The carpometacarpal joint of the thumb is a common site of degenerative arthritis. Several surgical treatments exist, but arthroscopic management offers the potential benefit of earlier recovery. The current study evaluated the early clinical outcomes of a procedure involving arthroscopic hemitrapeziectomy with Artelon spacer (Artimplant, Västra Frölunda, Sweden) interposition arthroplasty into the newly created carpometacarpal space.

A chart review of 9 patients treated with thumb carpometacarpal arthroscopic hemitrapeziectomy and Artelon spacer interposition arthroplasty between September 2005 and January 2009 was performed for postoperative complications, range of motion, and pinch strength (percentage of the contralateral limb). Subjective outcomes were analyzed by the Quick Disabilities of the Arm, Shoulder, and Hand questionnaire and the Patient-rated Wrist Evaluation. Mean follow-up was 23.4 months (range, 13-33 months). All patients maintained full range of motion. By the 1-year follow-up, mean pinch strength returned to 59%±19.1% of the contralateral limb strength. The Quick Disabilities of the Arm, Shoulder, and Hand and the Patient-rated Wrist Evaluation scores were 12.3±7.6 and 26.8±23.5, respectively. No significant complications occurred, and 1 patient with symptoms of synovitis was successfully treated with a corticosteroid injection. This study revealed excellent short-term results at the minimum 1-year follow-up for a less invasive treatment option that is appropriate for select patients with moderate thumb carpometacarpal arthritis (Eaton stages 2 and 3). The authors demonstrated a comparably good outcome of arthroscopic hemitrapeziectomy with Artelon spacer interposition arthroplasty with no evidence of foreign-body reaction. The authors also demonstrated the potential role of corticosteroid injections in the setting of a postoperative inflammatory reaction.
The carpometacarpal joint of the thumb is a common site of degenerative arthritis in the hand. Attenuation of the palmar beak ligament contributes to dorsal subluxation of the first metacarpal base on the trapezium, leading to increased shear forces and degeneration of the cartilage at the base of the thumb. When nonoperative management fails, several open treatments can be performed, including trapeziectomy, metacarpal extension osteotomy, ligament reconstruction, ligament reconstruction with tendon interposition, suspensionplasty, hematoma distraction arthroplasty, and fusion. Clinical studies have evaluated the outcomes of these procedures with variable results with respect to pain relief and pinch strength.

Artelon (Artimplant, Västra Frölunda, Sweden) is a polyurethane urea polymer that gained popularity as interposition material in thumb carpometacarpal arthroplasty based on good short-term results from arthroscopic and open procedures. This polyurethane urea bioimplant prevents articular impingement and provides a scaffold for tissue ingrowth. In a retrospective analysis of an open technique using Artelon spacer interposition arthroplasty in 13 patients, short-term results were comparable with abductor pollicis longus tendon suspensionplasty in terms of pain relief, and the results slightly favored Artelon spacer interposition arthroplasty in terms of pinch strength. Badia et al reported 12 patients who underwent arthroscopic hemi-trapeziectomy with Artelon spacer interposition arthroplasty who had marked pain relief and improved pinch strength compared with preoperative levels.

This retrospective case series evaluated the subjective and objective outcomes of arthroscopic hemi-trapeziectomy using Artelon spacer interposition arthroplasty in terms of pain relief and improved pinch strength compared with preoperative levels. The hypothesis was that patients undergoing arthroscopic hemi-trapeziectomy with Artelon spacer interposition arthroplasty would demonstrate comparable or better subjective and objective outcome measures compared with historic cohorts.

**MATERIALS AND METHODS**

Institutional review board approval was obtained. A retrospective chart review was completed of patients treated by one hand surgeon (J.Y.) at an academic center between September 2005 and January 2009. Mean follow-up was 23.4 months (range, 13-33 months). A total of 12 patients underwent arthroscopic hemi-trapeziectomy using Artelon spacer interposition arthroplasty for moderate to early advanced thumb carpometacarpal arthritis (Eaton stages II and III). Of the 12 patients, 3 did not participate in the study because they were no longer in the vicinity of the institution. Indications for surgical management included persistent symptoms despite a minimum of 6 months of nonsurgical treatment, including nonsteroidal anti-inflammatory drugs, intra-articular steroid injections, and splinting. Charts were reviewed for postoperative complications, range of motion (ROM) measured as opposition to the small finger metacarpophalangeal joint, and key pinch strength (as a percentage of the contralateral limb). The subjective patient evaluation included a Quick Disabilities of the Arm, Shoulder, and Hand (DASH) (scale, 0-100) score and a Patient-rated Wrist Evaluation (PRWE) (scale, 0-150) score.

