A Review Paper

Trapezium-Sparing Options for Thumb Carpometacarpal Joint Arthritis

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Abstract

Thumb carpometacarpal joint arthritis is a common condition, particularly in middle-aged women. There are many treatment options, ranging from joint arthroplasty to arthrodesis to arthroscopic débridement. Trapezium preservation has been increasingly recognized as desirable for maintaining length of the digit and strength in pinch and grasp. In this article, we review trapezium-sparing options for treatment of thumb carpometacarpal joint arthritis. These techniques allow surgeons to recontour or resurface the arthritic joint. Joint stability is critical to long-term success.

Thumb carpometacarpal (CMC) joint arthritis is a common complaint, particularly among women. Initial treatment can involve nonoperative measures, such as activity modification, corticosteroid injections, and splinting. Operative management may be offered when pain or functional deficits persist and are recalcitrant to nonoperative means.[1-8]

Success rates have been high when partial or complete trapeziectomy has been used to treat first CMC joint arthritis.[1,2,6,9-11] In the absence of a trapezium, however, migration of the thumb metacarpal and impingement on the scaphoid or trapezoid may be a source of pain. In addition, prolonged recovery is sometimes a problem with this procedure.[9,12] Therefore, it may be desirable, particularly in the early stages of CMC joint arthritis, to preserve all or part of the trapezium. Options for the hypermobile joint (stage 1 disease) include ligament reconstruction and metacarpal extension osteotomy, which are not discussed in this article.

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Arthroscopic Options

Arthroscopy is a minimally invasive technique that can be used to diagnose and treat pathology of the thumb CMC joint.[13-16] Arthroscopy has also been used as a diagnostic staging tool before treatment selection.[13,14,17] Patients with Eaton stage I, II, or III CMC arthritis may be candidates for arthroscopy to determine the true extent of joint changes. In early stages in which the articular cartilage is intact but synovitic changes or ligamentous laxity is present, pathology can be addressed by simple débridement and capsular shrinkage of the ligaments. Patients with frank changes, such as attenuation of the anterior oblique ligament and partial volar cartilage loss, may be candidates for extension osteotomy or arthroscopic débridement and interposition arthroplasty, while those with widespread cartilage loss may do best with arthroscopic débridement and interposition arthroplasty.[14,17]

"Because trapezium preservation may be a valid goal for middle-aged patients with CMC disease, it is important to know about these options."

Other authors have described the technique for arthroscopy of the CMC joint.[16,18] The thumb is suspended in traction, and surface landmarks are marked. The joint is penetrated with a needle; fluoroscopy is helpful to confirm correct entry to the trapeziometacarpal joint rather than the scaphotrapezial-trapezoidal joint.

The 2 general portals used are the 1-R (radial) and the 1-U (ulnar) portals (Figure 1). The 1-R portal is made between the abductor pollicis longus (APL) and flexor carpi radialis (FCR) tendons at the CMC joint level. It is best to make this portal closest to the FCR to allow for ideal triangulation and viewing. The 1-R portal is useful in examining the dorsal radial ligament, palmar oblique ligament, and ulnar collateral ligament and provides a view of the radial aspect of the joint. It also allows for visualization of the intermetacarpal ligament and the distal insertions of the anterior oblique ligament into the first metacarpal.

The 1-U portal is placed just ulnar to the extensor pollicis brevis tendon. Compared with the 1-R portal area, the 1-U portal area can have a higher incidence of superficial

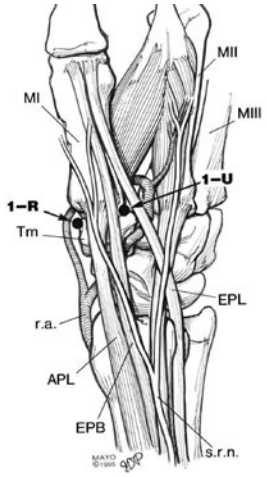

Figure 1. Drawing of 1-R (radial) and 1-U (ulnar) portals. Abbreviations: Tm, trapezium; r.a., radial artery; EPL, extensor pollicis longus; EPB, extensor pollicis brevis; APL, abductor pollicis longus; s.r.n., superficial radial nerve; MI, first metacarpal; MII, second metacarpal; MIII, third metacarpal. Reproduced from Berger RA. A technique for arthroscopic evaluation of the first carpometacarpal joint. *J Hand Surg Am.* 1997;22(6):1077-1080, by permission of Mayo Foundation for Medical Education and Research. All rights reserved.

