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Ligament Reconstruction with or without Tendon Interposition to Treat Primary Thumb Carpometacarpal Osteoarthritis

Surgical Technique

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INTRODUCTION

Osteoarthritis of the basal joint of the thumb can be painful and disabling. Ligamentous attrition along with incongruity and instability of the trapeziometacarpal joint may generate areas of high contact stress between the articular surfaces, thus shearing the articular cartilage and causing subsequent cartilage erosion that may progress to degenerative joint disease\(^1,2\).

In 1973, Eaton and Littler described a procedure for ligament reconstruction in which a strip of the tendon of the flexor carpi radialis was used to reinforce the incompetent palmar oblique ligament and to stabilize the symptomatic hypermobile pre-arthritic or mildly arthritic basal joint of the thumb\(^3\). This procedure was associated with favorable results, and, in 1983, Epping and Noack described an extended technique of ligament reconstruction to treat patients with more advanced stages of osteoarthritis as well\(^4\). Their method involved excision of the entire trapezium through a limited surgical incision over the basal joint of the thumb to remove the diseased joint surfaces followed by creation of a strong suspensory ligament with the radial half of the flexor carpi radialis tendon to reinforce the first intermetacarpal ligament.

Our clinical experience with and long-term results of the slightly modified Epping-Noack procedure has demonstrated improvement in symptoms, a high degree of patient satisfaction, and a favorable functional result in terms of the performance of daily activities and recreational tasks. We describe the procedure in detail.
After the administration of either a general or a regional anesthetic, the patient is placed in the supine position and a tourniquet, preset to 250 mm Hg, is placed around the arm. A single hockey-stick-shaped incision, approximately 3.5 to 4.5 cm in length, is made in a dorsoradial direction over the metacarpal and trapezial bones. The incision is oriented from distal to proximal, and it should curve for a short distance palmarly just proximal to the scaphotrapezial joint (Fig. 1).

RESULTS:
Postoperatively, the mean total Buck-Gramcko score was rated as excellent in group I and as good in group II (p = 0.036). Group I had significantly better mean scores for palmar and radial abduction, cosmetic appearance, and willingness to undergo the surgery again under similar circumstances (p < 0.05). The mean scores for tip-pincher strength and the mean subjective scores for pain, strength, daily function, dexterity, and overall satisfaction did not differ significantly between the groups. Both groups had satisfactory results with regard to their performance of activities of daily living and their ability to return to work. With the numbers available, the amount of proximal metacarpal migration, at rest and under stress, did not differ significantly between the groups.

FIG. 1
Skin incision. APL = abductor pollicis longus tendon, EPB = extensor pollicis brevis tendon, EPL = extensor pollicis longus tendon.

FIG. 2
Surgical approach to the trapeziometacarpal joint. APL = abductor pollicis longus tendon, EPB = extensor pollicis brevis tendon, EPL = extensor pollicis longus tendon, RA = radial artery.
Careful separation of the subcutaneous tissues is mandatory to ensure that the underlying superficial branches of the radial sensory nerve and the radial artery are not harmed. The radial artery, which courses within the anatomical snuff box, is retracted within the space between the thumb extensor and abductor tendons to minimize the risk of damage.

The trapeziometacarpal joint is exposed through a longitudinal incision between the extensor pollicis brevis and the abductor pollicis longus tendons. The incision is continued slightly proximal to the scaphotrapezial joint (Fig. 2). The capsule is sharply dissected from the trapezium as far as possible. Then, a properly sized Kirschner wire equipped with a short thread at its point is carefully introduced into the trapezium for use as a joystick to mobilize that bone. It is important that the trapezium is firmly attached to, but not completely penetrated by, the partially threaded Kirschner wire so that, when manipulated, it will not harm the adjacent bones (Fig. 3). The combination of gentle manipulation of the trapezium with the wire by the surgeon and careful traction on the thumb by the surgical assistant will facilitate removal of the trapezium in one piece. After the capsule and the ligaments are further sharply dissected at their insertions on the adjacent carpal bones, the trapezium is removed in one piece if possible. Alternatively, when resection in one piece is not possible, the trape-
The trapezium can be cut with an osteotome or a small saw and the trapezial fragments can be removed with a rongeur. During the entire process, it is imperative to keep in mind that the tendon of the flexor carpi radialis courses close to the palmar crest of the trapezium. Care has to be taken to ensure that damage to this structure is prevented, regardless of whether the trapezium is removed in pieces or as a whole.

It is important to inspect the edges of the base of the first metacarpal and to use a small rongeur to smooth them if they appear to be extended and sharp. If the synovium is inflamed, a synovectomy is performed. Furthermore, all loose bodies, particularly those occurring in the intermetacarpal space, should be removed.

The next step is to identify and prepare the flexor carpi radialis tendon in the depths of the trapezial void. That tendon is then grasped with a tendon-grasping tool.

**CRITICAL CONCEPTS**

**INDICATIONS:**
- Recurrent, therapy-resistant pain with or without substantial disability during activities of daily living, repetitive activities, sports, or work (especially during activities requiring tip-pinches) in a patient with osteoarthritis of the carpometacarpal joint of the thumb
- A patient with lower demands for thumb strength
- A compliant patient, especially one who will be compliant with the relatively long interval of postoperative care, which may last for as long as three to six months

**CONTRAINDICATIONS:**
- Active infection at or near the operative site
- Instability at the basal joint of the thumb without degenerative changes
- A patient with high demands for thumb strength
- A noncompliant, unreliable patient

continued
ring forceps. With the wrist flexed, as much tendon mass as possible is carefully drawn into the wound to mobilize a few millimeters of its length. It is very important to harvest an adequate length of the tendon to ensure that a complete passage of the split tendon through the drill canal can be performed. A 2.0 Vicryl suture is threaded as proximally as possible through the radial substance of the tendon mass (Fig. 4). The radial half of the tendon is then incised proximal to the suture and along the

**CRITICAL CONCEPTS | continued**

**PITFALLS:**

- Injury to the branches of the superficial radial nerve. As the skin incision is carefully made and the joint is approached, protection of these branches is essential and requires a thorough knowledge of the anatomy of the hand. Injuries may cause numbness, dysesthesias, and painful neuromas.

