

Discovery Elbow System: 2- to 5-Year Results in Distal Humerus Fractures and Posttraumatic Conditions: A Prospective Study on 24 Patients

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Purpose To prospectively evaluate preliminary results of the Discovery Elbow System (DES) used for acute distal humerus fractures and posttraumatic conditions.

Methods We analyzed 24 patients (9 men and 15 women), with a mean age of 69 years (range, 45–89 y). Ten had comminuted distal humerus fractures (group I), and 14 had severe post-traumatic arthritis, chronic instability, or nonunion (group II). Clinical and radiographic evaluations were performed. The preoperative (group II) and postoperative (both groups) evaluations were assessed with the Mayo Elbow Performance Score and Mayo Elbow Performance Index, the Quick Disabilities of the Arm, Shoulder, and Hand score, and the modified American Shoulder and Elbow Surgeons score. Patient satisfaction was evaluated on a 4-point scale.

Results Mean follow-up was 41 months (range, 29–63 mo). At the last evaluation, average flexion, extension, pronation, and supination were 136°, 17°, 80°, and 83°, respectively. The average Mayo Elbow Performance Score, Quick Disabilities of the Arm, Shoulder, and Hand score, and the modified American Shoulder and Elbow Surgeons score were 96, 20, and 84, respectively, and without significant intergroup differences. According to the Mayo Elbow Performance Index, there were 20 excellent, 3 good, and 1 fair result. Twenty patients were very satisfied or satisfied with the outcome. A significant increase in the functional scores was observed in group II compared with preoperative results. Radiological evaluation showed 1 patient with progressive radiolucency and 1 with a nonprogressive radiolucency at the final follow-up. No mechanical failures were observed. Two transient ulnar neuropathies, 1 wound infection, and 1 epicondyle fracture were observed.

Conclusions The DES yielded promising 2- to 5-year results in the treatment of acute fractures and posttraumatic conditions regarding pain relief, functional improvement, and patient satisfaction, achieving excellent results in most cases. The DES may represent an effective linked-implant option for total elbow replacement in such patients. However, long-term studies are needed. (*J Hand Surg Am.* 2014;39(9):1746–1756. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

Type of study/level of evidence Therapeutic IV.

Key words Discovery Elbow System, distal humerus fractures, distal humerus nonunion, post-traumatic osteoarthritis, total elbow arthroplasty.

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TOTAL ELBOW REPLACEMENT (TER) has evolved considerably in recent decades as a result of an improved knowledge of the elbow's anatomical structure and biomechanics, development of new materials, improvements in operating techniques, and a better definition of the surgical indications. Enhanced anatomical and biomechanical knowledge has also led to an improvement in prosthetic designs and a more accurate reproduction of elbow kinematics. Furthermore, the use of more wear-resistant materials and the advances made in cementing techniques have extended the survival of implants.¹ The main indications for TER are rheumatoid arthritis and posttraumatic conditions, that is, chronic instability, distal humerus nonunion, and malunion associated with severe articular degenerative changes.^{2–6} Another indication for TER is distal humerus fractures in the elderly,^{3,4,7–12} because comminution and poor bone quality cannot guarantee an adequate anatomical reduction and internal fixation of the fracture.^{3,9,13–16}

The Coonrad-Morrey device is the most widely used linked implant.^{2,4,5,7,12,17–20} In recent years, another linked device, the Discovery Elbow System (DES; Biomet Orthopedics, Warsaw, IN), has been available.²¹ The main characteristics of this implant are the anatomical design of its humeral and ulnar components, which may help reproduce the elbow axis of motion. Moreover, the spherical hinge mechanism increases articular surface contact, and a higher-quality polyethylene theoretically reduces bushing wear. Currently, short- to medium-term results for the DES are available for distal humerus fractures, whereas no data are available for posttraumatic indications.²² The aim of this prospective study was to compare the 2- to 5-year results of DES in patients with acute distal humerus fractures or posttraumatic elbow conditions.

PATIENTS AND METHODS

In light of Italian law, we were not required to ask for approval from an institutional review board or ethical committee for this type of study. However, each author certifies that his institution has approved the human protocol for this investigation and that all investigations were conducted in conformance with ethical principles of research.

Study population and preoperative evaluation

Between 2007 and 2011, 24 patients underwent a TER using the DES in our institution. The patients comprised 9 men and 15 women with a mean age of 69 years (range, 45–89 y). Ten of these patients, whose

mean age was 78 years (range, 66–89 y), had an acute comminuted distal humerus fracture that was classified as C3 in 8 cases and C2 in 2 cases according to the AO/OTA classification²³ (group I). One patient in group I also had an olecranon fracture associated with a C3 humeral fracture.

The remaining 14 patients, whose mean age was 63 years (range, 45–82 y), were affected by posttraumatic conditions (group II) that resulted in chronic pain and stiffness. Twelve of 14 had severe arthritis due to distal humerus malunion (n = 5) or complex elbow instability (n = 7). The remaining 2 patients had distal humerus articular nonunions. One of these had an associated olecranon hypertrophic nonunion secondary to an osteotomy. Nine of these 14 patients also exhibited ulnar neuropathy: 8 patients had an isolated sensory dysfunction, and 1 had a motor and sensory dysfunction. An electromyographic evaluation was performed to confirm the presence and the severity of the ulnar neuropathy in all cases.

All 24 patients were evaluated before surgery by means of standard x-rays and a computed tomography scan with 2- and 3-dimensional reconstructions. Moreover, group II patients underwent a functional preoperative evaluation using the Mayo Elbow Performance Score (MEPS) and Index (MEPI), the modified-American Shoulder and Elbow Surgeons score (m-ASES), and the Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH) score.^{24–26}

The patients in group I underwent a TER at a mean of 3 days following trauma (range, 2–5 d). All the patients in group II underwent TER after a mean of 3.9 years (range, 0.4–31 y; median: 0.95 y) following the initial trauma. Nine of the patients in group II had previously undergone 1 or 2 operations in different institutions. The remaining 5 patients had been treated conservatively after trauma with unsatisfactory results.

Surgical treatment

All the patients were positioned prone on the operating table and a posterior skin incision was performed. Various deep surgical approaches were used to expose the distal humerus and the proximal ulna, including 11 Alonso-Llames approaches, 6 Bryan-Morrey approaches, 6 Newcastle approaches, and 1 transolecranon approach with an anconeus flap^{27–29}; in this last case, an olecranon fracture was associated with C3 distal humerus fractures, which led to the exposure of the distal humerus. The ulnar nerve was isolated, protected, and transposed anteriorly and subcutaneously at the end of the procedure in all cases. Extensive debridement was performed in

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