*Internal*Brace™ Ligament Augmentation Repair

Faculty Forum Virtual Roundtable

Moderator

Thomas Clanton, MD
Steadman Clinic
Vail, CO

Participating Panelists

J. Chris Coetzee, MD, MBChB
Minnesota Orthopedic
Sports Medicine Institute
Edina, MN

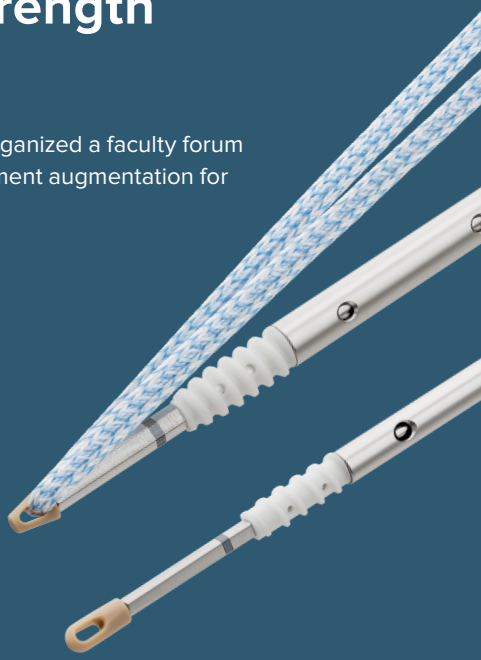
Professor Gordon Mackay, MD
The Mackay Clinic
Stirling, Scotland

Nicholas Gates, MD
Commonwealth
Orthopaedic Center
Edgewood, KY

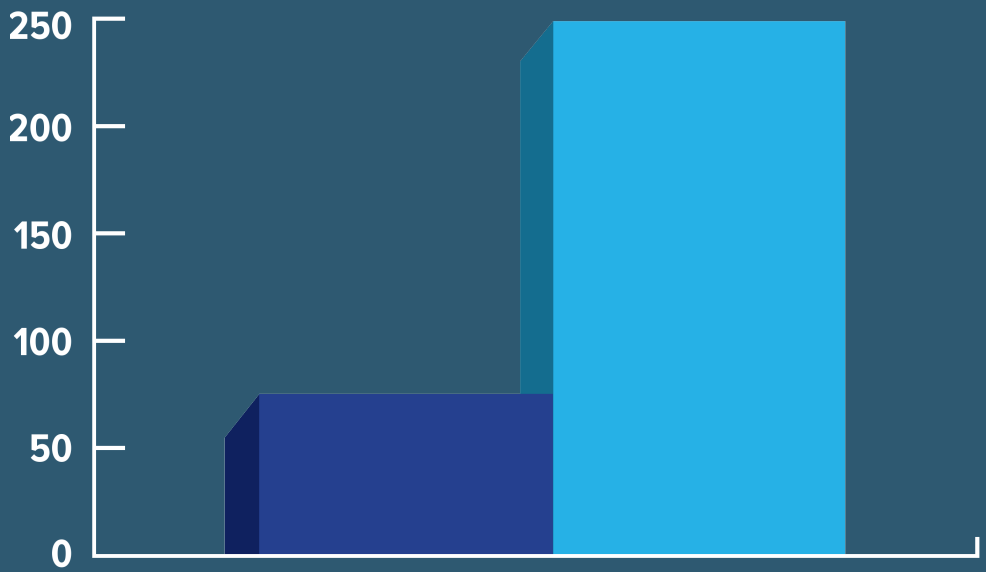
Arthrex®

Augment Your Brostrom Repair With Strength and Protection

In an effort to address the concerns and limitations of traditional Brostrom repairs, Arthrex organized a faculty forum virtual roundtable with thought leaders to discuss their experiences with *Internal*Brace™ ligament augmentation for lateral ankle instability.



Ultimate Failure (Newtons) at Time Zero



- ATFL repaired with Brostrom alone [*Am J Sports Med*. 2012;40(11):2590-2596]
- ATFL repaired with Brostrom and *Internal*Brace procedure [*Am J Sports Med*. 2014;42(2):405-411]

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.

