brace* technique experienced a significantly lower revision rate (1%) and similar patient-reported outcomes compared to patients who received an ACLR alone (8%).

The *Internal/Brace* surgical technique is intended only to augment the primary repair/reconstruction by expanding the area of tissue approximation during the healing period and is not intended as a replacement for the native ligament. The *Internal/Brace* technique is for use during soft tissue-to-bone fixation procedures and is not cleared for bone-to-bone fixation.

Smith PA,
Daniel AV,
Wijdicks CA



Smith PA,
Daniel AV

[Primary all-soft tissue quadriceps tendon autograft anterior cruciate ligament reconstruction with suture tape augmentation resulted in satisfactory patient outcomes and a low graft failure rate in high school and collegiate athletes.](#) *Arthroscopy*. Published online March 20, 2024. doi:10.1016/j.arthro.2024.02.047

- This retrospective case series evaluated patient outcomes in skeletally mature high school and college athletes after primary ACLR using an all-soft-tissue QT autograft augmented with suture tape.
- A total of 60 athletes with a mean age of 16 years and average final follow-up of 37 months were included.

Takeaway

Patients demonstrated promising postoperative outcomes, most notably the 0% rerupture rate. Additionally, at 7.5 months 90% of patients had returned to an equivalent level of competition, 80% of whom returned to pivoting sports.

MacKay GM,
Wilson WT,
Kennedy MJ,
MacLeod D,
Hopper GP

[Outcomes of anterior cruciate ligament reconstruction with independently tensioned suture tape augmentation at 5-year follow-up.](#) *Am J Sports Med*. 2023;51(14):3658-3664. doi:10.1177/03635465231207623

- Clinical outcomes in patients undergoing primary ACLR with suture tape augmentation (STA) were evaluated at 2 and 5 years.
- This prospective case series included 97 highly active patients with a mean age of 34. ACLR was performed with either an HT or a BTB autograft and both were reinforced with internal bracing.
- At a mean of 5 years, only 1 graft failure was documented (1.1% retear rate), which occurred in an adolescent martial arts athlete at 6-months post-op.

Takeaway

The authors concluded that ACLR with STA is a safe and promising technique, potentially lowering the risk of reinjury following a return to sports.

Smith PA,
Daniel AV

[Less subsequent revision anterior cruciate ligament \(ACL\) reconstruction following primary bone-patellar tendon-bone ACL reconstruction with suture tape augmentation-a retrospective comparative therapeutic trial with 5-year follow-up.](#) *Arthroscopy*. Published online February 3, 2024. doi:10.1016/j.arthro.2024.01.019

- Retrospective case series comparing patient outcomes following primary ACLR with traditional BTB autograft to BTB autograft with STA.
- 114 young, active patients (mean age <19 years) received equivalent adjustable-loop fixation devices (Arthrex BTB TightRope® implant) assembled with or without 2 mm FiberTape® suture (52 with; 62 without).
- At a minimum 5-year final follow-up, BTB with STA resulted in 0 retears, while isolated BTB had 5.

Takeaway

Both groups demonstrated a similar return to sports (89% at 7.1 months with STA and 87% at 7.5 months without). In the STA group, 87% of patients participated in high-risk sports compared to 81% in the isolated BTB group.



Smith PA,
Daniel AV,
Stensby JD,
Cook CS,
Wijdicks CA

[Quadriceps tendon autograft ACL reconstruction with suture tape augmentation: safe results based on minimum 2-year follow-up MRI.](#) *Orthop J Sports Med.* 2024;12(4):23259671241239275. Published 2024 Apr 11. doi:10.1177/23259671241239275

- The authors investigated the clinical and radiographic effects of STA with all–soft-tissue QT autograft (QTA) for ACLR.
- This case series included 25 patients with a mean age of 19.9 years who underwent QTA ACLR with independent STA.

Takeaway

No adverse intra-articular side effects were observed on MRI at ≥ 1 -year post-op. All patients demonstrated completely intact grafts, along with ACL signal intensity/PCL signal intensity ratios (APR) and MRI Osteoarthritis Knee Score (MOAKS) comparable to those previously described following traditional ACLR.

