Arthroscopic Resection Arthroplasty for Treatment of Combined Carpometacarpal and Scaphotrapeziotrapezoid (Pantrapezial) Arthritis

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Purpose Arthroscopy of the carpometacarpal (CMC) and scaphotrapeziotrapezoid (STT) joints has been described for the purpose of diagnosing, staging, and treating CMC and STT pathology. This study evaluates the short-term outcome of arthroscopic resection arthroplasty (ARA) for pantrapezial arthritis.

Methods Thirty-five cases of ARA of the CMC and STT joints were performed in 34 patients with one year minimum follow-up. There were 27 women and 7 men. Average age was 63 (range, 46 to 79). All patients had simultaneous ARA of both the CMC and STT joints. A 2- to 3-mm section of bone was resected from the proximal and distal aspect of both the CMC and STT joints. Preoperative data collected included 10-point self-reported pain scale, Disabilities of the Arm, Shoulder, and Hand (DASH) outcome measure, range of motion, grip strength, key and chuck pinch, length of symptoms, and treatment. Postoperative data included the same data plus patient satisfaction, graded on a 0 to 5 scale. Data were collected at postoperative months 1, 3, 6, and 12.

Results Average time of postoperative immobilization was less than 3 weeks (range, 2–6). The DASH scores averaged 46 before surgery, and 51, 30, 20, and 19 respectively, for the aforementioned postoperative intervals. The mean improvement in key pinch was 1.3 kg. The mean improvement in grip was 4.3 kg. Pain improved from 7 before surgery to 1 at one-year follow-up.

Conclusions Short-term analysis suggests that ARA for pantrapezial arthritis provides satisfactory pain relief and return of strength and function. (*J Hand Surg 2011;36A:413–419. Copyright © 2011 by the American Society for Surgery of the Hand. All rights reserved.*)

Type of study/level of evidence Therapeutic IV.

Key words Arthritis, arthroplasty, arthroscopy, CMC, resection arthroplasty, STT.

ARTHROSCOPIC RESECTION ARTHROPLASTY (ARA) of the carpometacarpal (CMC) joint has been reported by multiple authors with reasonably good results.[1,2,3–7] Indications have generally included

substantial cartilage loss at the CMC joint, precluding a joint-sparing procedure, and a preserved scaphotrapeziotrapezoid (STT) joint. Badia proposed an arthroscopic classification of the CMC joint based on arthroscopic findings that allows for better overall decision making of treatment options.[1] He proposed that arthroscopic resection arthroplasty be performed on stage III, which he described as widespread, full-thickness loss of cartilage of the CMC joint. Patients with advanced STT arthritis had open trapezial excision suspension plasty under Badia's treatment algorithm.

Arthritis of the scaphotrapeziotrapezoid (STT) joint can be a significant source of pain in patients with

thumb carpometacarpal (CMC) arthritis.[7–11] Arthroscopy of the STT joint has been described for the purpose of diagnosing, staging and treating STT arthritis.[12–20]

Arthroscopic debridement of STT arthritis has been reported to have a 90% satisfaction rate at 3-year follow-up.[18] Other authors have reported improvement in pain, mobility, and strength following ARA of the STT joint.[19] Interposition following ARA has been compared to arthroscopic resection without interposition. Grip and pinch improved in both groups. Patient satisfaction was comparable for both groups; however, STT resection arthroplasty without interposition showed substantially greater range of motion compared to patients with soft tissue interposition.[20]

The purpose of the study was to evaluate the early results of ARA of both the CMC and STT joints for patients with pantrapezial arthritis. Although the results of ARA for the CMC and STT independently have been good, results for the combined procedure for pantrapezial arthritis are lacking.

PATIENTS AND METHODS

Internal review board approval and informed consent were obtained. The authors are currently conducting a prospective study of ARA of the CMC joint. A total of 101 cases were treated over a 3-year period (2006–2008). Of these cases, 39 also had ARA of the STT joint. The current study of these 39 cases of pantrapezial ARA in 38 patients represents a subset of this prospective CMC study. Four patients were lost to follow-up. After excluding these 4 patients, we had a total of 35 cases of pantrapezial ARA in 34 patients with a minimum of 1 year follow-up. All cases were performed by 1 surgeon. The mean age was 64 years (range, 46–84) at the time of surgery. There were 27 women and 7 men. Preoperative length of symptoms averaged 48 months. The dominant side was involved in 16 cases. Five cases were involved in workers compensation claims.

