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CASE STUDIES

Unique application of a metacarpophalangeal joint implant as a radial head prosthesis

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The Essex-Lopresti injury or longitudinal instability of the forearm may occur after trauma or surgery to the forearm axis. Although initial instability may not be present after radial head excision, postoperative attrition of the interosseous membrane may occur. Compromise of the interosseous membrane can yield longitudinal instability, which can result in forearm pain, ulnocarpal impaction, and radiocapitellar impingement. Radial head replacement, to preserve forearm length and stability, is one of the reconstructive strategies to ameliorate these symptoms.[1,14,28,29]

During the past 40 years, prosthetic radial head implants have evolved to become the modular and articulated bipolar systems commonly used today. In addition, surgeons now have complete radiocapitellar joint replacements at their disposal.[12,13,17,32] Despite the advances in implant technology, the altered radial and capitellar joint anatomy observed with congenital or developmental anomalies often presents significant challenges in attempting reconstruction.

Radial head dislocation or subluxation is theorized to occur secondary to congenital or developmental problems. Current literature suggests that a congenitally dislocated radial head or unrecognized childhood trauma that results in dislocation can cause abnormal remodeling and bone growth as development continues.[24,30] Radiographic patterns indicative of such pathologic changes may include an underdeveloped radial head, a dome-shaped radial head, or a hypoplastic capitellum.[2,11,18,19,22,24,27,31] These abnormalities make radial head replacement with conventional prostheses challenging even for the experienced surgeon. In addition, when viable cartilage persists on the surface of the capitellum, complete radiocapitellar replacement could be debated as excessive or even unwarranted.

We report a novel technique for radial head replacement with use of a convex pyrocarbon metacarpophalangeal (MCP) joint prosthesis (Ascension Orthopedics, Austin, TX, USA) to restore longitudinal stability and forearm length in the setting of a congenital radial head dislocation with forearm instability. The favorable wear properties of pyrocarbon have been established, and the material has shown moderate success rates when it is implanted in the proximal interphalangeal and MCP joints.[15,33] Non–Food and Drug Administration–approved uses of these implants in other joints about the hand, including hemiarthroplasty procedures, have been documented with success.

Case report

A 57-year-old right-hand dominant woman presented from an outside institution having previously undergone radial head excision for osteoarthritis of her right radiocapitellar joint secondary to congenital radial head subluxation. She had a long-established diagnosis of bilateral congenital radial head dislocations; however, the left elbow was asymptomatic. Three weeks from her initial operation, the

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patient noted a worsening of her right wrist pain without resolution. Her postoperative symptoms worsened at 4 weeks, with reported difficulties in elbow flexion, extension, pronation, and supination.

On physical examination, she had a well-healed lateral incision over the right elbow. Her active and passive range of motion was from 45° of extension to 130° of flexion. She was able to achieve 20° of supination and 90° of pronation. Pain became significant for the patient with terminal flexion, extension, pronation, and supination. Moderate discomfort was present at the wrist with all motion. The elbow joint maintained stability to varus and valgus stress, and her pivot shift test result was negative. In comparison, the patient's contralateral elbow exhibited range of motion from 20° to 140° of extension and flexion, 80° of supination, and 90° of pronation. There was no evidence of distal neurovascular compromise on examination bilaterally.

Radiographs and a computed tomography scan were obtained, revealing radial head excision with proximal migration of the radius. A concave capitellum was visualized along with clear impingement of the radial neck on the capitellum (Figs. 1 and 2). Radiographs of the wrist displayed more than 2 cm of ulnar positive variance on the right compared with the contralateral side.

Given the patient's presentation, there was concern for longitudinal instability of the forearm, or Essex-Lopresti injury.

Secondary to the patient's clinical examination and radiographic findings, radial head replacement arthroplasty surgery was considered. Goals of the surgery were to restore the longitudinal length of the forearm, to reduce the radiocapitellar impingement, and to correct the ulnar impaction. However, imaging also revealed that the capitellum was deformed and concave in shape, rather than convex. A standard radial head arthroplasty was not optimal secondary to the deformed capitellum's preventing congruent articulation. This incongruence could potentially exacerbate the patient's symptoms or result in implant failure. To compensate for this deformity, a convex implant was chosen because of the patient's unique anatomy. The patient elected to proceed with surgery, which would include a convex pyrocarbon MCP joint prosthesis, after she was informed that the device was being used in an off-label fashion not approved by the Food and Drug Administration.

Figure 1 Computed tomography scan with 2-dimensional reconstruction demonstrating impingement of the radial neck against the concave capitellum.

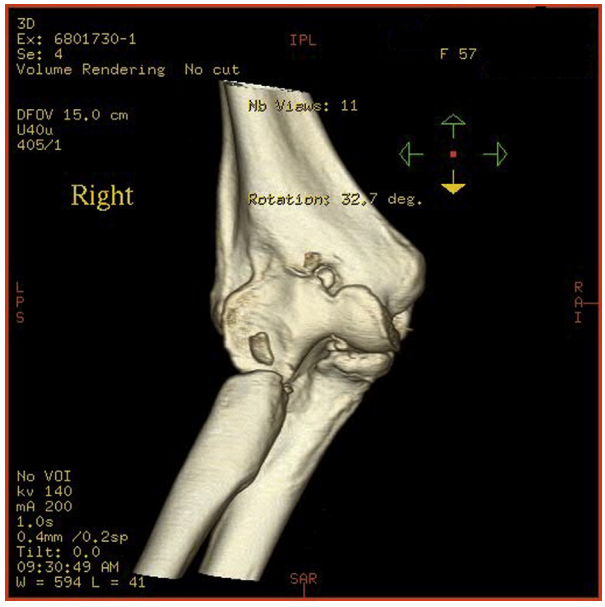

Figure 2 Computed tomography scan with 3-dimensional reconstruction demonstrating impingement of the radial neck against the concave capitellum.

Surgery

Under general anesthesia, the patient was placed in a supine position; the prior surgical incision and Kocher interval were used. The lateral capsule was entered anterior to the lateral collateral ligament. The annular ligament and capsule were reflected to expose the radial neck and prior surgical excision site. Given the large degree of scar present, a small portion of the lateral collateral ligament and anterior capsule were reflected from the lateral epicondyle and anterior humerus to facilitate exposure. Despite the scarring, the lateral ulnar collateral ligament was preserved. The neck of the radius was then prepared with the reamers for the metacarpal head portion of the MCP pyrocarbon implant. After sufficient canal preparation, an appropriately

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