Simard SG,
Greenfield CJ,
Khoury AN

[Anterior cruciate ligament repair with suture tape augmentation of proximal tears and early anterior cruciate ligament reconstruction with suture tape augmentation result in comparable clinical outcomes with anterior cruciate ligament reconstruction at 2-year follow-up.](#) *Arthroscopy.* Published online July 26, 2024. doi:10.1016/j.arthro.2024.07.021

Arthroscopy. Published online July 26, 2024. doi:10.1016/j.arthro.2024.07.021

- Level II prospective study comparing clinical outcomes following acute ACL repair to acute and nonacute ACLR performed with STA.
- 100 patients with a minimum 2-year follow-up were categorized into 3 groups based on tissue quality, tear type, and duration of injury. All 3 groups received STA as part of their surgical intervention. The ACL repair group included 34 patients with a proximal avulsion (Sherman type I) sustained less than 8 weeks prior. The remaining 66 patients underwent ACLR using an all-inside technique with HT autograft (33 treated before 8 weeks = ACLR_{acute}) and all 3 groups demonstrated improved PROs with no significant differences in side-to-side knee laxity, range of motion, or retear rates. MRI at 1-year post-op revealed proper graft incorporation among all 3 groups with no evidence of intra-articular complications.

Takeaway

When performed acutely with STA, ACL repair was noninferior to both ACLR groups. Additionally, the differences between acute and nonacute ACLR were negligible.

Daniel AV,
Sheth CD,
Shubert DJ,
Smith PA

[Primary anterior cruciate ligament reconstruction with suture tape augmentation: a case series of 252 patients.](#) *J Knee Surg.* 2024;37(5):381-390. doi:10.1055/a-2129-8893

- Prospective case series studying the impact of internal brace augmentation in ACLR among all graft types.
- 252 patients with a mean age of 23.6 years and average follow-up underwent ACLR with either all–soft-tissue QT autograft, BPTB autograft, HT autograft, or preassembled allografts.

Takeaway

“Primary ACLR with internal bracing led to acceptable patient outcomes and a graft failure rate of less than 1%.”



Lavender CD,
Schaver AL,
Taylor S,
Peluso R,
Berdis G,
Singh V,
Cipriani K,
Jasko J,
Hewett TE

[Anterior cruciate ligament \(ACL\) reconstruction augmentation with bone marrow aspirate, demineralized bone matrix, and suture tape demonstrates no difference in outcomes, but faster functional recovery, versus non-augmented ACL reconstruction.](#) *Arthroscopy*.

Published online July 22, 2024. doi:10.1016/j.arthro.2024.06.042

- Level II randomized controlled trial comparing patient outcomes following standard ACLR versus biologically augmented ACLR with BMAC, DBM and the *InternalBrace*™ technique.
- 59 patients with a minimum 2-year follow up underwent all-inside ACLR with either QT autograft (43) or FGL allograft (16), depending on skeletal maturity (< 25 years old = QT autograft; > 25 years old = allograft). 29 ACLRs included BMAC, DBM and *InternalBrace* augmentation (Group A), while 30 were performed in standard fashion (Group NA).
- Functional outcomes, including early ROM and limb symmetry, were significantly improved in patients who received biologically augmented ACLRs combined with STA. Both groups had similar IKDC scores (A = 91.05 vs. NA = 85.32) and 0 reruptures.
- 6-month CT scans revealed significantly less bone tunnel enlargement on average for patients in Group A compared to NA.

Takeaway

This study highlights the potential to accelerate recovery following ACLR through biologic augmentation and suture tape reinforcement.

Noonan BC,
Bachmaier S,
Wijdicks CA,
Bedi A

[Independent suture tape reinforcement of tripled smaller-diameter and quadrupled grafts for anterior cruciate ligament reconstruction with tibial screw fixation: a biomechanical full construct model.](#) *Arthroscopy*. 2020;36(2):481-489. doi:10.1016/j.arthro.2019.06.036

- This study compared the effect of high-strength suture tape reinforcement (using the *InternalBrace* procedure) on dynamic elongation, stiffness behavior, and ultimate failure load in comparison to standard ACLR with small-diameter soft-tissue grafts.
- Tripled small-diameter and standard quadrupled tendon grafts were tested with and without suture tape reinforcement using an adjustable-loop device (ALD) for femoral fixation and an interference screw for tibial fixation.
- Tripled constructs performed significantly worse than quadrupled constructs at higher loads. Reinforcement with suture tape significantly reduced total elongation in both the tripled and quadrupled groups. Failure loads were also significantly improved in the suture-augmented groups.