- Injury to the radial artery. During the dissection, this structure should be carefully retracted and protected to prevent the risk of creating a false aneurysm.

- Perforation of the trapezium and potential damage to the underlying carpal bones. The partially threaded Kirschner wire must be inserted carefully into the trapezium. Excessive force should never be used during insertion.

- Inadequate length of the split tendon. It is essential to create a tendon strip that is long enough to be drawn in its entirety through the drill canal in the metacarpal base.

- Injury to the tendon of the flexor carpi radialis. The tendon runs in a groove that opens to the ulnar side of the trapezium and is overlapped by its palmar tubercle. Therefore, the flexor carpi radialis tendon may be easily injured when the trapezium is approached and then resected in its entirety or piecemeal. This tendon should be carefully isolated and protected because partial or complete transection will necessitate a change in the operative procedure.
length of its midportion for a short distance. The forceps are removed. By pulling gently on the suture, the split in the tendon is extended distally, with the tendinous insertion being left intact on the base of the index metacarpal (Figs. 5-A and 5-B). At the end of the split, a 4.0 Vicryl suture is placed to secure the tendon strip in the depths of the arthroplasty space (Fig. 6).

Approximately 1 cm proximal to the base of the first metacarpal, a canal is created with a wire snare to grasp the free end of the Vicryl suture, thereby routing it slowly back through the canal (left, dorsal view; right, volar view). I = first metacarpal, II = second metacarpal, FCR = flexor carpi radialis tendon.

Critical Concepts

- Continued postoperative pain at the basal joint of the thumb. Potential reasons for postoperative pain may be the presence of an infection, synovitis, fragments that become detached from the base of the first metacarpal, bone chips from the drill canal, loose bodies in the intermetacarpal space, and osseous contact between the metacarpal base and the adjacent bones. Attention must be paid to all of these factors to eliminate potential postoperative symptoms.

- Inadequate tension of the tendon. The key to successfully achieving an adequate suspensory ligament reconstruction is the proper tensioning of the flexor carpi radialis tendon strip. Excessive tightening will result in impingement of the base of the first metacarpal against the neighboring bones, causing osteolytic changes and/or postoperative pain. Conversely, a very loose tendon strip may slip out of the drill canal and become squeezed between the base of the first metacarpal and the adjacent bones, possibly causing pain and jeopardizing the objective of the suspension arthroplasty.

- Insufficient rehabilitation. Postoperatively, the patient must be well instructed with regard to the hand-therapy program—and must also comply with it—to ensure a successful result.
3.2-mm burr, running from a dorsoradial to a palmar-ulnar direction through the metacarpal base (Fig. 7). A small rongeur is useful for squaring off any sharp edges that may be present at the exit and/or entry point of the canal. Next, a very thin wire snare is introduced into the canal to pass, with a slow and gentle movement, the 2.0 Vicryl suture back through the canal (Fig. 8). Tension is then applied to the suture to pull the entire tendon strip out of the drill-hole in the first metacarpal.

With gentle traction applied to the first metacarpal, the strip of the flexor carpi radialis tendon is adequately tensioned and wedged in place through the packing of smooth cortico-cancellous and cancellous bone chips into the canal. These fragments originate from the trapezium, which has been resected, morselized, and saved for intraosseous fixation of the tendon strip (Fig. 9). It is of utmost importance to take care that proper tension is applied to the tendon strip to avoid osseous impingement against the index metacarpal or the trapezoid (Fig. 10). Proper spacing should be confirmed radiographically during the procedure if the surgeon is not quite sure whether there is optimal distance between the metacarpal base and the neighboring bones. By moving the thumb in all directions, gently applying slight traction on the thumb, and pulling on the segment of the tendon strip that is protruding from the dorsoradial drill hole, the surgeon should evaluate whether the fixation of the tendon strip is firm enough to provide reliable stability. When secure fixation of the tendon strip is confirmed, the end of the tendon strip is tacked to the periosteum of the base of the first metacarpal with 4.0 Vicryl sutures (Fig. 11).
The wound is irrigated with saline solution, and the tourniquet is deflated. After hemostasis has been achieved, a suction drain is placed into the arthroplasty space. The capsule is closed with 4.0 Vicryl sutures, and the skin is closed with 5.0 Ethilon sutures.

Postoperatively, the thumb is immobilized in a split forearm-based thumb-spica cast. The suction drain is removed on the first or second day after surgery. The sutures are removed on the tenth postoperative day. A new closed spica cast is then fashioned. This cast must be left on until the end of the twenty-first postoperative day, at which time it is then replaced with a short thumb-spica splint, which is individually fashioned by a hand therapist and is intended to be worn at all times for an additional three weeks. At six weeks, active and active-assisted range-of-motion and thenar muscle-strengthening exercises are started under the supervision of an experienced hand therapist.

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REFERENCES


AUTHOR UPDATE:
Since the time that our prospective randomized study was published in February 2004, no changes have been made to the surgical technique.