Semiconstrained bipolar implant arthroplasty of the distal radioulnar joint. Case report

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Abstract

Introduction: The distal radioulnar joint is of paramount importance for proper functioning of the upper extremity. There are a wide variety of procedures for treatment of advanced pathology but none is capable of providing a stable load-bearing joint.

Clinical case: We present the case of a 54-year-old male who was treated with semiconstrained bipolar distal radioulnar joint arthroplasty (Aptis) and had a distal radioulnar impingement secondary to a distal ulnar resection (Darrach) previously performed to treat a fracture-dislocation of the distal radioulnar joint.

Conclusion: This was the first case of a semiconstrained bipolar distal radioulnar joint arthroplasty (Aptis) performed in Mexico. This treatment provides a stable load-bearing joint.

Key words: distal radioulnar joint, arthroplasty.

Introduction

The distal radioulnar articulation is the middle bicondylar joint of the forearm. Along with the proximal radioulnar articulation, it provides the essential movement of pronosupination. Equally, it has a crucial role and is little recognized when carrying objects by hand. The ability to perform painless pronosupination is fundamental to the functioning of the entire upper extremity.1-3

Traditionally, complex or chronic diseases of the distal radioulnar articulation such as comminuted fractures of the ulnar head, osteoarthritis or symptomatic distal radioulnar instability were treated by resection of the ulnar head (Darrach) or arthrodesis (Sauvé-Kapandji).4-7 The last quarter century has shown a better understanding of the radioulnar articulation through anatomic and biomechanical studies focused on skeletal anatomy, dynamic extrinsic stabilizers of the forearm rotation and the triangular fibrocartilage complex.1,8-12 This has resulted in more appropriate surgical procedures to reestablish the biomechanics of the distal forearm. The need for a stable and mobile articulation for proper function of the forearm has been recognized; however, the radioulnar articulation is inconsistent because it depends on the soft tissues, mainly in the triangular fibrocartilage complex for stability.1,13 When the articular surfaces of the sigmoid fossa and ulnar head are found to be intact, stabilizing procedures such as reintegration of the triangular fibrocartilage or radioulnar ligament reconstruction are the procedures of choice to restore proper functioning of the radioulnar articulation.14-16 Furthermore, when there is symptomatic osteoarthritis or a significant loss of articulation, interposition of arthroplasty is indicated for resuperficialization or ulnar head replacement.17-19 The disadvantage of these treatments is that they require intact stabilizers for adequate functioning, which is unlikely to be found in posttraumatic or chronic cases. Traditional treatments for rescue for the distal radioulnar articulation, such as Darrach and Sauvé-Kapandji, maintain the movement of pronosupination and improve painful symptoms; nevertheless, patients presented with radioulnar impaction at the ulnar stump because of the absence of the articulation.20,21

Arthroplasty with the Aptis distal radioulnar articulation (Aptis Medical, Louisville, KY, USA) designed by Dr. Luis Scheker is a semi-constrained bipolar prosthesis that replaces both the sigmoid fossa as well as the ulnar head. It allows for complete pronosupination through the rotational movement and translational in a proximal and distal component of polyethylene of ultra-high molecular weight. Similarly, the semi-constrained design reestablishes the distal radioulnar stability.
We present here the first case of arthroplasty of the radioulnar articulation with a constrained bipolar prosthesis (Aptis) performed in Mexico.2

Clinical case

We present the case of a 54-year-old male who experienced a bicycle crash in 2007 that resulted in a fracture of the distal third of the shaft of the radius and an ulnar head fracture with posterior displacement of the ulna (Galeazzi equivalent) of the left wrist (Figure 1). The patient was treated with an osteosynthetic plate of the radius and with radioulnar percutaneous fixation with K nails. Ulnar pain persisted and a resection of the ulnar head was performed (Darrach). Subsequently, the patient developed painful pinching and instability of the ulna treated by stabilization of the unspecified symptoms that did not improve (Figure 2). At the time of his initial consultation, the patient had a wrist flexion and extension of 10° to 30°, respectively, and a complete pronosupination. Grip strength was 40% of the contralateral wrist. He showed complete inability to carry heavy objects due to a painful pinched ulna. The patient underwent removal of osteosynthetic material and semi-constrained bipolar implant arthroplasty (Aptis) in October 2010 (Figure 3).

Discussion

As mentioned previously, proper functioning of the wrist, distal forearm and entire upper extremity requires a stable, mobile and painless distal radioulnar articulation. This articulation should be allowed to have a painless pronosupination load.1,2

This articulation is thus inconsistent because movement during pronosupination is translation and rotation.22,23 The patient received substantial loads due to the loads transmitted from the hand to the remainder of the upper extremity. Because of his incongruity, stabilizers (triangular fibrocartilage complex) were needed for proper operation.24-26

Degenerative diseases of the distal radioulnar articulation have been treated since 1913 through the resection of the distal segment of the ulna as described by Darrach,4 Dingman5 and Tulipan27 with favorable results. They are related to the amount of ulnar resection and grip strength increases in 38%. However, grip strength is recorded only with a dynamometer, which only evaluates the axial force without applying functional loads in the position of “zero rotation.”