Takeaway

The authors concluded that suture tape reinforcement for ACLR may provide an option for protecting autografts and allografts against irreversible lengthening during the maturation and remodeling phases of healing.



Bodendorfer BM,
Michaelson EM,
Shu HT,
Apseloff NA,
Spratt JD,
Nolton EC,
Argintar EH

[Suture augmented versus standard anterior cruciate ligament reconstruction: a matched comparative analysis.](#) *Arthroscopy*. 2019;35(7):2114-2122. doi:10.1016/j.arthro.2019.01.054

- Authors compared outcomes between ACLR using hamstring grafts with and without suture augmentation (SA).
- “Patients who underwent ACLR with hamstring autografts or allografts with a minimum 2-year follow-up were reviewed.”
- “Postoperative average daily (0.60 ± 1.25 vs 1.66 ± 1.90) and maximum daily pain (1.57 ± 1.83 vs 3.35 ± 2.28) were significantly lower for the SA group ($P < .014$). SA was significantly correlated with improved time to return to preinjury activity level (9.17 ± 2.06 vs 12.88 ± 3.94 months; $P = .002$) and percentage of preinjury activity level ($93.33\% \pm 13.22\%$ vs $83.17\% \pm 17.69\%$; $P = .010$). There was a trend toward improved rate of return to preinjury activity level for SA.”

Takeaway

Compared to standard hamstring ACLRs, the authors found suture-augmented hamstring ACLRs to be associated with improved PROMs, less pain, and a higher percentage of and earlier return to preinjury activity level without evidence of overconstraint.

In Vitro Citations: Biomechanical Validation

[Independent suture tape internal brace reinforcement of bone–patellar tendon–bone allografts: biomechanical assessment in a full-ACL reconstruction laboratory model.](#) *J Knee Surg*. 2020;33(10):1047-1054. doi:10.1055/s-0039-1692649

- This study evaluated the effects of an *InternalBrace*™ repair on the biomechanical properties of ACLR in a full-construct experimental model.
- “Three groups (n= 10 each) were tested in a full-construct porcine-bone model with human bone-patellar tendon-bone allografts using different reconstruction techniques: interference screw fixation on femur and tibia (S-S group), adjustable-loop device (ALD) fixation on the femur with tibial interference screw without suture tape (ALD-S group), and with internal brace (ALD-S-IB group).”
- “The ALD-S-IB group (2.9 ± 0.8 mm) displaced significantly less than the ALD-S (4.2 ± 0.9 mm; $p=0.015$) and S-S group (4.3 ± 1.1 mm; $p=0.017$). No significant difference was found between the ALD-S and the S-S group. Construct stiffness was significantly higher for the ALD-S-IB group (156 ± 23 N/mm) and the ALD-S group (122 ± 28 N/mm) than for the S-S group (104 ± 40 N/mm; $p=0.003$ and $p=0.0042$), but there was no significant difference between both ALD groups.”

Takeaway

The authors concluded that these results indicate that using the *InternalBrace* technique with BTB grafts in ACLR improve construct biomechanics, which has clinical implications regarding initial construct stability.

Smith PA,
Bradley JP,
Konicek J,
Bley JA,
Wijdicks CA



Lamplot JD,
Wallace GJ,
Thompson JD,
Diekfuss JA,
Champagne AA,
Myer GD,
Kaiser J

[Suture augmentation of a four-strand semitendinosus graft improves time-zero biomechanical properties.](#) *Arthroscopy*. 2024;40(1):124-132. doi:10.1016/j.arthro.2023.06.020

- A full-construct cadaveric model was used to evaluate the impact of independently tensioned suture augmentation on HT autograft biomechanics.
- 24 human semitendinosus (ST) grafts were divided evenly and prepared in 1 of 3 ways: quadrupled ST, quadrupled ST and 1.3 mm SutureTape, and quadrupled ST and 2 mm FiberTape® suture.