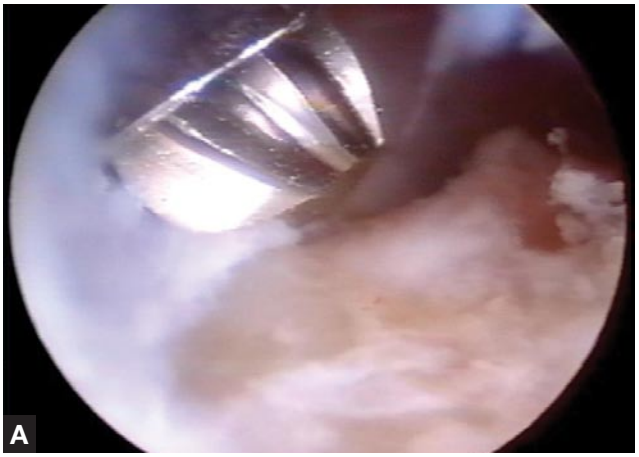

Figure 2. A small joint burr is useful in removing the arthritic distal trapezium (A), which may be done under fluoroscopic visualization (B).

radial nerve branches crossing the portal site. In addition, the radial artery is only a few millimeters from the ulnar side of the portal. Similar to the procedure used for establishing the 1-R portal, the skin is carefully incised, and a small hemostat is used to gently dissect and spread down to the capsular tissue, which helps avoid causing traumatic injury to either branches of the superficial radial nerve or the radial artery. The 1-U portal tends to enter the joint

Figure 3. Preoperative (A) and postoperative (B) images after arthroscopic débridement and interposition arthroplasty demonstrate maintenance of space between the remaining trapezium and the first metacarpal (B) after resection of the arthritic distal trapezium (A). Reproduced with permission from Adams JE, Merten SM, Steinmann SP. Arthroscopic interposition arthroplasty of the first carpometacarpal joint. *J Hand Surg Br.* 2007;32(3):268-274.

either through the dorsal radial ligament or between the dorsal radial ligament and the palmar oblique ligament. This portal allows for visualization of the anterior oblique ligament and the ulnar collateral ligament. It may also be used as the main working portal for interventions after diagnostic arthroscopy.[18]

A standard 1.9-mm arthroscope is used to visualize the CMC joint. The camera and working portal can be switched back and forth between the 1-R and the 1-U portals as the arthroscopy progresses. After diagnostic arthroscopy, the cautery or radiofrequency ablation probe can be helpful in débriding the joint of soft tissue. The radiofrequency ablation probe is useful also for capsular shrinkage when laxity is present. A small joint shaver (3.5 mm) can be used

Figure 4. The Artelon® implant (Small Bones Innovations, Morrisville, PA) may be placed using an open (A) procedure or arthroscopic procedure. Preoperative (B) and postoperative (C) images demonstrate a maintained posthemitrapeziectomy space.

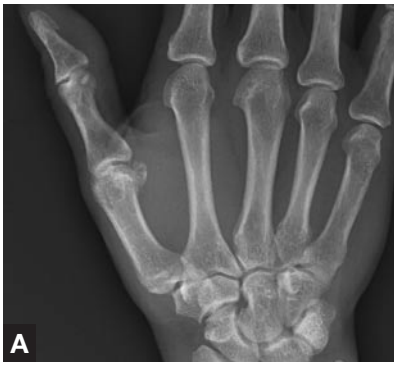

Figure 5. Preoperative (A) and postoperative (B) images of pyrocarbon carpometacarpal prosthesis.

to débride the joint further. Visualization is improved with use of a standard arthroscopic mechanical pump to continuously irrigate the joint with saline. A dedicated outflow cannula is not needed if both working portals are large enough to allow egress of fluid.