In 1936, Sauvé and Kapandji28 described their technique consistently used in arthrodesis of the distal radioulnar...
articulation in addition to proximal ulnar resection, creating a pseudoarthrosis for forearm rotation. This method of treating the degenerative disease of the distal radioulnar articulation has the advantage over that of Darrach that theoretically prevents ulnar translation and proximal carpus, leaving support for the ulnar side of the wrist. Sanders et al.,29 reported good results in 9/10 patients undergoing this procedure. Vincet et al.,30 treated 21 wrists in 17 rheumatic patients using the Sauvé-Kapandji procedure and also achieved good results, but these authors also did not evaluate the ability to carry objects in a functional position.

As described by Bell and Hill20 and subsequently demonstrated radiographically by Lee and Schecker,21 the most common complication resulting from these procedures is a painful ulnar impingement that is more common in younger and/or active patients (Figure 4). To resolve this problem, many techniques of interposition or stabilization of the ulnar stump have been proposed but none has resulted in being a consistent solution. Semi-constrained distal radioulnar arthroplasty solves the problem of distal ulnar impingement because it provides a foothold for the radius during loading. Being semi-constrained also resolves the instability.2

Arthroplasties are another solution to the degenerative disease of the distal radioulnar articulation. In 1985, Bowers et al.,17 reported a posterior interposition arthroplasty to the hemi-resection of the ulnar head. In general, Bowers et al.17 and Watson et al.31 reported 76% good to excellent results with this technique. Since 1973, replacement arthroplasties have been reported for the distal radioulnar articulation.19

van Shoonhoven et al.32 described a substitution hemiarthroplasty indicated in patients with symptomatic resection of the ulnar head, which consists of an intramedullary ulnar stem holding a ceramic head. The results with this hemi-prosthesis have been favorable in 22/23 patients with a mean follow-up of 27 months. The authors reported an increase in grip strength and in the range of motion as well as a significant decrease in pain.

Willis et al.18 also reported their results with a replacement hemi-arthroplasty of the ulnar head and pain and grip strength improved in 17/19 patients. Interposition arthroplasty or ulnar stem substitution depends on soft tissue for stability, which cannot always be performed in posttraumatic cases. The prosthesis used for distal radioulnar articulation designed by Scheker is a full prosthesis that requires no local stabilizers for proper function and replaces both articulate surfaces, preventing bone erosion resulting from contact with metal or ceramic surfaces.2 This advantage of total arthroplasty has previously been well demonstrated in other articulations such as the shoulder and hip.

Semi-constrained distal radioulnar arthroplasty replacement (Aptis) (Figure 5) replaces the sigmoid fossa through
Distal radioulnar arthroplasty

a component that is positioned through a transverse rod coated with plasma as well as with proximal screws. The ulnar head is replaced with an intramedullary rod that is also coated in plasma and placed under pressure, which carries at its distal end the movable component of polyethylene. This arthroplasty allows complete pronosupination movement maintaining a stable ulna through the movements made by the mobile component, with rotation and translation movements of the near-distal direction only. There is no translational anterior-posterior movement as in the natural articulation. The need to clarify the clinical significance of this lack of translation remains because patients have apparently not experienced any clinical impact. This type of arthroplasty is indicated for cases of rheumatoid arthritis, degenerative diseases or post-traumatic situations where patients experience pain or weakness in the wrist, instability of the ulnar head with radiographic evidence of dislocation or erosive changes, failed Darrach or Sauve-Kapandji, primary replacement of complex fractures of the distal ulna or in failed arthroplasties of the ulnar head.

Scheker et al. reported the results of 49 patients with a minimum follow-up of 2 years. The minimum grip strength was 64% compared to the contralateral hand. It is even more important to note that prior to surgery patients could carry an average of 1.2 kg, which increased to 5.3 kg. The pain (according to a scale of 0–5) decreased from 3.8 to 1.3. Supination was 72° (30 to 90°), whereas pronation was 79° (15 to 90°).

In conclusion, the case described here is the first reported of a total bipolar semi-constrained arthroplasty of the distal radioulnar articulation performed in Mexico and exemplifies an indication for use as well as the expected outcomes using this procedure. We believe it is the procedure of choice for rescue of the distal radioulnar articulation in active patients with a high functional demand and is superior to hemicartroplasties of the ulnar head when the replacement of both surface articulates and has an intrinsic stability. Unlike traditional salvage procedures (Darrach and Kapandji), it prevents ulnar impingement and instability of the ulnar stump.

References