Takeaway

Both suture augmented groups demonstrated superior loads to failure and significantly less elongation than the isolated ST group. Particularly, grafts reinforced with 2 mm FiberTape suture had the most favorable biomechanical profile.

Matava MJ,
Koscso J,
Melara L,
Bogunovic L

[Suture tape augmentation improves the biomechanical performance of bone-patellar tendon-bone grafts used for anterior cruciate ligament reconstruction.](#) *Arthroscopy*. 2021;37(11):3335-3343. doi:10.1016/j.arthro.2021.04.053

- In this study, the authors used human BPTB grafts (10 mm × 20 mm bone plugs on both sides) to reconstruct the ACL in juvenile porcine knees. Both groups used 8 mm-diameter biocomposite interference screws for fixation in the femur and tibia.
- The STA group differed from the control in that a FiberTape suture for the *InternalBrace*™ technique was fixed independent of the graft using a TightRope® button on the femur and a SwiveLock® anchor on the tibia prior to fixation of the graft.

Takeaway

STA resulted in statistically significant improvements of time-zero biomechanical properties in terms of increased stiffness (104% increase) and ultimate failure load (57% increase) while not negatively affecting cyclic elongation, which may reduce the graft failure rate in a clinical setting.

Bachmaier S,
Smith PA,
Bley J,
Wijdicks CA

[Independent suture tape reinforcement of small and standard diameter grafts for anterior cruciate ligament reconstruction: a biomechanical full construct model.](#) *Arthroscopy*. 2018;34(2):490-499. doi:10.1016/j.arthro.2017.10.037

- This study compared dynamic elongation, stiffness, and ultimate load of standard and small grafts with and without suture tape reinforcement (using the *InternalBrace* procedure).
- Suture reinforcement of a small-diameter graft significantly reduced dynamic elongation (38%). A 15% decrease in dynamic elongation was also observed in a standard-diameter graft. The ultimate load of the small and standard grafts improved by 64% and 40% when compared to their respective controls.

Takeaway

The authors concluded that independent suture tape reinforcement (using the *InternalBrace* procedure) of soft-tissue grafts for ACLR leads to significantly reduced elongation and higher ultimate load. The suture tape reinforcement technique may decrease the risk of graft tears, particularly when a small graft is used.



Soreide E,
Denbeigh JM,
Lewallen EA,
Thaler R,
Xu W,
Berglund L,
Yao JJ,
Martinez A,
Nordsletten L,
van Wijnen AJ,
Kakar S

In Vivo Citations: Translational Research

[In vivo assessment of high-molecular-weight polyethylene core suture tape for intra-articular ligament reconstruction.](#) *Bone Joint J.* 2019;101-B(10):1238-1247. doi:10.1302/0301-620X.101B10.BJJ-2018-1282.R2

- 18 rabbits underwent bilateral ACLR with autograft, FiberTape® suture, or FiberTape suture-augmented autograft.
- At 8 weeks, both FiberTape suture alone and FiberTape suture-augmented autograft demonstrated improved ultimate load to failure, elongation, and energy absorption when compared with autograft. FiberTape suture samples also demonstrated increased bone mineral density in the bone tunnel.

Takeaway

The authors concluded that FiberTape suture increases the biomechanical performance of intra-articular ligament reconstructions in a verified rabbit model at eight weeks. Additionally, FiberTape suture did not demonstrate any deleterious effects, such as adversely affecting bone tunnel healing or invoking a prolonged elevation in inflammation.

Smith PA,
Bozynski CC,
Kuroki K,
Henrich SM,
Wijdicks CA,
Cook JL

[Intra-articular biocompatibility of multistranded, long-chain polyethylene suture tape in a canine ACL model.](#) *J Knee Surg.* 2019;32(06):525-531. doi:10.1055/s-0038-1655765

- The authors sought to assess the intra-articular use of a nonabsorbable braided suture tape for its biocompatibility when implanted next to the native ACL in a canine model.
- No severe inflammatory or immune responses, bony erosions, or premature OA development were noted during the 6-month study period, even in a “worst-case” scenario model.
- “The hypothesis was accepted as study results support the biocompatibility of suture tape in the canine knee.”