Q. Why have Brostroms been considered the gold standard when some of the literature indicates that patients have to step down in their activities? Shouldn't this be considered a failure or complication?

Dr. Clanton
The 2013 Maffulli article in *AJSM*[2] is one of the only articles that includes a long-term outcomes analysis of the Brostrom procedure and suggests such a reduction in activity (42%). Most other studies, which look at shorter term results, generally have reported success rates ranging from 85% to 95% with the Brostrom procedure or with the Gould modification of this procedure.

Please scan QR code for SwiveLock® video showing blood and bone marrow flow through the anchor.

Q. Why do you feel it is important to use the *Internal*Brace™ procedure to augment your Brostrom repair?

Dr. Clanton
I treat a high percentage of athletes and very athletic individuals who want to return to their activities. Sometimes this results in such individuals pushing the limits on their rehabilitation, which may be detrimental to the Brostrom procedure.

Dr. Gates
Its greatest value to me is its ability to show very consistent strength of repair during the healing phase,[1] despite the quality of original ATFL and capsule. Many patients have a lateral capsule that is in poor condition due to repeated lateral ligament sprains and nonsurgical treatment. By consistently employing the *Internal*Brace augmentation, I finish every case with great confidence, regardless of the tissue quality.

Dr. Coetzee
The *Internal*Brace protects the repair during the healing phase and allows it to mature without stretching out.

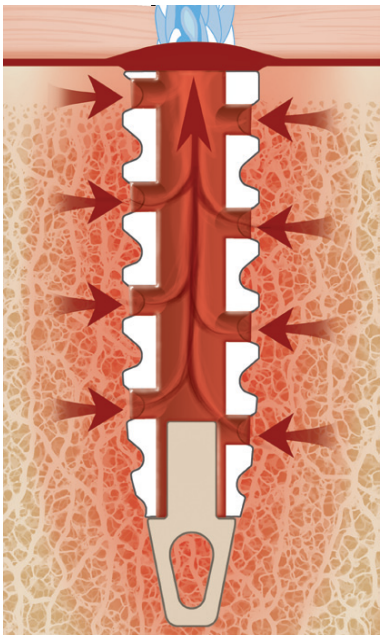
Q. What are your concerns with current Brostrom repairs?

Dr. Clanton
With lateral ankle sprains being the most common time-loss injury in sports, one can expect that patients who undergo lateral ankle ligament reconstructions will be subjected to the probability of a re-injury once they return to sports. I am concerned that this will lead to recurrent problems, particularly in younger patients and higher level athletes who have Brostrom repairs. I think that this is potentially more likely in cases such as those reported by Maffulli et al, where only the anterior talofibular ligament (ATFL) is repaired.

Dr. Coetzee
My main concern is that it really takes a long time for the tissue to mature. In a true chronic grade 3 tear, you essentially suture scar tissue back to the fibula. For that to organize into good tissue takes a long time; therefore, the number of failures we see. A standard Brostrom is also not great for patients with underlying tissue abnormalities, i.e. Marfan's etc.

"Its greatest value to me is its ability to show very consistent strength of repair during the healing phase, despite the quality of original ATFL and capsule."[1] -Dr. Gates

Dr. Gates
Again, my biggest concern over many years was encountering poor tissue quality, and at times less than optimal retinacular tissue. This could lead to a hesitancy to rehab early and longer periods of post-op protection.



SwiveLock cannulation and vents allow blood and bone marrow to flow through the anchor.

Q. What compelled you to use the *Internal*Brace™ procedure to augment your Brostroms?

Dr. Clanton
After hearing Gordon Mackay's presentation on the *Internal*Brace concept, we performed biomechanical testing that confirmed the improved strength of the augmentation. This was published in the February 2014 issue of the *American Journal of Sports Medicine*.[1]

Dr. Gates
It was a new technique that actually solved a problem I was encountering. Too often new devices or techniques are presented that are different in approach or implant, but propose to solve a problem that I don't really have.

