The arthroplasty described by Weilby is a reliable procedure for the treatment of stage 2 and 3 basal thumb osteoarthritis. Although the technique provides good pain relief, optimal thumb mobility, and acceptable levels of grip and pinch strength in most cases, it is common to see the thumb collapsing because the interposed knot has disassembled. We have found a more effective way to prepare and stabilize that interposition material. With this modification, we have had less thumb subsidence than with the original technique. (J Hand Surg Am. 2014;39(2):362–367. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

**Key words** Osteoarthritis, suspension-plasty, thumb, trapeziometacarpal joint, arthroplasty.

According to a recent survey by Wolf and Delaronde,¹ the most frequently performed operation for painful trapeziometacarpal (TMC) osteoarthritis in the United States is so-called ligament resection, tendon interposition (LRTI) arthroplasty.² After removing the entire trapezium, a distally based strip of flexor carpi radialis (FCR) tendon is threaded through a tunnel across the base of the first metacarpal, and coiled over itself to form a ball (anchovy) that will be interposed between the first metacarpal and the scaphoid. In the early postoperative period, the LRTI copes effectively with the tendency of the unsupported thumb to subside. Unfortunately, the restored intermetacarpal link becomes weak with time and yields under the traction and torque involved in thumb function. Actually, the functional end result of most LRTI arthroplasties is similar to that of a trapeziectomy alone.³

Another alternative to stabilize the base of the first metacarpal is the technique described by Weilby.⁴ ⁵ A distally based strip of FCR is looped several times around the abductor pollicis longus (APL) and the intact portion of the FCR tendon, forming a thick fibrous cylinder, aimed at preventing thumb subsidence. The cylinder is held in place by its APL and FCR distal insertions to the first and second metacarpals. With this technique, the first metacarpal does not hang from the second metacarpal by a short tendinous connection, as is the case with the LRTI, but rests on that thick fibrous cylinder, as if it were a hammock suspended between the first and second metacarpals. Because there is more tissue sharing the load, stresses tend to be better tolerated than with the LRTI operation. The main problem with the technique described by Weilby is that the interposed cylinder tends to yield under load and the thumb progressively migrates proximally.⁴ ⁶ To minimize this problem, we have modified the manner of preparing the nucleus of tendon that will be interposed between the base of the thumb and the scaphoid. This article describes a modification and the results obtained with this modification.

**INDICATIONS**

Trapeziometacarpal osteoarthritis requires surgery only when a nonsurgical approach has repeatedly failed to mitigate the patient’s symptoms.² The modified technique is recommended for the treatment of TMC osteoarthritis stages 2 and 3, particularly in
patients whose vocational or avocational activities do not require a strong pinch, but a highly mobile, stable thumb.\textsuperscript{4,5}

**CONTRAINDICATIONS**

The modified technique should not be used in heavy manual workers, in advanced stage 4 (pantrapezial) osteoarthritis, or when the patient’s health does not permit complex surgery. For the first, a TMC fusion may be a better option; for the other 2, either an arthroscopy-guided TMC hemiarthroplasty or a thumb denervation may be recommended.

**SURGICAL TECHNIQUE**

We perform this operation under regional anesthesia and pneumatic tourniquet. Although the procedure can be done through a dorsolateral approach, we prefer entering the joint through the Wagner anterior approach. A curved skin incision is traced following the proximal contour of the abductor pollicis brevis (APB) muscle. The incision extends proximally, in a zigzag fashion, across the volar crease of the wrist. Under the subcutaneous tissue, the superficial fascia is incised, the recurrent branch of the radial artery is ligated, and the main radial artery trunk is displaced laterally to allow better exposure of the trapezium. The anterolateral insertion of the APB muscle is detached and retracted distally to uncover the volar capsule of the TMC joint. A transverse capsulotomy allows one to check the status of the cartilage.

To remove the trapezium, some authors recommend fragmenting the bone with an osteotome and

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**FIGURE 1:** Schematic axial representation of the technique described by Weilby: (1) Detachment of all soft tissues inserted onto the anterolateral aspect of the trapezium (yellow arrows), taking care not to injure the adjacent radial artery. (2) Release of the FCR tendon sheath, and section of the volar trapezium-trapezoidal ligaments (yellow arrows). (3) If the patient has symptoms of median nerve (MN) compression, a carpal tunnel release may be obtained by sectioning the septum that separates the FCR from the flexor pollicis longus (FPL) tendon. (4) Once the trapezium has been excised, a strip of FCR is obtained and looped around the APL in a triple figure-of-eight configuration. This creates a closely packed bulky knot of tendon, aimed at preventing first metacarpal (I) subsidence. Trzd, trapezoid bone; II, second metacarpal.
excising all fragments with a rongeur. We prefer enucleating it in 1 piece (Fig. 1). We start by releasing 2 cm of the FCR tendon sheath, proximal to the palmar crease. Radial to the tendon, and distal to the scaphoid tuberosity, the scaphotrapezial joint is identified and released completely, ligaments included. We recommend leaving some capsular tissue attached to the distal scaphoid for later APB muscle reattachment. The TMC joint is also released and its ligaments are incised. We use a beaver blade to detach the periosteal tissue that covers the lateral aspect of the bone. Care must be taken not to injure the radial artery that is located adjacent to the tissue that is being elevated. We then release the FCR tendon sheath and pull the tendon out of its groove. With this, the floor of the FCR tunnel is exposed, revealing a section of the thick capsulo-ligamentous tissue that spans the scaphotrapezial and trapeziotrapezoid joints. Once freed from anterolateral and medial capsular connections, the trapezium is grasped with a bone forceps and forcefully rotated to break its posteromedial hidden attachments. With this, the bone can be completely enucleated.

