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Operative Techniques in
Orthopaedics

Trapeziectomy and Suspensionplasty Using an Acellular Dermal Matrix Allograft

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Trapeziectomy and suspensionplasty with or without interposition is the most commonly performed surgery in the United States for symptomatic thumb carpometacarpal joint arthritis that has failed conservative treatment. The anterior oblique ligament is traditionally reconstructed using tendon autograft to stabilize the first ray after trapeziectomy, but concerns regarding donor site morbidity have led to the use of commercially available products. Acellular dermal matrix (ADM) allograft has been successfully and safely used in several orthopaedic procedures including anterior oblique ligament reconstruction and interposition following trapeziectomy. The use of ADM negates the need to harvest tendon autograft and therefore reduces both morbidity and operative time while also providing the ability to perform a consistent procedure in both primary and revision cases. In this article, we describe our preferred surgical technique of trapeziectomy and suspensionplasty using an ADM allograft.

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Introduction

Thumb carpometacarpal (CMC) arthritis is one of the most commonly treated conditions by the hand surgeon. Essential movements of the thumb are required for most daily activities, leading many patients to pursue surgery if conservative treatment fails to provide adequate pain relief. Although many surgical techniques have been described for this condition, trapeziectomy and subsequent reconstruction of the attenuated anterior oblique ligament with or without interposition remains the most commonly performed in the United States.[1,2] A tendon autograft such as the flexor carpi radialis (FCR), abductor pollicis longus (APL), or extensor carpi radialis longus are typically used for reconstruction. However, harvest of the tendon autograft risks significant donor site morbidity such as pain, adhesions, and loss of strength or motion.

In an effort to reduce morbidity, commercial implant options have become increasingly popular. Silicone and Gore-Tex (W.L. Gore & Associates, Newark, DE) were previously used for interposition material but have been abandoned due to particulate synovitis and osteolysis.[3-5] Use of porcine collagen xenograft for interposition has had a similar fate due to biocompatibility concerns.[6] A prospective, randomized trial using porcine collagen xenograft was discontinued when 6 of 13 patients developed clinically significant foreign body reactions. In light of these issues, an ideal commercial product for suspensionplasty must provide reliable strength and resistance to both host-immune response and particulate wear.

Use of acellular dermal matrix (ADM) allograft has become increasingly popular in hand surgery.[7] Theoretically, the removal of donor cells reduces immunogenicity whereas preservation of the extracellular matrix maintains strength. In addition, the ADM allograft also provides a scaffold for host revascularization and tissue ingrowth. A case series of 17 patients described the use of an ADM allograft, GraftJacket (Wright Medical Group, Memphis, TN), for interposition

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following partial arthroscopic trapeziectomy for Eaton stage II and III arthritis.[8] In total, 94% of patients reported some degree of satisfaction with no reactions to the allograft reported at 17 months average follow-up. GraftJacket has similarly been shown to adequately maintain the post-trapeziectomy space following open excision for Eaton stage III and IV arthritis when used for interposition.[9] There is also good evidence for its use as an augment to tendon repair, as the addition of GraftJacket demonstrated increased healing rates of arthroscopically repaired massive rotator cuff tears and improved postoperative clinical outcome measures when compared to controls in a prospective, randomized trial.[10]

The use of ADM allograft to reconstruct the anterior oblique ligament and provide interposition following trapeziectomy was first described by Kokkalis et al.[11] Due to the concern for donor site morbidity associated with tendon autograft harvest, the authors began using GraftJacket in 2004 and retrospectively reviewed their first 100 cases. The senior author (J.J.T.) also switched from using a split-FCR autograft to GraftJacket in 2007 due to similar donor site concerns. However, our technique does not include interposition as we have found it unnecessary to achieve stability and reduces the potential of foreign substance reaction.

There are several potential benefits of ADM allograft use for ligament reconstruction following trapeziectomy. The primary benefit is the lack of tendon autograft harvest, which reduces operative time and, more importantly, avoids associated morbidity such as pain and scarring. Using a commercially available product also provides the ability to perform the same ligament reconstruction technique regardless of tendon autograft availability (ie, revision cases when the preferred tendon has been previously used or iatrogenic tendon injury). Lastly, in patients with collagen abnormalities such as Ehlers-Danlos syndrome, stability of the ligament reconstruction does not depend on insufficient collagen associated with a tendon autograft.

The most serious potential disadvantage of using ADM allograft is host-immune response to the foreign substance. This has not been reported in the literature when used for thumb CMC arthritis and has not been seen over the past decade of using it in our practice, but there have been 2 reported cases of giant cell reaction to the graft when used for glenoid resurfacing.[12] Other disadvantages to this technique include increased cost when compared to techniques, which uses a tendon autograft and the added potential risk of infection with allograft use.

Indications for trapeziectomy and suspensionplasty with ADM allograft include:

(1) Primary thumb CMC arthritis (Eaton stages II-IV) that has failed conservative treatment.
(2) Revision suspensionplasty due to thumb metacarpal subsidence, instability, or impingement.
(3) Suspensionplasty in patients with genetic collagen abnormalities.

Technique

The procedure can be safely performed under regional or general anesthesia. After the correct operative site is confirmed by the patient in the preoperative area and marked as such, the patient is transported to the operating room and laid on the operating room table in a supine position. The operative extremity is placed on a hand table and a well-padded pneumatic tourniquet is placed on the upper arm. The entire upper limb is prepped and draped in the usual sterile fashion. While the patient is being positioned, the ADM allograft should be immersed in sterile normal saline solution to rehydrate until it is needed later. We prefer the GraftJacket Maxstrip (Wright Medical Group, Memphis, TN) as its 1 × 12 cm dimension allows for easy preparation.

The upper extremity is exsanguinated and the pneumatic tourniquet is inflated to 250 mmHg. An approximately 4 cm longitudinal skin incision is made overlying the first dorsal compartment from the base of the thumb metacarpal to the scaphotrapezial joint (Fig. 1). Blunt dissection identifies any branches of the dorsal radial sensory nerve (DRSN), which are bluntly retracted throughout the remainder of the procedure. The APL and extensor pollicis brevis (EPB) tendons are identified and a #64 scalpel is used to incise the interval between the tendons to expose the thumb CMC joint capsule (Fig. 2). The EPB tendon is bluntly retracted dorsally to protect the radial artery and any dorsal branches of the DRSN. The APL is retracted volarly along with any volar branches of the DRSN. A longitudinal incision is made through the capsule of the thumb CMC joint, periosteum of the trapezoid, and capsule of the scaphotrapezial joint. These are then peeled as a sleeve in both the radial and ulnar directions to expose the trapezium for excision, taking care not to release the APL insertion at the base of the thumb metacarpal (Fig. 3). Gentle traction is pulled on the thumb to facilitate exposure of the trapezium and any visualized capsular and ligamentous attachments are incised sharply. A 1/2″ osteotome is used to divide the trapezium into quadrants which are subsequently excised with a rongeur and #64 scalpel (Fig. 4). Care is specifically taken not to injure the FCR tendon directly beneath the trapezium in the floor of the wound (Fig. 5). Direct

Figure 1 Planned 4 cm longitudinal skin incision between the APL and EPB tendons, centered over the trapezium. (Color version of the figure available online.)