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Augmented Bröstrom Repair Using Biologic Collagen Implant: Report on 9 Consecutive Patients

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The Foot & Ankle Journal 1 (7): 4

The Modified Bröstrom stabilization is commonly performed for chronic lateral ankle injuries. However, tissue viability, chronic injury, and/or injury severity may require a non-anatomic repair necessitating a tendon transfer. We present a series of 9 consecutive cases of Modified Bröstrom stabilization with OrthADAPT™ Bioimplant augmentation with 9 month follow-up. The average pre-operative Visual Analog Pain Score (VAS) was 5.78 out of 10 (range 5-8, SD 1.09). The mean duration of physical therapy was 2.3 months (range 6 weeks – 3 months). The mean length of time from surgery to discharge from care was 4.4 months (range 4-6 months). VAS was reduced to an average of 1.89 post-operatively at time of discharge from care (range 0-3, SD 1.05). The results were statistically significant (p>0.0001) at a 95% confidence interval. We conclude that the OrthADAPT™ Biologic Collagen provides support for augmentation and enhance the stability of the Modified Bröstrom procedure. Additionally, it may prevent the need for tendon transfer and its inherent complications.

Key words: Modified Bröstrom stabilization, OrthoADAPT™ Biologic collagen, chronic lateral ankle injury

Accepted: May 2008 **Published:** July 2008

The Modified Bröstrom stabilization is a common anatomic reconstruction performed for chronic lateral ankle injuries of the anterior talofibular and calcaneofibular ligaments.[1] At times, tissue viability, injury chronicity, and/or severity of injury may require a non-anatomic repair (i.e., Evans Tenodesis), necessitating a tendon transfer.[2,3] This creates a need for additional surgery and rehabilitation with all its associated complications.[4,5,6] A novel use of a biologic collagen implant (OrthADAPT™ Bioimplant, Pegasus Biologics, Irvine, CA) is described, which strengthens the Bröstrom-Gould repair and obviates the need for additional tendon harvesting.

The OrthADAPT™ Biologic Collagen Implant is a biologic scaffold that provides support for augmentation by fortifying and promoting tissue ingrowth to enhance the stability of the reconstruction procedure.

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ISSN 1941-6806 doi: 10.3827/faoj.2008.0107.0004

Figure 1 Incision is made over the ATFL.

Figure 2 Anterolateral ankle capsule and ATFL sectioned.

The purpose of this paper is to illustrate a new surgical technique using the Pegasus OrthADAPT™ Bioimplant for augmentation of the modified Bröstrom procedure for reconstruction of the lateral ankle ligament complex. A case series of 9 patients with 9-month follow-up is also presented.

Materials and Methods

The procedure is performed in the supine position under sedation with local infiltration. A roll is placed under the ipsilateral hip to allow for internal rotation of the leg and easy access to the surgical site. A high-ankle tourniquet is used for hemostasis. The incision is made just below the tip of the distal fibula and extended dorsally across the skin tension lines along the anterior fibula.

A controlled depth incision is made mimicking the initial skin incision. (Fig. 1) Care is taken to prevent violating the subtalar joint, and proper retraction is used to avoid the peroneal nerve, artery, and tendons. The ankle joint is identified using a 25-guage needle or via fluoroscopy. The anterior lateral ankle capsule and ATFL are sectioned and reflected proximally. (Fig. 2)

Figure 3 Pants-over-vest repair of the ATFL.

The lateral talar dome may be inspected for the presence of any osteochondral lesions or osteophytes, and are corrected if present.

The foot is held is maximal eversion and the ligament is repaired as a Modified Bröstrom in a pants-over-vest fashion using 2.0 FiberWire®. (Fig. 3)

The calcaneofibular ligament is examined and primarily repaired, if needed, by reefing the tendon and suturing it onto itself.

Figure 4 OrthADAPT™ implant strip.