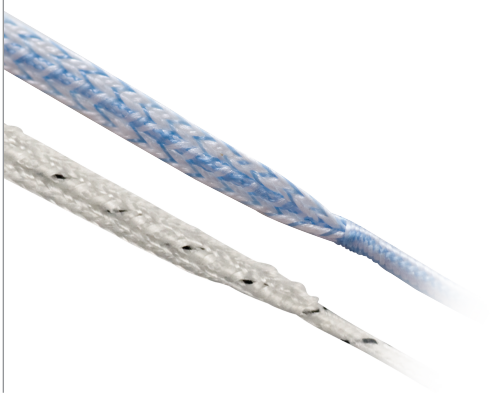
Dr. Mackay
It's easy and minimally invasive, and I sleep easy.

Dr. Coetzee
My first few cases were in patients that failed a Brostrom as well as an anatomic reconstruction using a semitendinosus graft. The options were to do another reconstruction with a graft or use the *Internal*Brace procedure. This turned out to be much less surgery and very simple post-op recovery.

"It was a new technique that actually solved a problem I was encountering." -Dr. Gates

Q. We often hear "I never met a Brostrom that needed augmentation" or "My Brostroms all do fine". Knowing the clinical value, what would be your response to those conversations?

Dr. Clanton
The Brostrom procedure has been an excellent procedure over the short term, but does not work in all situations. For example, it is not appropriate for patients who are re-injured and have instability following prior ankle reconstructions. I also do not favor the Brostrom technique in patients who are hyperflexible. In my opinion, we should always be vigilant for methods by which we can improve the results of what we do for our patients.

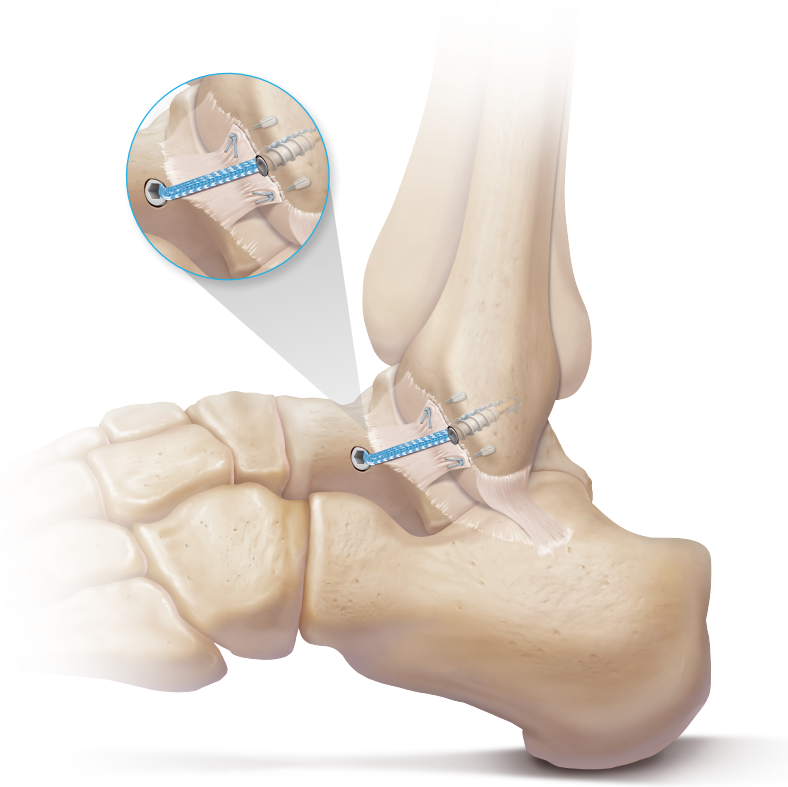


Dr. Gates
I would remind them that one of the first modifications of the Brostrom was actually an "augmentation" using the extensor retinaculum. Someone saw the need for augmentation then, as I still see it today. Unfortunately the retinaculum is a non-anatomic augmentation, while the *Internal*Brace technique is designed to mimic anatomy. I think that surgeons who are looking to advance their confidence will see that we have an opportunity to move past "fine."

Dr. Mackay
Patients often have poor tissue quality and I am only too happy to augment with the *Internal*Brace procedure. Every other area of orthopedics— hand, shoulder, knee surgery, etc—recognizes the dangers of prolonged and unnecessary immobilization. Even simply to reduce the risk of DVT would justify it in my practice.