Surgical indications included pain localized to both CMC and STT joints; radiographic changes consistent with arthritis; and full-thickness, widespread cartilage loss of both joints found at the time of arthroscopy. Diagnostic injections under fluoroscopic control were used when needed to confirm the diagnosis. Diagnostic injections were performed as follows: pinch and grip strength and pain were evaluated before and 10 minutes after injection of local anesthetic into the CMC joint under fluoroscopic control. Patients who continued to have pain after the CMC injection were re-evaluated 10 minutes after injection of the STT joint. Those with

relief of some but not all pain after the CMC injection who had complete relief of pain and improvement in strength after the STT injection were considered to have a positive injection test of both the CMC and STT joints and, therefore, to be good candidates for ARA of both the CMC and STT joints.

All patients received conservative treatment, which included rest, splints, anti-inflammatory drugs, cortisone injections, and physiotherapy. A total of 14 patients had 1 injection, 3 patients had 2 injections, and 4 patients had 3 or more injections. A total of 23 injections were given at the CMC, and 11 were given at the STT joint.

Patients were assessed before surgery and at 1, 3, 6, and 12 months after surgery. All patients had a minimum of 1 year of follow-up. Key pinch, chuck pinch, and grip strength were assessed by an occupational therapist with a pinch gauge (Sammons Preston, Inc., Bollingbrook, IL) before surgery and at 1, 3, 6, and 12 months after surgery. Grip strength was assessed at the same time intervals using a Jamar hand dynamometer (Sammons Preston, Inc.), with strength reported for the second Jamar setting. Measurements for thumb CMC motion were obtained before surgery and at 1, 3, 6, and 12 months after surgery. All measurements were obtained by certified hand therapists using a standard goniometer. Opposition, palmar abduction, and web span are reported. Occupational therapists used methods of measurement as directed in the American Medical Association's *Guides to the Evaluation of Permanent Impairment*, 5th edition, for measurement of opposition and palmar abduction. Web span was measured from the thumb interphalangeal crease to the proximal flexion crease of the index, with the thumb in radial abduction.[21] The DASH scores were obtained before surgery and at each postoperative interval. Return to work time was calculated for working patients.

Additional follow-up was obtained by phone consultation on all patients at an average of 24 months (range, 12 to 40). Variables assessed by phone follow-up included pain, satisfaction, presence or absence of revision surgery, and whether the patient would have the surgery again. Pain was recorded on a scale of 0 to 10 before surgery, at each postoperative interval, and by phone follow-up. Satisfaction was assessed at each postoperative interval and at phone follow-up, based on a scale of 0 to 5, with 0 being completely unsatisfied and 5 being completely satisfied.

Surgical technique

The patient was placed on an operating room table with the shoulder abducted and externally rotated. The arm was
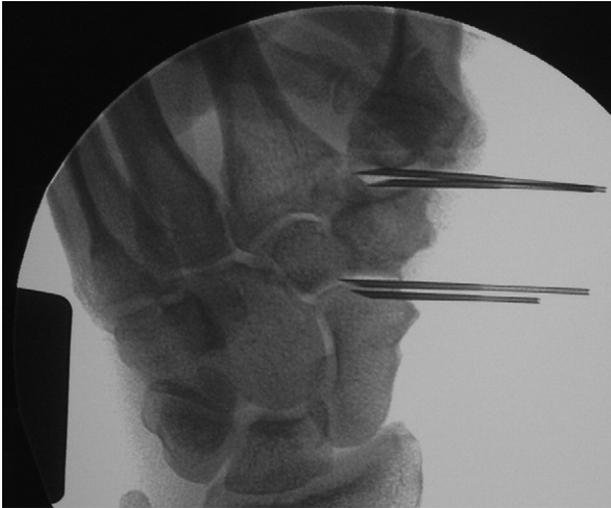
FIGURE 1: Fluoroscopic view of portal placement. Note that needles have been placed parallel to the joints.