**SURGICAL TECHNIQUE**

The patient’s thumb is placed into a standard wrist arthroscopy tower with...
12 lb of longitudinal traction placed on the operative thumb. A pneumatic tourniquet is then inflated. The dorsal ulnar arthroscopic portal is made using a #11 blade just through the skin. The subcutaneous tissues are bluntly dissected to the level of the capsule, which is then bluntly entered with a small clamp. A 2.5-mm arthroscope (Linvatec, Largo, Florida) is inserted into the thumb carpometacarpal space via this portal, and a diagnostic arthroscopy is performed. Often, significant synovitis and loose bodies are visualized in the joint (Figure 1A). The thenar portal is then made under direct visualization using the same portal technique mentioned above. A 2.5-mm full radius motorized shaver (Linvatec) is inserted to perform a synovectomy (Figure 1B). All cartilaginous debris and loose bodies are removed using the shaver and arthroscopic graspers (Linvatec).

To perform the hemitrapeziectomy, a 3.5-mm Vortex burr (Linvatec, Largo, Florida) is inserted, and approximately 5 mm of the distal trapezium is resected (Figure 2). Alternating the working portals between the thenar and dorsal ulnar portals is typically necessary to complete the hemitrapeziectomy. Once the debridement and hemitrapeziectomy are completed, fluoroscopic imaging is used to confirm positioning of the carpometacarpal joint, with the creation of the carpometacarpal space (Figures 3, 4). The wings of the Artelon intra-articular spacer are trimmed and the spacer is folded in half; it is then introduced via the thenar portal into the carpometacarpal space. This is visualized using the arthroscope in the dorsal ulnar portal. After seating the Artelon spacer in the position of the resected trapezium, a 0.045-in K-wire is drilled retrograde into the first metacarpal, through the Artelon spacer, and farther into the remaining trapezium (Figure 5). This aids in maintaining the carpometacarpal space and allows a hematoma to form in the space. Final fluoroscopic imaging confirms the placement of the pin and maintenance of distraction (Figure 6). Then, the pin is bent and cut at the level of the skin. Portal sites are closed with 4-0 nylon sutures. A dry, sterile, compressive dressing is placed, followed by a well-molded thumb spica splint.

Postoperative Care
Patients were followed up at 2, 4, and 12 weeks and 6 and 12 months postoperatively. Two weeks postoperatively, the splint was changed to a short-arm thumb spica cast, including the interphalangeal joint of the thumb, to ensure adequate immobilization and discourage thumb use during this period. Four weeks postoperatively, the cast and pin should be removed, and the patient can begin ROM exercises under the supervision of a certified therapist.
hand therapist. A removable splint should be given for lifting and nighttime use while sleeping. Twelve weeks postoperatively, the patient can return to full activities of daily living.

**RESULTS**

All 9 patients (5 men and 4 women; 7 right-handed and 2 left-handed) participated in QuickDASH, PRWE, and key pinch strength testing. Two patients had a history of thumb trauma. One patient considered the carpometacarpal pain to be a work-related injury but was not involved in a worker’s compensation case. All patients developed full ROM designated as opposition to the metacarpal joint of the small finger by 3 months postoperatively (Table).

Mean follow-up was 23.4 months (range, 13-33 months). At minimum 1-year follow-up, QuickDASH and PRWE scores were 12.3±7.6 and 26.8±23.5, respectively. Mean pinch strength was 59%±19.1%.

No significant complications occurred. One patient developed persistent synovitis 3 months after the index procedure, which resolved with 1 corticosteroid injection at 6 months postoperatively. The patient was followed until 1 year postoperatively, at which point no synovitis was present.

