Primary Combined Replacements for Treatment of Distal Radius Physeal Arrest

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J Wrist Surg 2014;3:203–205.

Abstract

Keywords

- distal radius
- physeal fracture
- growth arrest
- total wrist arthroplasty
- ulnar head implant

This is a case report of a 59-year-old female patient with a posttraumatic growth arrest of the distal radius, leading to radioscaphoid osteoarthritis, carpal instability, and a symptomatic ulnocarpal impaction syndrome that was successfully treated with combined total wrist arthroplasty and ulnar head implant. One year postoperatively, there was no change in position without any signs of loosening of both implants. Both subjectively and functionally, all clinical parameters—Disabilities of the Arm, Shoulder, and Hand (DASH), visual analog scale (VAS), grip strength—had improved.

Level of Evidence: IV

Posttraumatic malunited growth arrest is a rare complication after physeal fractures at the distal radius among children and adolescents; the incidence is reported to be 1% to 7%.^{1–3} All types of physeal fractures have been implicated in causing growth arrest.⁴ In the *Salter-Harris type V* injuries the diagnosis is often made retrospectively as clinical or radiographic deformity develops.^{1,2} This type can lead to severe shortening and multiplanar deformity.² The long-term consequences of untreated physeal arrest in adult patients include a pronounced ulnar plus variance and marked radial shortening, resulting in ulnocarpal impaction and secondary osteoarthritis of the wrist joint. No dependable radiographic criteria exist to predict the amount of physeal disturbance at the time of injury.²

The ossification of the distal radius epiphysis begins in the central radius region; it then initially continues only in the ulnar direction. Only at the end of this process does the radial-dorsal region ossify.⁵ Another possible cause of growth arrest can occur after surgical treatment of a distal radius fracture in childhood, as a consequence of premature physeal arrest due to local traumatic or thermal necrosis following the use of Kirschner wires (K-wires).

The radiocarpal arthrosis can be treated with a radioscapholunate fusion, a total wrist joint arthrodesis, or a total wrist arthroplasty (TWA) depending on the patient's physical demands. Treatment options of the ulnar positive deformity

would include a hemiresection-interposition arthroplasty (Bowers, 1985 / Watson, 1986), complete ulnar head resection (Darrach, 1912), a *Sauvé-Kapandji* arthrodesis (1936), or an ulnar head replacement (UHR).

Case Report

A 59-year-old female patient presented with a history of K-wire fixation of a left distal radius fracture at age 11. There was no history of any additional trauma nor genetic disorders. Starting at age 30, she had developed intermittent and increasing pain in her left wrist that was interfering with her work as a secretary. There was a marked restriction of wrist motion from 0 to 10 degrees in the ulnar direction (➤Fig. 1a). The anteroposterior (AP) X-ray image showed marked radial shortening with secondary radioscaphoid osteoarthritis (➤Fig. 1b). The lateral X-ray showed dorsal tilt with a subluxation at the capitulum joint (➤Fig. 1c).

At the time of surgery, the wrist joint was exposed through a dorsal incision. Advanced radiocarpal osteoarthritis with instability of the proximal row was evident (➤Fig. 1d). Following an extensive capsular release, a RE-MOTION total wrist replacement (Small Bone Innovations, Morrisville, PA, USA) was inserted, followed by a UHEAD ulnar head implant (Small Bone Innovations, Morrisville, PA, USA).

Fig. 1a–e Case report, pre- and intraoperative. (a) Clinical photo of radial deviation of the carpus with a prominent distal ulna. (b) Ulna plus deformity with ulnar impaction (arrow), dysplastic sigmoid notch, and radiocarpometacarpal Z-deformity (lines). Note the radial shortening and carpal collapse with radioscaphoid osteoarthritis (arrow). (c) Dorsal tilt of the lunate with dorsal subluxation of the capitate. (d) Complete scapholunate (SL) and lunotriquetral (LT) instability (arrows) with radial translation of the capitate and scaphoid. (e) RE-MOTION (size S) with carpal polyethylene ball (size plus) and UHEAD.

Because of the radial translation of the capitate, the stem of the carpal prosthesis component could not be positioned precisely along the axis of the third metacarpal bone. To avoid radiocarpal impingement, we performed a radial-side diagonal resection of the proximal scaphoid, preserving the distal pole. The radial fixation screw could not be placed entirely within the scaphoid because of the carpal deformity. The triangular fibrocartilage complex (TFCC) was sutured to the two holes in the top of the UHEAD. There was no impingement of the implants intraoperatively (►Fig. 1e).

After surgery, the left arm was immobilized in a cast. Two weeks later, the wrist was freed, while the elbow joint was immobilized for another 2 weeks. Strengthening was started after the sixth postoperative week. After 10 weeks, the patient returned to full duty at work.

At the 1-year follow-up, supination/pronation had improved from 60°/70° (preoperative) to 80°/90°. The total arc improved from 72% (preoperative) to 94% to the opposite side. Extension and ulnar deviation improved from 30°/–10° (preoperative) to 40°/ + 10°. Flexion worsened from 25° (preoperative) to 20°. The radial deviation, at 20°, was identical to the preoperative situation; when movement was forced, the patient reported pain at the maximum range of motion.

Radiologically, there was no change in position of both implants after 6 and 12 months, without any signs of loosening (►Fig. 2a,b). The pain with extremes of radial deviation

Fig. 2a–c Case report, 1 year postoperative. (a) No signs of loosening of either implant. Note the diagonal resection of the proximal scaphoid (arrow). (b) No subluxation of the UHEAD (arrow). (c) Impingement between the radial RE-MOTION component and the distal scaphoid with terminal radial deviation (arrow).

correlated radiologically with demonstrable impingement between the distal scaphoid pole and the offset of the radial RE-MOTION component (►Fig. 2c).

The pain improved from 8 points (preoperative) to 3 points on visual analog scale (VAS) 0–10. The QuickDASH (Disabilities of the Arm, Shoulder, and Hand) score improved from 68 (preoperative) to 37. The grip strength (Jamar dynamometer) increased from 4 kgf (preoperative) to 7 kgf. The patient reported she would have the same procedure again.

Discussion

The management of posttraumatic growth arrest in children and adolescents is dependent on the severity of the deformity and the remaining growth potential of the patients.^{1,3,6} Ulnar shortening osteotomy is used in the skeletally mature or those with little remaining growth potential.^{1,4,6,7} Ulnar epiphysiodesis on its own or with a shortening osteotomy is useful in those who are skeletally immature.³ These are no longer options in adult patients. We present a successful short-term follow-up of a combined TWA and UHR as a salvage procedure for treatment of a long-standing growth arrest of the distal radius.

Conflict of Interest

None

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