If bony work after synovectomy or soft-tissue débridement is indicated, a 2.7- or 3.5-mm burr may be used to remove the distal trapezium (Figure 2A). Care is taken also to remove bony osteophytes from the volar ulnar edge of the joint near the second metacarpal. After initial bony work is done, the arthroscope may be removed and the burring done under fluoroscopy to ensure adequate removal of bone (Figure 2B).

After bony recontouring, the joint is then ready for placement of the interposition tissue. Arthroscopic use of autograft tissue, such as half of the FCR or the palmaris longus tendon, has been described.[16,19] Alternatively, a variety of biologic materials can be processed as interposition materials. Graftjacket® (Wright Medical Technology, Arlington, TN) is a human dermal matrix that is processed to render it acellular. Clinical and animal studies suggest it serves as a scaffold for ingrowth of native cells, and in our series of patients, outcomes were satisfactory at a mean follow-up of 17 months.[15,20] Other choices include a polycaprolactone-based polyurethaneurea implant (Artelon®; Small Bone Innovations, Morrisville, PA), a novel biomaterial that one of the authors (RWC) has used successfully in a series of patients as a simple interposition material after arthroscopic débridement. The interposition material can be placed into the joint with a small curved hemostat through a portal. The portals are then closed, and a thumb spica splint is applied. Immobilization is continued for a total of 6 weeks. Postoperative radiographs are obtained to document maintenance of the postoperative space (Figure 3).

Resurfacing Options

Artelon Resurfacing (Open Procedure)

Nilsson and colleagues[21] described using Artelon for interposition arthroplasty of the first CMC joint. As reported, this implant undergoes slow degradation, which allows it to serve as a scaffold for ingrowth of cartilage-like tissues. Use has been investigated in Eaton stage 3 CMC arthritis. The implant was placed using an open procedure with minimal (2-mm) trapezium resection (Figures 4A–4C). Patients who received the implant developed improved pinch strength relative to preoperative values and relative to a cohort of patients who underwent trapeziectomy and APL suspensionplasty. Pain relief was equivalent to that of the APL group at 3-year follow-up.[21] Although the first studies of this implant were of its use in stage 3 CMC arthritis—securing a T-shaped device designed to reinforce ligamentous constraints and to resurface the CMC—there may be cases in which stability may need to be enhanced with a tendon transfer. One option is to use a distally based slip of APL, transferred dorsally, deep to the radial artery, around or through the extensor carpi radialis longus, and then back to itself. In addition, it has become clearer with anecdotal reports that the implant is best secured with suture or suture anchors rather than with screws, which may pull through the device.

Pyrocarbon Hemiarthroplasty

Although hemiarthroplasty designs have been commercialized by Ascension Orthopaedics (Austin, TX) and Nexa/Tornier (San Diego, CA), published reports and valid outcome studies are lacking. However, anecdotal clinical reports and the material benefits of pyrocarbon—its favorable wear characteristics and the tolerance of articular cartilage to the material—support further investigation of

the merits of these 2 designs. These designs retain stability differently: with a saddle-like lip in the case of the Ascension implant (Figure 5) or with central recession of the trapezium in the case of the Nexa device. We have no personal experience with these implants.

In that trapezium preservation may be a valid goal for middle-aged patients with CMC disease, it is important to know about these options. What remains to be seen with resurfacing using these options, or with using Artelon, is long-term success.

Salvage and Revision

Because of the novelty of these recontouring and resurfacing procedures, there are few data on salvage in the event of failure. However, as these procedures are designed to be less invasive and to preserve the trapezium, revision to more traditional procedures is possible. Resurfacing arthroplasties can be readily revised to ligament reconstruction and tendon interposition, simple trapeziectomy, or fusion.

Conclusions

There are multiple options for treating first CMC joint arthritis. Procedures that preserve the trapezium may be associated with improved grip strength and metacarpal length. Arthroscopy is useful in staging the extent of disease and guiding selection of treatment options. Satisfactory outcomes occur when these procedures are performed in the appropriate patient. However, enthusiasm for these procedures is tempered by the limited follow-up and outcomes studies available to date.

Authors' Disclosure Statement

Dr. Adams reports no actual or potential conflict of interest in relation to this article.

Dr. Steinmann reports a consulting arrangement with Wright Medical Technology (Arlington, TN).

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