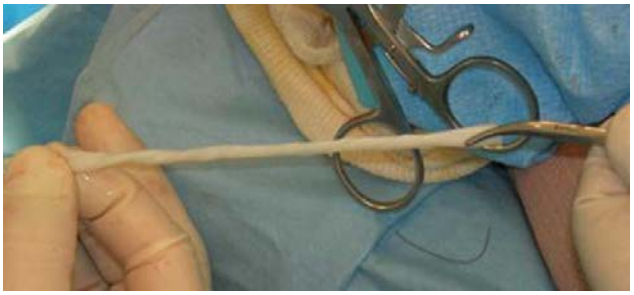

Figure 5 OrthADAPT™ implant is fashioned into a cable.

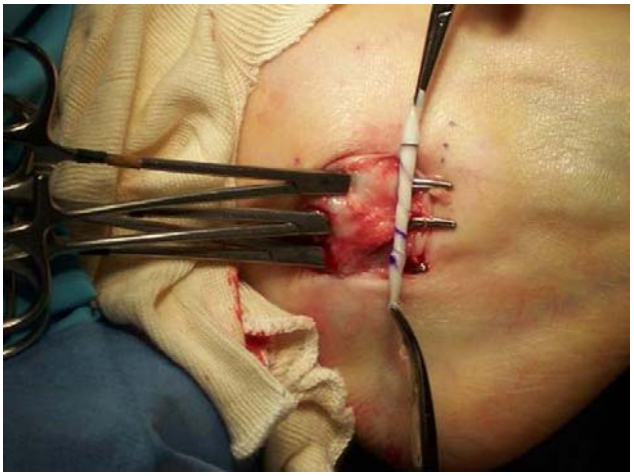

Figure 6 Hemostats are placed under the repaired ATFL to fascilitate weaving of the implant.

A 1x10cm strip OrthADAPT™ implant is prepared according to the manufacturer directions and is used for the repair. (Fig 4)

Two hemostats are placed at both ends of the strip and are twisted to make a cable. (Fig 5)

Figure 7 The implant is woven across the repaired ATFL.

Figure 8 OrthADAPT™ implant patch over the repair.

One end of the strip is sutured to the distal end of the ATFL using 2.0 FiberWire®. A hemostat is placed through the repaired ATFL and the OrthADAPT™ Bioimplant cable is fed and drawn through. (Figs. 6, 7)

This maneuver is repeated 3-4 times over and under the repaired ATFL and sutured to the proximal end of the ATFL.

Additionally, a 4x4 sheet of OrthADAPT™ Bioimplant may be used as a patch over the repair. (Fig 8) This may minimize adhesions between the primary repair and the skin and impart additional security and strength.

Figure 9 Skin closure.

4.0 FiberWire® is used in a vertical mattress suture pattern to secure the patch to over the repair. Skin closure is obtained using absorbable sutures and adhesive strips. (Fig 9)

Post-Operative Protocol

The patient is maintained in a non-weight bearing short-leg cast with slight inversion for the initial first 3 weeks, and then progresses to a walking boot for the next 3 weeks. An intense physical therapy protocol is initiated after the cast is removed. A Stromgren® ankle brace is used for the next 6 weeks and with activity for the next 6 months. Non-contact sports may be initiated after 6 weeks, with any activity restrictions lifted at 3 months.

Results

Nine cases of augmented Bröstrom repair using OrthADAPT™ implants were performed from April 2006 to September 2007. All cases were unilateral; 6 had chronic ankle instability and 3 were acute-on-chronic in nature. Seven patients were female and two were male. The age range was between 24-58 years old. Patients who had associated injuries or needed additional surgery, such as peroneal augmentation, were excluded from the study.

A Wong-Baker Faces Visual Analog Score (VAS) was administered to each patient and recorded pre-operatively and at each post-operative visit. The average pre-operative VAS was 5.78 out of 10 (range 5-8, SD 1.09). The average duration of physical therapy was 2.3 months (range 6 weeks – 3 months). The average length of time from surgery to discharge from care was 4.4 months (range 4-6 months). VAS was reduced to an average of 1.89 post-operatively at time of discharge from care (range 0-3, SD 1.05). The results were statistically significant ($p>0.0001$) at a 95% confidence interval.