Dr. Coetzee
Well, I was one of those who said exactly that. I still believe most standard Brostroms do very well, but if you are totally objective, the failure rate, or at least, suboptimal functional outcome, is much higher than what we believe.

"I would remind them that one of the first modifications of the Brostrom was actually an "augmentation" using the extensor retinaculum. Someone saw the need for augmentation then, as I still see it today." -Dr. Gates



Q. It is understood that this procedure is relatively new with limited, long-term clinical follow-up. Can you comment on the outcomes and your experience with your patients you have treated? Please explain the difference between standard Brostrom repair and those that have *Internal*Brace™ ligament augmentation.

Dr. Clanton
While the procedure is relatively new for the ankle, the implants and technique have been used in other areas such as the shoulder and the Achilles tendon.

Dr. Mackay
I have over 3 years experience and I am delighted at how it has changed my practice. Patients are impressed by their recovery.

Q. What have been the most positive effects of the *Internal*Brace augmentation repair for your patients?

Dr. Gates
The confidence I have in the repair is conveyed directly to the patient as they embark on a rehab protocol. I draw the analogy with my knee colleagues who perform ACL reconstructions, because I now find myself motivating and challenging my patients to take the responsibility to regain strength and motion, just like my knee partners have been doing for ACL patients for years.[3]

Dr. Mackay
Athletes like the idea that they have some internal support that may minimize the risk of further injury.

Q. Surgeons often speak of clinical studies before trying something new. Why try the *Internal*Brace augmentation repair now? What are the minimum expectations you have?

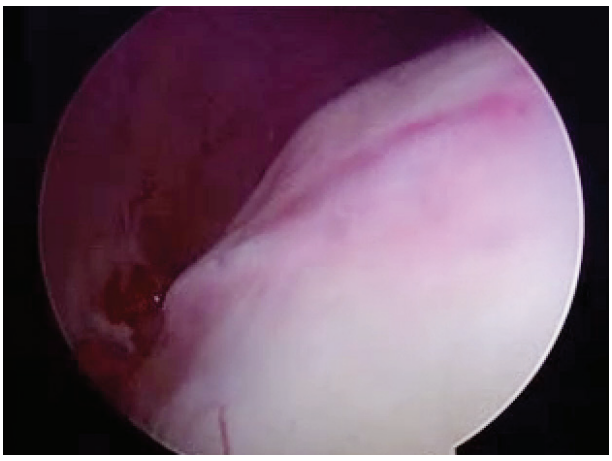
Dr. Clanton
Fortunately, there are now biomechanical studies that support the use of the *Internal*Brace procedure and there are individuals such as Drs. Mackay, Coetzee, Gates and Ellington who have extensive experience with the technique in the lateral ankle as well as other locations.

Dr. Gates
I consider this in some ways to be doing the same procedure I have been doing for 16 years, only with a much better ”anchor” if you will. Since the beginning of the lateral ligament anatomic repair timeline, there has been an evolution of technique from simply soft tissue repair, to using drill holes in the fibula, and then to anchors. The *Internal*Brace repair represents the next step in that evolution, rather than a brand new procedure.

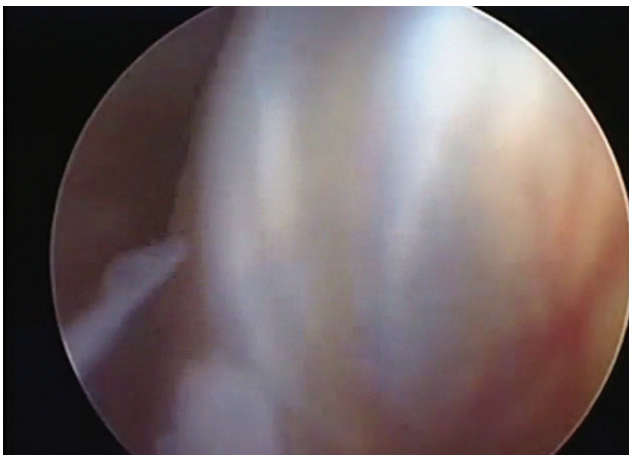
Dr. Mackay
The components have an excellent track record of safety and I have been happy with their biocompatibility in my shoulder practice for years.[3] The collagen has been shown to grow over the inert scaffold as the ligament heals. It is an easy step to take.