FIGURE 2: An STT joint, showing resection of proximal surface of trapezium and trapezoid. The cartilage of the trapezio-trapezoid joint is shown separating the trapezium and the trapezoid.

placed on an arm table, with a nonsterile tourniquet placed on the brachium. The brachium was taped to the arm table. The arm was suspended using 5 to 10 lb of finger trap traction on only the thumb. Routine arthroscopy was performed using a 2.3 mm or 2.7 mm arthroscope. The 2.3 mm arthroscope was used on smaller joints that would not accept a 2.7 mm arthroscope. The 1R and 1U portals were used for CMC arthroscopy. The STT arthroscopy was performed using 1R and 1U portals, which were placed approximately 1 cm proximal to the 1R and 1U portals described for CMC arthroplasty. The 1R and 1U portals were localized with hypodermic needles with the aid of fluoroscopy (Fig. 1). Needles were placed into the joint and confirmed to be parallel on fluoroscopy. These portals lay on either side of the thumb first dorsal compartment.

An additional dorsal portal was created, using an inside-out technique, by placing a blunt probe through the 1R portal, across the STT or CMC joint, and out the dorsum of the hand. A minimum of 4 portals were used, 2 for the CMC and 2 for the STT joints. A total of 6 portals were used in many cases. A 2- or 3-mm section of bone was resected arthroscopically from the joint surfaces of both the trapezium and the trapezoid at the distal aspect of the STT joint (Fig. 2). A full-radius mechanical shaver with suction was used for synovectomy and cleaning the joint of debris for better visualization. Radiofrequency ablation (Oratec, 60°, 2 mm) was also used in all cases. Thermo-capsulorrhaphy was performed to tighten the capsule and for joint denervation. Constant fluid outflow was used to prevent overheating.
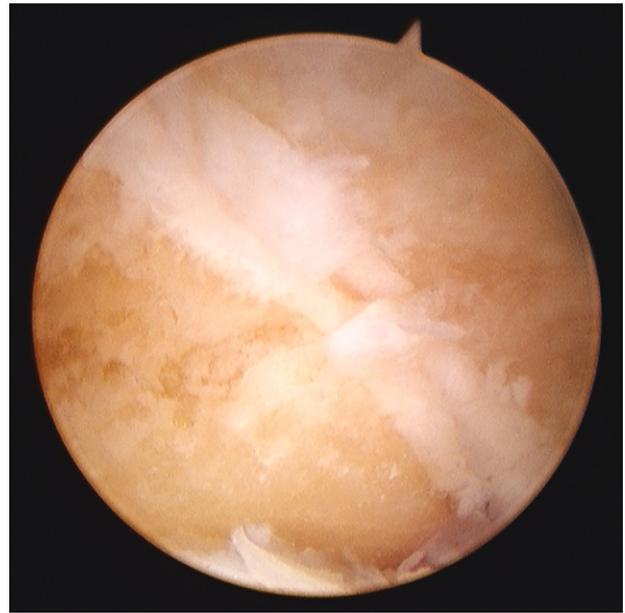
A 3.0- or 4.0-mm barrel burr was used to resect 2 to 3 mm from each side of both the CMC and STT joints. The 4.0-mm barrel burr was preferentially used in joints large enough to accept it. In others, the 3.0-mm burr was used. Interposition material, when used, was fixed in the resected joint with suture, which was tied over a button external to the skin on the volar and dorsal aspects of the joint or tied inside the joint, using an arthroscopic knot pusher. When interposition material was used, it was used at both the CMC and STT joints. Graft jacket (Wright Medical Technology Inc., Arlington, TN) was used as interposition material in 23 cases. The method of interposition fixation uses absorbable suture, which is passed through the interposition material. The sutures are passed on Keith needles through the R1 portal, across the resected joint, and out the dorsum of the hand. The suture is used to pull the interposition material into the resected joint. A second suture is passed through the opposite side of the interposition material before pulling the interposition material into the joint. The interposition material is centered in the joint and confirmed to be centered under direct arthroscopic visualization. After it is centered in the joint, the sutures are tied over felt and buttons in both volar and dorsal directions. The same method was used for both CMC and STT joints. Alternatively, in some cases, the interposition material was tied inside the
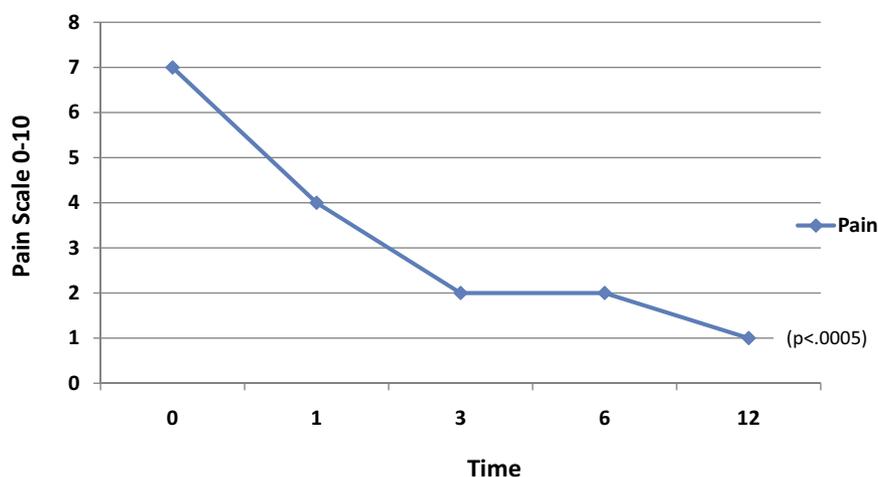
FIGURE 3: Graph of pain scale (0–10) for preoperative (0) and each of the postoperative time intervals.