Takeaway

Results of this study support the biocompatibility and safety of intra-articular suture tape for augmentation of ACLR or repairs.

Cook JL,
Smith P,
Stannard JP,
Pfeiffer F,
Kuroki K,
Bozynski CC,
Cook C

[A canine arthroscopic anterior cruciate ligament reconstruction model for study of synthetic augmentation of tendon allografts.](#) *J Knee Surg.* 2017;30(7):704-711. doi:10.1055/s-0036-1597618

- The study objective was to describe and validate a translational canine model for all-inside ACLR using a QT allograft with internal brace (QTIB).
- Results suggest that a QTIB construct used in ACLR can provide sustained knee stability and function without the development of premature OA in a valid preclinical model.

Takeaway

The authors concluded that the configuration of the QTIB prevented early failure, allowed for direct, four-zone graft-to-bone healing, and functional graft remodeling while avoiding problems noted with use of all-synthetic grafts.



Maginnis C,
Root C,
Schiavo JH,
Ierulli VK,
Vopat B,
Mulcahey MK

Systematic Review/Meta-Analysis

[Analysis of graft types augmented with an internal brace for ACL reconstruction: a systematic review.](#) *Am J Sports Med.* 2024;52(9):2415-2423. doi:10.1177/03635465231196157

- Systematic review comparing clinical outcomes following ACLR with STA in all graft types.
- 10 studies met the inclusion criteria and were stratified as follows: HT = 5; QT = 3; BTB = 1 and HT/QT = 1. Complication rates were low among all graft types.
- Compared to the control, HT autografts augmented with ST demonstrated decreased dynamic and peak elongation, higher loads to failure, and increased dynamic stiffness. Additionally, there was a significant reduction in postoperative laxity without significantly impacting range of motion.
- BPTB allografts augmented with ST demonstrated a 31% reduction in cyclic displacement, increased load, and increased stiffness compared to isolated BPTB allografts.
- STA increased graft strength in QT allografts, while improving KOOS in human QT autografts.

Takeaway

“All graft types with ST augmentation showed no evidence of clinical disadvantage, with some studies indicating significant biomechanical or clinical advantages compared with conventional ACLR.”

Root C,
Braman M,
Srinivas M,
Ringenberg J,
Long R,
Morey T,
Vopat M,
Vopat B

[Suture tape augmentation of posterior cruciate ligament reconstruction shows improved biomechanical stability with equivalent outcome and complication rates: a scoping review.](#) *Arthroscopy.* Published online March 25, 2024. doi:10.1016/j.arthro.2024.03.025

- This systematic review summarized 6 technical, animal, biomechanical, and clinical studies evaluating the efficacy of STA for PCL reconstruction.
- Biomechanical advantages of grafts with STA were identified, including significant reduction in posterior tibial slope, 45% to 58% decrease in total elongation, and increased load to failure.
- Clinically, PCL reconstructions with STA resulted in improved or equivalent patient-reported outcomes with no difference in complication rate compared to standard PCL reconstruction.

Takeaway

The authors concluded that STA in PCL reconstruction has the potential to improve time-zero biomechanical characteristics through load sharing without added complications.



[Suture tape augmentation of anterior cruciate ligament reconstruction increases biomechanical stability: a systematic review of biomechanical, animal, and clinical studies.](#) *Arthroscopy*. 2022;S0749-8063(21)01127-0. doi:10.1016/j.arthro.2021.12.036

- This systematic review summarized 22 technical, animal, biomechanical, and clinical studies focused on ACLs augmented with suture tape to assess the pertinent literature currently available and “determine what evidence exists to support and oppose the technique in clinical practice.”
- No significant difference in complications, rates of ligamentization, histological findings, or evidence of stress shielding was found.
- PROMS in clinical studies include improved or equivalent outcomes in IKDC scores and return to sport.

Takeaway

Cited advantages of grafts with STA include evidence of gradually increasing load-sharing characteristics, 12.2% to 73.0% greater load to failure, and 17.0% to 60.2% reduced elongation.