Dr. Coetzee
I believe the ideal situation to use it now is for a case where you ran out of options. You will be pleasantly surprised at the ease of use and the simplified post-op course.

"The *Internal*Brace repair represents the next step in that evolutions, rather than a brand new procedure." -Dr. Gates



Please scan QR code for 4 months second-look FiberTape® video.



Please scan QR code for 6 weeks second-look FiberTape video.

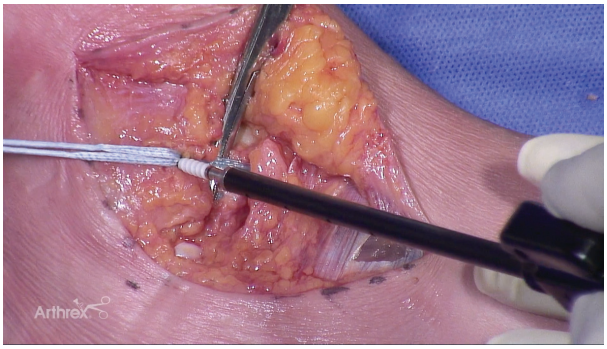
Q. What are the technique pearls you have learned and can pass along?

Dr. Clanton
It is important to follow the recommendations for exactly how to perform the technique, and to understand the anatomy and biomechanical function that one wishes to restore. It is certainly possible to place the augmentation in an incorrect position and overconstrain the joint. Gordon's technique of keeping a hemostat under the FiberTape® during the insertion of the second SwiveLock® anchor seems to help in avoiding this.

Dr. Gates
1. Expose and prepare the fibula first to determine optimal location of your anchors for the capsule and the location of your fibular SwiveLock.
2. Reflect the capsule back to visualize the intra-articular lateral talar anatomy, while your assistant holds the ankle in neutral position. This allows for more confidence after capsular repair, when placing the talar SwiveLock through the capsule to gain an extra-articular position of the repair.

Dr. Mackay
The ATFL fixation is usually sufficient to support your soft-tissue repair. Balance in neutral and, if concerned about tensioning, fix the talus SwiveLock first and after soft-tissue repair fix the fibula SwiveLock (using a larger drill but with 3.4 mm, which allows space for tape). Extremely easy and quick.

Dr. Coetzee
1. I drill and prepare all the holes before doing the Brostrom. That way I know the anchors will be close to the anatomic positions. The *Internal*Brace repair should be extra-articular; therefore, on the outside of the Brostrom.
2. It is sometimes difficult to find the direction of the talar drill hole. After tapping the hole I place a blunt-tipped wire in the hole to remind me where it goes.
3. Never over tighten the *Internal*Brace suture. I place a Freer under the suture when inserting it into the fibula or calcaneus to ensure it has some slack.



Please scan QR code for Dr. Clanton's technique video.

Q. In simple terms, explain your surgical technique.

Dr. Clanton
I perform the Brostrom procedure and augment it with the *Internal*Brace placed over the top of the ATFL arm of the Brostrom.

Dr. Gates
I perform a standard Brostrom using two anchors in the fibula. I expose and place these anchors first, then drill the fibular SwiveLock hole between the two anchors. I shorten and repair the anterolateral capsule with the anchors, then place the *Internal*Brace suture in an extra-articular fashion. The SwiveLock drill locations mimic the ATFL attachments to the talus and fibula, but the *Internal*Brace procedure is augmenting the tissue that is deep to it, rather than replacing the ligament.

Dr. Coetzee
I use the standard lateral approach and extend it a little proximal and distal for adequate exposure. Then a standard Brostrom repair preparation. I do not attach the ligaments with anchors into fibula. I overlap the tissue flaps and suture in the shortened position. A small incision is made at the footprint of the ATFL and CFL. The drill hole is made into the talar neck, angled into the body of the talus. It is worthwhile to do this under fluoroscopy the first few times until you are comfortable with the direction of the drill hole. If I am fixing the CFL, that goes in third. Insert the talus 3.5 mm SwiveLock first, loaded with FiberTape, and tension to the fibula. This is after the Brostrom is tensioned.