The original technique described by Weilby consists of circumferentially wrapping the FCR and APL with 3 loops of tendon strip. We have found that an
interlocking figure-of-eight configuration is better than 3 simple loops. The technique is described step by step in Figure 2. By tightly tying the interwoven strip of tendon, a bulky, closely packed nucleus of fibrous material is obtained (Fig. 3). For this fibrous interposition material to be really solid, it is important that each time the strip goes around the FCR or the APL tendon, the return is done over the top of the previous loop. As if it were a tie knot, the end result is a closely packed fibrous ball difficult to disassemble.

After verifying the stability and mobility of the metacarpal, layered closure of the surgical wound is performed. It begins by suturing the flexor retinaculum to the capsular tissue that we have left inserted into the scaphoid tubercle. It is important to leave the FCR tendon behind that repair to ensure that the

FIGURE 4: Case example. A, B Preoperative posteroanterior and semipronated radiographs of the osteoarthritic joint of the patient described in this article. C, D: X-rays obtained 46 months after surgery. At follow-up, soon after surgery the scaphometacarpal space was 5% narrower.
tendon does not subluxate over the scaphoid tuberosity. The APB muscle is reinserted on to the repaired flexor retinaculum, and the skin is closed, leaving a subcutaneous drain.

POSTOPERATIVE CARE AND REHABILITATION
The thumb is immobilized in a well-padded short-arm thumb spica cast in neutral position. At 7 days, sutures are removed, but the thumb is kept in a removable splint for 3 more weeks. During this period, the splint is removed 3 times a day to perform circumduction exercises of the TMC joint. At 4 weeks, the patient starts progressive muscle strengthening exercises, emphasizing the first dorsal interosseous muscle, the only one whose contraction minimizes thumb subsidence. With the only limit being pain tolerance, at 6 weeks, patients are allowed to resume their usual activities.

CLINICAL CASE
In October 2005, 3 months after a minor sprain to the right dominant wrist, a 52-year-old woman presented with pain and swelling around the base of the thumb. Grip and pinch strength were substantially reduced. There was no systemic disease explaining the symptoms. Radiographs demonstrated stage 3 TMC osteoarthritis. Unresponsive to nonsurgical treatments, the patient underwent the technique described by Weilby in January 2006. In May 2006, she was able to cope effectively with usual activities, with only minor discomfort when performing strenuous work. In February 2010, 49 months after surgery, the patient was fully satisfied. Physical examination disclosed 15% reduction of the overall TMC motion, 22 kg grip strength, 4.8 kg tip pinch, 5.6 kg key pinch, and 17 points on the Disabilities of the Arm, Shoulder, and Hand questionnaire. The shortest distance between scaphoid and the first metacarpal gap was 7 mm after the operation, and 6 mm at follow-up. No osteoarthritic changes in the adjacent joints were observed (Fig. 4).

COMPLICATIONS
Pantrapezial osteoarthritis usually involves degeneration of both the scaphotrapezial and scaphotrapezoid joints; the latter tends to predominate. Removal of the trapezium alone does not solve the scaphotrapezoid problem. (Fig. 5) Some patients may remain symptomatic despite the carefully executed technique described by Weilby. In those cases, a distal scaphoid excision plus capsular interposition may help solve the problem.

DISCUSSION
Thumb subsidence is inevitable after removing the trapezium. To minimize the extent of this problem, several surgical options have been described. The
average loss of trapezial space after most ligament reconstruction arthroplasties is between 45% and 80%. We have used the above modification in 27 patients (4 men and 22 women; mean age, 57 y; 10 left, 16 right, and 1 bilateral; 6 stage 2, 19 stage 3, and 2 stage 4 TMC osteoarthritis). After surgery, the so-called trapezial space ratio was on average 22% less than before surgery (range, 13% to 37%). At an average follow-up of 43 months (range, 24–68 mo), that ratio had increased up to 27% (range, 12% to 36%). Certainly, a 5% subsidence in more than 3 years is a positive result. Indeed, when it comes to thumb subsidence, our modified technique performs better than the original technique.

According to some recent publications, the expected pinch strength after a trapeziectomy alone is not different from the strength obtained after a tendon reconstruction of the I–II intermetacarpal linkage. Our findings prove that this is not entirely correct. At follow-up, our patients had a stronger thumb than the reported strength after a trapeziectomy alone. Indeed, whereas our patients showed an average of 4.2 kg tip pinch (range, 2.8–11 kg) and 5.1 kg key pinch (range, 1.6–11 kg), the average reported tip and key pinch of 62 patients who underwent a trapeziectomy alone was only 2.8 and 3.2 kg, respectively. Certainly, the modification suggested in this article has had a positive influence on the quality of results obtained by our patients with basal thumb osteoarthritis.

REFERENCES