Technical Note Citations

Surgical technique publications describing the *InternalBrace*™ technique in cruciate ligament reconstruction are listed below.

Lavender C,
Johnson B,
Singh V,
Dennis E,
Torres L

[The Lavender fertilized anterior cruciate ligament reconstruction: a quadriceps tendon all-inside reconstruction fertilized with bone marrow concentrate, demineralized bone matrix, and autograft bone.](#) *Arthrosc Tech*. 2019;8(9):e1019-e1023. doi:10.1016/j.eats.2019.05.013

McGee R,
Daggett M,
Jacks A,
Hoang V,
Theobald HA

[Patellar tendon graft anterior cruciate ligament reconstruction technique with suture tape augmentation.](#) *Arthrosc Tech*. 2019;8(4):e355-e361. doi:10.1016/j.eats.2018.11.003

Saper MG

[Quadriceps tendon autograft anterior cruciate ligament reconstruction with independent suture tape reinforcement.](#) *Arthrosc Tech*. 2018;7(11):e1221-e1229. doi:10.1016/j.eats.2018.08.007

Daggett M,
Redler A,
Witte K

[Anterior cruciate ligament reconstruction with suture tape augmentation.](#) *Arthrosc Tech*. 2018;7(4):e385-e389. doi:10.1016/j.eats.2017.10.010

Aboalata M,
Elazab A,
Halawa A,
Imhoff AB,
Bassiouny Y

[Internal suture augmentation technique to protect the anterior cruciate ligament reconstruction graft.](#) *Arthrosc Tech*. 2017;6(5):e1633-e1638. doi:10.1016/j.eats.2017.06.020

Smith PA,
Bley JA

[Allograft anterior cruciate ligament reconstruction utilizing internal brace augmentation.](#) *Arthrosc Tech*. 2016;5(5):e1143-e1147. doi:10.1016/j.eats.2016.06.007



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1. Daniel AV, Wijdicks CA, Smith PA. Reduced incidence of revision anterior cruciate ligament reconstruction with internal brace augmentation. *Orthop J Sports Med.* 2023;11(7):23259671231178026. doi:10.1177/23259671231178026
2. Wilson WT, Kennedy MJ, MacLeod D, Hopper GP, MacKay GM. Outcomes of anterior cruciate ligament reconstruction with independently tensioned suture tape augmentation at 5-year follow-up. *Am J Sports Med.* 2023;51(14):3658-3664. doi:10.1177/03635465231207623
3. Daniel AV, Smith PA. Primary All-soft tissue quadriceps tendon autograft anterior cruciate ligament reconstruction with suture tape augmentation resulted in satisfactory patient outcomes and a low graft failure rate in high school and collegiate athletes. *Arthroscopy.* Published online March 20, 2024. doi:10.1016/j.arthro.2024.02.047
4. Daniel AV, Smith PA. Less subsequent revision anterior cruciate ligament (ACL) reconstruction following primary bone-patellar tendon-bone ACL reconstruction with suture tape augmentation-a retrospective comparative therapeutic trial with 5-year follow up. *Arthroscopy.* Published online February 3, 2024. doi:10.1016/j.arthro.2024.01.019
5. Bachmaier S, Smith PA, Bley J, Wijdicks CA. Independent suture tape reinforcement of small and standard diameter grafts for anterior cruciate ligament reconstruction: A biomechanical full construct model. *Arthroscopy.* 2018;34(2):490-499. doi:10.1016/j.arthro.2017.10.037
6. Bedi A. Editorial commentary: buckle up surgeons: “safety belt” reinforcement of knee anterior cruciate ligament reconstruction grafts. *Arthroscopy.* 2018;34(2):500-501. doi:10.1016/j.arthro.2017.12.009
7. Arthrex, Inc. LA1-00086-EN_B. Naples, FL; 2018.
8. Mackay GM, Blyth MJ, Anthony I, Hopper GP, Ribbans WJ. A review of ligament augmentation with the *InternalBrace™*: the surgical principle is described for the lateral ankle ligament and ACL repair in particular, and a comprehensive review of other surgical applications and techniques is presented. *Surg Technol Int.* 2015;26:239-255