Dr. Mackay
I use a standard approach but 1 cm more distal. Gentle dissection exposes residual ATFL. Mark the mid-point origin and insertion and drill for the *Internal*Brace repair before starting Brostrom repair. Drill the talus with the foot in neutral and angle at 45 degrees to the sagittal plane while parallel to the sole.

Please scan QR code for Dr. Gates' testimonial and technique video.

Q. Describe the optimal technique for tensioning the final construct.

Dr. Gates
I use a marker to mark the top and bottom of the second SwiveLock®, and use a hemostat to palpate the tension of the *Internal*Brace™ repair. I find it helpful to do this with the ankle in neutral and free from any upward pressure on the heel. There is no need to apply aggressive eversion nor posterior drawer, just make sure there is no accidental anterior drawer force from a heel bump. It is the same technique I use for a standard Brostrom, other than monitoring the *Internal*Brace suture with the hemostat. I find I can make the tension on the suture lay down similar to the tension I placed on the capsular repair, which I like.

Dr. Mackay
As described above, in neutral without excessive tension.

Dr. Coetzee
This is the hardest part of the procedure. I measure distance from the fibula hole to the talar hole. Then add the depth of the drill hole and add 2 to 3 mm not to over-tighten the repair. I also place a Freer under the suture when screwing it down to make sure it is not too tight.

Q. Describe your post-op rehab protocol? What is your post-op rehab protocol for your lateral ankle repairs without *Internal*Brace ligament augmentation?

Dr. Clanton
*Internal*Brace repair: Patients are splinted for 7 to 14 days to allow the inflammation of surgery to resolve. During this time, they can ambulate with toe touch on crutches. At the first postoperative visit when the splint and sutures are removed, they begin a physical therapy program working on motion and strength with the goal of returning them to activity as soon as they develop balance, strength, motion, and endurance suitable for their sport or occupation.

Reference footnote below, but for my personal standard Brostrom without *Internal*Brace ligament augmentation the rehabilitation is similar, but I limit the patient's inversion and forced plantar flexion movement for 4 to 6 weeks following the Brostrom and tend to protect these patients longer in a walking boot.

Please scan QR code for patient walking 6 weeks post-op video.

Dr. Gates
*Internal*Brace repair:

1. Immediate partial weight-bearing
2. At 2 weeks, go full weight-bearing in boot and start physical therapy for range of motion and calf strength.
3. At 4 weeks, convert to brace and advance physical therapy.
4. At 6 weeks ,advance to jog, run, and non-lateralizing agility.
5. At 8 to 10 weeks, consider return to agility and progress to sports as proprioception and strength testing is passed.

Reference footnote below, but for my personal standard Brostrom without *Internal*Brace ligament augmentation the rehab is as follows:

1. Immediate partial weight-bearing
2. At 2 weeks, full weight-bearing in boot
3. At 6 weeks, begin PT for range of motion and calf strength
4. At 8 to 10 weeks, advance physical therapy to non-lateralizing agility
5. At 12 to 16 weeks, consider return to sports as tolerated.

Dr. Mackay
*Internal*Brace repair: Soft boot for 10 to 12 days to allow wound to heal but can weight bear as able and mobilization out of boot is encouraged at rest.

Reference footnote on previous page, but for my personal standard Brostrom without *Internal*Brace ligament augmentation the rehab is as follows: can no longer justify this approach to my patients. Former management involved 2 weeks cast followed by 4 to 6 weeks in boot with progressive weight bearing.

Please scan QR code for patient walking 12 days post-op and 6 weeks post-op video.