joint, using standard arthroscopic knot-tying techniques.

Patients were immobilized for 2 to 6 weeks after surgery, depending on their progress and tolerance. Patients who were comfortable were mobilized at the second or third postoperative week. Eleven cases were casted for 2 weeks and 12 for 3 weeks. Eight were not casted; rather, they used splints as needed for 2 to 3 weeks. Splints were used based on patient preference. The remaining 4 progressed more slowly and were immobilized for longer periods of time, 2 for 4 weeks, 1 for 5 weeks, and 1 for 6 weeks. In general, patients were mobilized at 2 to 3 weeks or as early as possible. Those with substantial postoperative pain were immobilized for a longer period of time. Fifteen patients had concomitant procedures, including 10 carpal tunnel releases, 1 first dorsal compartment release, 2 trigger finger releases, 1 ganglion excision, and 1 distal interphalangeal joint arthrodesis.

Statistical analysis

Preoperative and 12-month postoperative data were analyzed using the Wilcoxon signed-rank test. Corresponding Wilcoxon signed-rank analyses were used to establish 95% confidence intervals, as well as the changes within individuals from baseline to follow-up at 1 year. For change over time, the tests are one-tailed, as we tested for improvement.

Change in pain and DASH scores were evaluated as a percentage of potential relief. This allows the change to be independent of preoperative baselines. This method avoids the floor and ceiling effects on different scores and also compensates for variations in patients' perception of the same pain. The estimated median percentages of relief are estimated as the medians of the

Walsh averages, and the corresponding p values and 95% confidence intervals are calculated using the Wilcoxon rank sum tests.

RESULTS

Pain

The average preoperative pain score was 7 (range, 5–10) with a 95% confidence interval of 6.5 to 7.5. Pain improved to an average of 4 (range, 2–7) at 1 month, 2 (range, 1–7) at 3 months, 2 (range, 0–6) at 6 months, and 1 (range, 0–6) ($p < .0005$) at 1 year (Fig. 3). Twelve patients reported no pain at 1 year. The median percentage of potential pain relief at 52 weeks compared to preoperative pain score was 86% (95% CI, 75% to 93%; $p < .0005$).