**DISCUSSION**

As arthroscopic technology evolves, the treatment of carpometacarpal arthritis improves. Theoretic advantages of arthroscopic treatment for carpometacarpal arthritis include quicker recovery, less scarring, and less pain. Although a recent negative opinion has occurred regarding open Artelon spacer interposition arthroplasty, the current authors reported favorable results for arthroscopic Artelon spacer interposition arthroplasty. Compared with conventional hematomata distraction arthroplasty, arthroscopic hema-trapeziectomy does not require an open full trapeziectomy, which could have an advantage in terms of preventing subsidence. Although no literature supports this, it could be significant for younger patients with heavier load requirements. Although the authors had a limited follow-up time, no patients in the study showed signs of subsidence. The Artelon spacer is marketed as the spacer that eliminates diseased joint surfaces; however, it is unclear whether it promotes soft tissue in-growth or how much mechanical advantage it provides. The current patients exhibited excellent subjective outcomes based on the QuickDASH and PRWE questionnaires (12.3 and 26.8, respectively) at a mean 23.4-month follow-up. Patients achieved full ROM and 59%±19.1% of pinch strength at final follow-up.

Many studies of clinical outcomes have compared different treatment techniques for carpometacarpal arthritis, and the comparison of all available surgical options is beyond the scope of this study. Within the past 2 decades, the arthroscopic treatment of carpometacarpal arthritis has yielded satisfactory results, particularly with respect to pain relief. Menon reported 33 partial arthroscopic interposition arthroplasties using palmaris longus, flexor carpi radialis, Goretex, or fascia lata allograft (WL Gore & Associates, Inc, Flagstaff, Arizona) with complete pain relief in 25 patients at 24- to 48-month follow-up. Earp et al reported 11 patients undergoing arthroscopic hema-trapeziectomy with palmaris longus or flexor carpi radialis tendon interposition with significantly decreased pain scores at mean 11-month

### Table

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Abbreviations: DASH, Disabilities of the Arm, Shoulder, and Hand; L, left; PRWE, Patient-rated Wrist Examination; R, right; ROM, range of motion; Surg, surgical.
follow-up (8.59 to 1.77 pain score decrease). Hofmeister et al\textsuperscript{19} reported 18 thumbs at 7.6 year follow-up after arthroscopic hemitrapeziectomy of the distal trapezium with pancapsular thermal shrinkage and temporary K-wire fixation, and the results demonstrated complete subjective satisfaction in pain, pinch activities, strength, and ROM. Despite an average metacarpal subsidence of 1.8 mm, an improvement occurred in key pinch from 8 to 11 lbs, in tip pinch from 4 to 5 lbs, and in thumb function score from 60 to 90.

Recent clinical outcomes studies have conflicted with respect to Artelon spacer interposition arthroplasty. Nilsson et al\textsuperscript{13} published the initial report with respect to Artelon spacer interposition arthroplasty for thumb carpometacarpal arthritis using an open procedure. This study incorporated a prospective controlled trial of open hemitrapeziectomy with Artelon spacer interposition arthroplasty (10 patients) compared with total trapeziectomy and abductor pollicis suspensionplasty (5 patients).\textsuperscript{13} This study reported equivalent pain relief scores but had improved pinch strength with Artelon spacer interposition arthroplasty at 3-year follow-up (5 vs 8 kg; \( P<.05 \)). A histology specimen 6 months postoperatively demonstrated full incorporation into the host bone with no signs of adverse reactions. Badia\textsuperscript{14} reported 12 patients (13 thumbs) with marked pain relief, improved pinch strength from preoperative values, and preserved joint space 1 year after performing his technique of arthroscopic hemitrapeziectomy with Artelon spacer interposition arthroplasty. Quantitative data were not reported because this was primarily a technique paper. Jorheim et al\textsuperscript{15} compared the short-term results of open Artelon spacer interposition arthroplasty with trapeziectomy and abductor pollicis longus interposition suspensionplasty. The median QuickDASH scores for the Artelon group and the abductor pollicis longus group at 1-year follow-up were 25 and 20, respectively. Median pinch strength was 61% and 86%, respectively. The adjusted odds ratio demonstrated dissatisfaction with Artelon spacer interposition arthroplasty compared with abductor pollicis longus arthroplasty. Although abductor pollicis longus arthroplasty appeared to provide greater satisfaction, the data were not statistically significant.