Patient images, videos and/or testimonials used with written authorization of the patient. Brostrom rehab protocols vary greatly in literature. The traditional protocol describes 6 weeks non–weight-bearing and casting followed by 6 weeks weight-bearing in boot and formal therapy not being initiated until 3 months with goals of return to sport at 4 to 6 months. Other protocols that report of "early" rehab (Petrera et al, [4]*AJSM* April 2014, and others) which allow for immediate weight-bearing, early initiation of rehabilitation within weeks for surgery, and goals of early return to sport and activity within months of surgery. Certainly the current trend is to be more aggressive as we understand that early motion and use of any joint, including ankle, should allow ligament healing to occur earlier. There is also enough literature and overall comfort in the orthopedic foot and ankle community to support more aggressive rehab protocols for ligament reconstruction procedures (Miyamoto et al, [5]*AJSM*, April 2014).

Q. When would you use *Internal*Brace™ ligament augmentation in your lateral ankle instability cases? Do you incorporate a calcaneofibular ligament (CFL) limb, if so how often (what percent of the time)?

Dr. Clanton
I use it with the Brostrom procedure. I do not use a calcaneofibular limb (at least not so far). For those indications, I use allograft and tenodesis fixation.

Dr. Gates
I am using the *Internal*Brace augmentation of a Brostrom for all of my primary and some revision instability cases. I agree with the literature that states a separate CFL reconstruction is not necessary, so I do not do it. I do reach as posterior in my capsular reefing as I can, but without any aggressive mobilization of the peroneal tendons. SwiveLock® cannulation and vents allow blood and bone marrow to flow through the anchor.

Dr. Coetzee
I use it for all revision cases. Also for people with known generalized ligamentous laxity. Third group now are high-level athletes. I augment the CFL limb in all revisions. I personally like it and it makes sense to me. Most of these cases have an anterior drawer and a positive talar tilt. Repairing only one of the two might lead to the kinematic issues we discussed before. I will do the CFL limb in all primaries that have a positive talar tilt. So far that amounts to about 50%.

Q. What are your thoughts on indications of *Internal*Brace augmentation versus when to do a full allograft reconstruction with tenodesis screw fixation?

Dr. Gates
Though I typically have great confidence in using the *Internal*Brace augmentation in some revision cases, I will be ready to convert to an allograft with tenodesis screw fixation for those individuals with failed previous peroneal tendon rerouting procedures, cavus foot alignment, and those with more than one previous procedure.

Dr. Coetzee
Interesting question. I will use an allograft with tenodesis screws when the native tissue is not of good enough quality to function as a true lateral repair. On occasion you see a case where the tissue is very thin and atrophic, and no matter how you fix it to the fibula, it will not provide strength. The unanswered question for me is if I then should protect my allograft with an *Internal*Brace repair?[1]

Q. Have you ever considered *Internal*Brace augmentation for other indications (spring ligament and/or lateral ankle with arthroplasty)?

Dr. Clanton
I have used the *Internal*Brace procedure in both of those situations and it has been very effective.

Dr. Gates
I have done spring ligament cases in conjunction with stage 2 flatfoot reconstructions in some patients, but my surgical practice is weighted toward a more active population as a whole.

Dr. Coetzee
I have used it with the spring ligament. I think it might be a great augmentation of a PTT repair, and also allow your repair to mature while the *Internal*Brace repair protects it.

Lateral Ankle Repair Revolutionized

Please scan QR code for DX FiberTak® Soft Anchor Surgical Technique Animation

Please scan QR code for MN defensive back with bilateral Brostrom with *Internal*Brace™ procedure, 7 weeks post-op.

Patient images, videos, and/or testimonials used with written authorization of the patient.

*Internal*Brace™ Ligament Augmentation Repair Kit

The Brostrom lateral ankle ligament secondary repair is a proven method for treating a chronic lateral ligament disruption with instability. Since its original description in 1966, certain problematic issues have stimulated the use of augmentation techniques such as the use of the inferior extensor retinaculum, periosteum, and/or tendon transfer for lateral ankle ligament pathologies. The issues for which these augmentations have been designed include the fact that (1) the Brostrom repair needs a fairly extensive period of immobilization and protection to allow the tissue to mature adequately; (2) it does not work well in ligamentously lax patients; (3) patients with associated subtalar instability may require more substantial stabilization; (4) concerns exist regarding the adequacy of the secondary repair in especially large individuals; (5) questionable tissue for repair is often encountered; and (6) there are 10% to 20% recorded failure rate over time. Since all of the described augmentations to date use normal tissues in a non-anatomical fashion, we offer a simple augmentation technique that exceeds the native ATFL strength[1], does not violate normal tissue, and protects the ligament repair while it matures.