Activity and function

Preoperative DASH scores averaged 46 (range, 8–88). After surgery, the average DASH score was 51 (range, 14–69) at 1 month, 30 (range, 4–56) at 3 months, 20 (range, 1–56) at 6 months, and 19 (range, 1–50) at 1 year (Fig. 4). The median percent of potential improvement in DASH at 52 weeks compared to the preoperative DASH was 57% (95% CI, 41% to 69%; $p < .0005$). The average return to limited duty was 11 days (range, 5–35), and the average return to full duty was 34 days (range, 14–91).

Motion

Preoperative palmar abduction averaged 45° (range, 28° to 65°). Palmar abduction did not change, averaging 44 (range, 30–60) at 12 months. All patients could reach to the proximal digital crease of the little finger before surgery. About half the patients (17) could reach
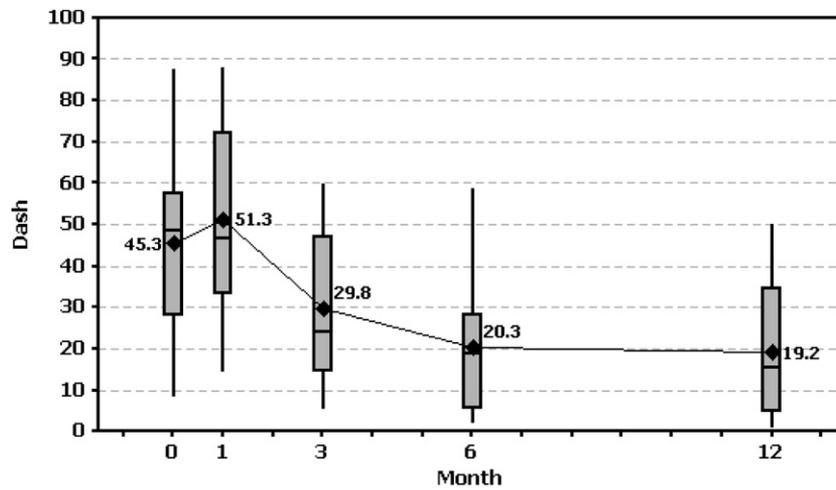
FIGURE 4: Box plots of DASH scores for preoperative (0) and the postoperative time intervals.
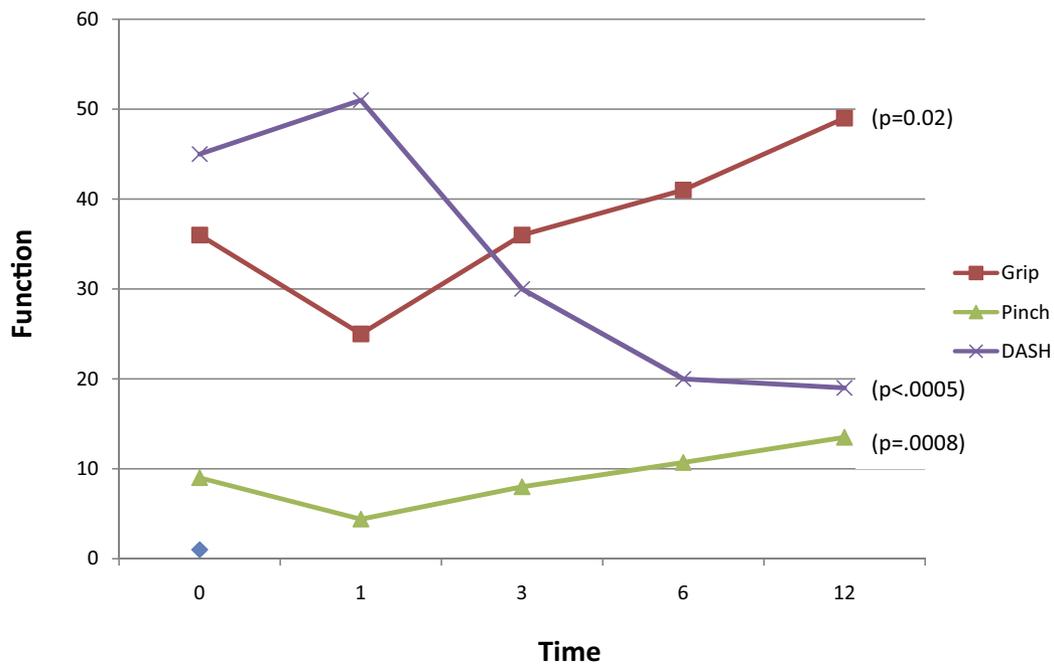