In comparison with the results by Jorheim et al\textsuperscript{15} in which Artelon spacers were inserted in an open protocol, the current case revealed a similar mean pinch strength of 59\%±19.1\% and lower QuickDASH (11.1±7.5) scores at 1-year follow-up. The difference in QuickDASH scores may be related to the benefits of a minimally invasive approach that preserves the integrity of the carpometacarpal capsule, involves less soft tissue dissection and injury, and allows faster postoperative rehabilitation.

Two recent case reports have raised concern for foreign body reactions to the Artelon spacer. Giuffrida et al\textsuperscript{20} reported persistent pain and swelling at the scaphotrapeziotrapezoidal joint that persisted for 8 months postoperatively. Histology revealed an exuberant foreign body giant cell reaction. Symptoms resolved after the removal of the Artelon spacer. Choung and Tan\textsuperscript{21} reported a similar foreign body reaction in the carpometacarpal joint 12 weeks postoperatively. The patient’s symptoms also resolved after removing the spacer.

In the current study, 1 patient had prolonged pain and swelling at 3-month follow-up, but the symptoms resolved completely with 1 corticosteroid injection at 6-month follow-up. This patient was followed for 6 more months, with no recurrence of discomfort. At average 23-month follow-up, no evidence existed of foreign body reaction in any patients in radiographic or clinical evaluation.

The results of the current study are important because concern has existed recently for foreign body reactions to the Artelon spacer, whereas others have reported good results with the implant. The good clinical outcome achieved in the current series is also notable because all of the implants were trimmed prior to insertion. Representatives from the manufacturer of the device have suspected that trimming the implant may contribute to the issues with foreign body reactions, but that was not the case in the current case based on the authors’ results. Even with open techniques, mixed results have occurred in terms of failure due to foreign body reaction, and no consensus exists as to why different groups are having significantly different clinical outcomes. Lack of preoperative antibiotics was suggested as a possible etiology for need for late revision.\textsuperscript{22} The current authors may have achieved superior results with the less-invasive arthroscopic technique because it may produce a less inflammatory reaction during the initial procedure.

The current study had some weaknesses. Although the authors had excellent clinical outcomes data, this retrospective case series lacks a control and comparison for the preoperative subjective and objective values. However, the authors reported a good clinical outcome of arthroscopic carpometacarpal arthroplasty with the use of the Artelon spacer in the light of many reports suggesting foreign body reaction with the open technique.\textsuperscript{20,21,23} The exclusion of 3 patients due to inadequate follow-up in a small study could have also influenced the data, but the clinical data from all 3 patients would have only improved all parameters in the current study, which makes the authors less inclined to believe they pursued care at another institution. Rather, given the transient nature of the current patients (many come from all over the West Coast), it was difficult to have patients with good results come back beyond the 3-month follow-up. Most of the current patients were retired or no longer working at the time of the procedure. Those who were working were able to return to their previous level of employment. Regarding the minimum follow-up period...
of 12.3 months (mean, 23 months) in the current study, in the authors’ experience, patients who need revision carpometacarpal arthroplasty typically present during the early postoperative period with suboptimal outcome regardless of the procedure chosen. These patients typically undergo all available conservative postoperative treatment measures before possible implant removal and a revision procedure. With the Artelon spacer, authors have reported suboptimal outcomes in the patients who needed eventual explantation well before their 1-year follow-up.20-23 By the 1-year follow-up, the current authors can reliably identify the patients who would need eventual revision.

The specific benefits of arthroscopy include faster recovery compared with other procedures that require pinning, less scar tissue formation, no need for graft harvest, and greater patient satisfaction and were not directly compared with another technique. Furthermore, faster removal of pins and no need for graft harvest may be significant contributors for higher patient satisfaction during the early recovery period. Finally, arthroscopic hemitrapeziectomy and Artelon spacer interposition arthroplasty may be revised to other available surgical techniques without significant difficulty. In the worst case scenario, arthroscopic hemitrapeziectomy and Artelon interposition may also allow for easy revision to a more traditional open full trapeziectomy and ligament reconstruction procedure should the need arise. A larger randomized multicenter trial with longer than 1 year of follow-up may provide more information in terms of comparative subjective and objective data. Nevertheless, this study revealed excellent short-term results at minimum 1-year follow-up for a less-invasive treatment option that is appropriate for select patients with moderate thumb carpometacarpal arthritis.

REFERENCES