*Internal*Brace System, **Plus**

Product Description	Item Number
BioComposite SwiveLock® w/ Collagen-Coated FiberTape® Suture, 4.75 mm	AR-**1789J-CP**
BioComposite SwiveLock Anchor, 4.75 mm	
Drill, 3.4 mm	
Drill, cannulated, 3.4 mm	
Drill, 4.0 mm	
Drill Guide w/ Metal Insert for Talus	
Drill Guide w/ Metal Insert	
Bone Tap	
Guidewire w/ Trocar Tip	
Guidewire Sleeve	
Suture Passing Wire	
Free Needle	
JumpStart® Single-Layer Dressing, 2 in × 5 in	

*Internal*Brace System, **Standard**, BioComposite

Product Description	Item Number
BioComposite SwiveLock w/ Collagen-Coated FiberTape Suture, 4.75 mm	AR-**1788J-CP**
BioComposite SwiveLock Anchor, 3.5 mm	
Drill, 2.7 mm	
Drill, cannulated, 2.7 mm	
Drill, 3.4 mm	
Drill, cannulated, 3.4 mm	
Drill Guide w/ Metal Insert for Talus	
Drill Guide w/ Metal Insert	
Bone Tap	
Guidewire w/ Trocar Tip	
Guidewire Sleeve	
Suture Passing Wire	
Free Needle	
JumpStart Single-Layer Dressing, 2 in × 5 in	

*Internal*Brace System, **Standard**, PEEK

Product Description	Item Number
PEEK SwiveLock w/ Collagen-Coated FiberTape Suture, 4.75 mm	AR-**1788PJ-CP**
PEEK SwiveLock Anchor, 3.5 mm	
Drill, 2.7 mm	
Drill, cannulated, 2.7 mm	
Drill, 3.4 mm	
Drill, cannulated, 3.4 mm	
Drill Guide w/ Metal Insert for Talus	
Drill Guide w/ Metal Insert	
Bone Tap	
Guidewire w/ Trocar Tip	
Guidewire Sleeve	
Suture Passing Wire	
Free Needle	
JumpStart Single-Layer Dressing, 2 in × 5 in	

*Internal*Brace System, **Mini**

Product Description	Item Number
PEEK SwiveLock w/ Collagen-Coated FiberTape Suture, 3.5 mm	AR-**1787PJ-CP**
PEEK SwiveLock Anchor, 3.5 mm	
Drill, 2.7 mm	
Drill, cannulated, 2.7 mm	
Drill, 3.4 mm	
Drill Guide w/ Metal Insert for Talus	
Drill Guide w/ Metal insert	
Bone Tap	
Guidewire w/ Trocar Tip	
Guidewire Sleeve	
Suture Passing Wire	
Free Needle	
JumpStart Single-Layer Dressing, 2 in × 5 in	

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2. Maffulli N, Del Buono A, Maffulli GD, et al. Isolated anterior talofibular ligament Broström repair for chronic lateral ankle instability: 9-year follow-up. *Am J Sports Med*. 2013;41(4):858-864. doi:10.1177/0363546512474967.

3. Mackay GM, Blyth MJG, Hopper GP, Anthony I, Ribbans WJ. A review of ligament augmentation with the *Internal*Brace: 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.

4. Petrera M, Dwyer T, Theodoropoulos JS, Ogilvie-Harris DJ. Short- to medium-term outcomes after a modified Broström Repair for Lateral Ankle Instability With Immediate Postoperative Weightbearing. *Am J Sports Med*. 2014;42(7):1542-1548. doi:10.1177/0363546514530668.

5. Miyamoto W, Takao M, Yamada K, Matsushita T. Accelerated versus traditional rehabilitation after anterior talofibular ligament reconstruction for chronic lateral instability of the ankle in athletes. *Am J Sports Med*. 2014;42(6):1441-1447. doi: 10.1177/0363546514527418.

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