FIGURE 5: Preoperative (0) and postoperative grip, pinch, and DASH scores.

to the base of the little finger by the first postoperative month. All but one achieved this goal by month 12. Web span averaged 45 mm (range, 25–60) before surgery and 51 (range, 30–88; p = .239) at month 12.

Strength

Preoperative grip was 16.4 kg (range, 2.3–45.5) for the affected hand and 22.7 kg (range, 6.8–43.2) for the contralateral hand. After surgery, the grip decreased to 11.4 kg (range, 2.3–34.1) at the first month. It improved to 16.4 kg (range, 4.6–29.6) by 3 months. Continued improvement was seen at 6 and 12, months measuring

18.6 kg (2.7–31.8) and 21.8 kg (range, 5.5–25.5), respectively. Mean improvement in grip was 9.52 lb (95% CI, 0.5–17.6; p = .023). Pinch strength showed significant improvement by 1 year (p = .0008; Fig. 5). Mean improvement in key pinch was 1.3 kg (95% CI, 0.38–5.4 kg; p = .008). Mean improvement in chuck pinch was 1.8 kg (95% CI, 1.2–2.4 kg; p < .0005).

Repeat surgery and complications

Four patients had additional surgery. None of these patients were pain free at final follow-up after additional surgery. The reason for repeat surgery was deep
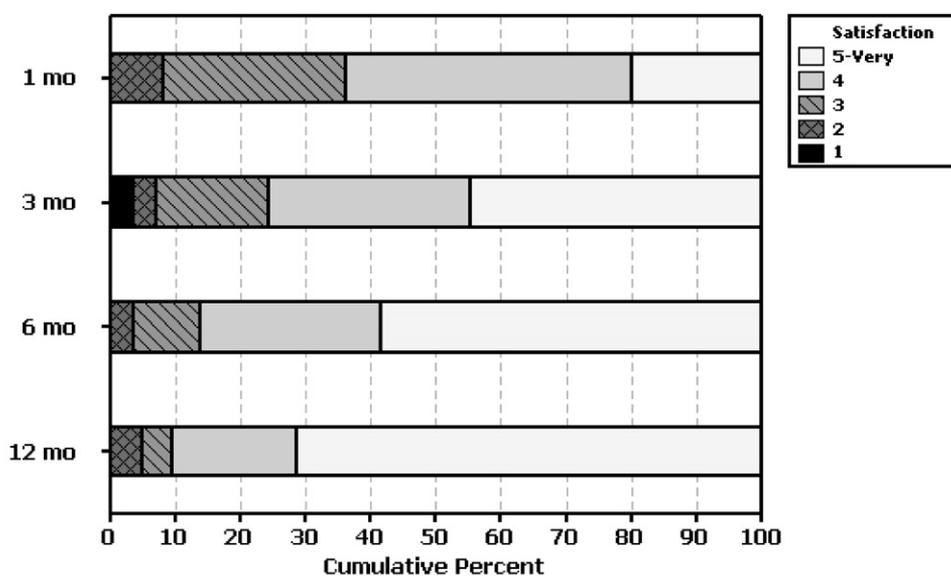
FIGURE 6: Stacked bar chart of patient satisfaction at each postoperative time interval.

infection in 1, flexor carpi radialis tendonitis in 1, and persistent pain in 2. The 2 patients with persistent pain were revised elsewhere to an open procedure. It is not known whether these revisions were for persistent pain at the CMC or STT joint. These 2 patients reported their pain level by phone follow-up after the revision surgery to be 5 and 7, respectively. Five reported paresthesias in the distribution of the superficial branch of the radial nerve. All of these resolved by 3 months after surgery. One patient developed a deep infection requiring repeat surgery. This patient had revision STT ARA with removal of the graft. One patient developed a superficial infection at the site of the button, which resolved with outpatient oral antibiotics. Three patients developed flexor carpi radialis tendonitis in the postoperative period. One required surgical release of the flexor carpi radialis. The other 2 resolved with conservative treatment.