There was one complication in this series that resulted in an explant. The patient complained of an "overstuffed" feeling in the area of the repair which was causing irritation in shoes. There was skin breakdown which exposed the patch repair. The patient was brought into the operating room and the patch was removed. Upon inspection, there was no issue with the weave portion of the repair, and it was left intact. The time from implant to explant was 3 months and this subsequently healed uneventfully.

Discussion

Lateral ankle sprains are a common injury and account for 15% to 25% of all musculoskeletal injuries.[7] The anterior tibiofibular ligament (ATFL) is the most frequently sprained ligament in the body and has a 3:1 ratio of injury when compared to the calcaneofibular ligament (CFL). Most patients do well with conservative treatment and rehabilitation, and are able to return to function relatively soon after injury.[8] However, 10 to 30% of this population may develop chronic instability and repeated injuries.[9] The most common complaint is pain, swelling, and tenderness over the lateral ligament complex.[10]

The integrity of the ankle ligaments should be assessed on physical examination. This examination can be difficult at times due to patient guarding. A high ankle block with lidocaine or bupivicaine may aid with patient compliance to the examination.

Figure 10 Positive talar tilt on fluoroscopic examination.

A positive anterior drawer sign of >5mm than the contralateral side or 10mm of absolute translation indicates that there has been compromise of the ATFL.[11] A talar tilt of <10 degrees indicates injury to the CFL. Figure 10 demonstrates a positive talar tilt on fluoroscopic examination.

It is also important to investigate and address any associated injuries such as anterolateral impingement lesions, peroneal tendon injury and peroneal retinaculum pathology.[10]

Surgery is considered when conservative management has not produced successful results, and can be categorized into anatomic and non-anatomic procedures. The most commonly performed anatomic technique is the Bröstrom or Modified-Bröstrom Procedure, and has yielded very good results.[12,13] The benefits of performing anatomic repair include the utilization of local host anatomy, a simple surgical approach, and few complications However, the anatomic ligament repairs have less success with increased length of symptoms, history of previous surgery, and ligamentous laxity as its relies on potentially poor or lax local tissues to restore normal resistance to anterior translation and inversion.[14,15]

Girard, et.al, described a Modified Bröstrom-Evans which uses the anterior one-third of the peroneus brevis tendon in the general patient population as an added static restraint.[16]

Others have promoted the use of graft materials to reinforce the repair, such as plantaris tendon, fascia lata, and toe extensors.[17] The disadvantages of using autograft tendon include morbidity associated with harvesting, muscle weakness in the area where the graft was obtained, and increased surgical time required to harvest and prepare the graft before implantation.[18] In contrast, allograft materials may help improve recovery time. In this instance, operative time is less because the graft preparation and primary surgical approach may be done simultaneously without donor site morbidity. The disadvantages of allograft may include a slower incorporation rate, increased inflammation and the possibility for disease transmission.[18]

Non-anatomic repairs utilize tenodesis procedures to restrict ankle motion without repair of the ligaments of the ankle.[17] While these procedures increase stability, they also have increased morbidity and reduce ankle and subtalar motion.[7] Our rationale for using the OrthADAPT™ implant to enhance the primary repair is to harness the benefits of an allograft augmentation, without the risks of disease transmission and increased inflammation. The OrthADAPT™ implant is derived from equine pericardium and functions as a resorbable scaffold to promote healing in damaged or diseased tissues. The cross-linking sterilization method enables it to withstand enzyme degradation, thereby providing durability, with enhanced tensile strength, suture pull-out strength, and burst strength test.[19] Our results are favorable when compared with other autograft materials that have been reported in the literature.[17]

Conclusion

The OrthADAPT™ Biologic Collagen Implant is a biologic scaffold that provides support for augmentation by fortifying and promoting tissue ingrowth to enhance the stability of the Modified Bröstrom procedure. Additionally, it may prevent the need for tendon transfer and its inherent complications.

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