Phone follow-up

Of the 34 patients, 32 stated that they would have the surgery again. At one year, patient satisfaction was high, with 25 at the highest level of 5 and 32 with at least 4. The average satisfaction at final follow-up was 4 (range, 2–5) (Fig. 6).

DISCUSSION

Ashwood et al[18] reported good to excellent results in 9 of 10 patients following arthroscopic debridement (without resection arthroplasty) of the STT joint. They reported improvement in visual analog pain scale from

a mean of 86 to 14 points. Our results are comparable, with an improvement in pain from 7 of 10 to 1 of 10 at 1 year. At final follow-up, their key pinch averaged 89% of the contralateral side compared to 93% for our patients.

These authors recommended a 1.5-cm skin incision in the snuffbox to minimize risk to neurovascular structures. We have used standard arthroscopic-size portals (4–5 mm) by blunt dissection, with no known radial artery injuries and 5 (13%) transient superficial nerve abnormalities, all resolving by the third postoperative month. We agree that the portal between the first and third dorsal compartments is the most at-risk portal. A safer, all-arthroscopic approach might be an outside-to-inside approach to the 1R portal followed by an inside-to-outside approach to the ulnar portal. Although the current series had no known injuries to the radial artery, the authors caution readers concerning the potential risks.

Rin and Mathoulin reported on 13 cases of ARA of the distal pole of the scaphoid for STT arthritis with good results.[19] Garcia-Elias et al found a 26% improvement in grip and a 40% improvement in pinch following open resection of the distal pole of the scaphoid in 21 patients.[20] Improvement in our grip and pinch were 31% and 44%, respectively.

Comparing our results to those of ligament reconstruction interposition arthroplasty and open hematoma distraction arthroplasty (HDA), increase in grip strength in the present study (31%) was better than that reported by Tomaino et al[22] (21%) and Yang and Weiland[23]

(9%) for ligament reconstruction interposition arthroplasty but less than that (47%) reported for HDA 47% by Kuhns et al.[24] Improvement in key pinch for the present study (44%) was better than that reported by all 3, which were 8%, 17%, and 33%, respectively. Kuhns reported excellent pain relief following HDA. The percentage of patients reporting no pain at 6 and 24 months was 73% and 92%, respectively. Our patients seem to perform poorly by comparison, with 26% of patients rating their pain as zero, on a scale from zero to 10, at 6 months and 33% at 24 months. Nevertheless, our patients reported an average pain score of 1 at final clinical follow-up for the present series. Furthermore, 32 of 34 patients stated that they would have the surgery again.

Although not all the data relative to pain is reported in the Yang and Weiland[23] series, their results state "only 4 reported pain at the follow-up visit; 2 were graded 1 and 2 were graded 5 on a scale of 1 to 10." This would seem to suggest that 31% of their patients had pain at final follow-up and, therefore, 69% had no pain. However, the pain score of the other 9 patients is not specifically reported.

Mobility for our patients was excellent, with all but one patient able to touch the base of the little finger. Kuhns et al.[24] reported similar findings for HDA. Yang and Weiland[24] reported 7 of 25 patients were unable to perform this task at 2 years and 2/24 at 9 years.

Our data provide for short-term evaluation of an evolving technique. Surgical techniques varied within this study with respect to the use of interposition. The treating surgeon has had personal communication with other surgeons performing ARA without interposition with good results. Placement of interposition increases the surgical time and expense of the procedure. Furthermore, there is a potential risk of infection, disease transmission, and inflammation; therefore, the routine use of interposition has been abandoned. Data are currently being collected to evaluate the effect of interposition. Our study is limited by fairly short follow-up. Furthermore, the failures are not well understood relative to the causation. Longer term follow-up and, perhaps, a prospective randomized study will be required to make a final assessment of this procedure.

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