Total Wrist Arthroplasty: A Single-Center Study of 219 Cases With 5-Year Follow-up

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Purpose To assess implant survival and radiographic loosening after total wrist arthroplasty (TWA) operated at a single tertiary referral center in Sweden.

Methods In a prospective cohort study, we evaluated 189 consecutive patients with a TWA (219 wrists). The wrists were implanted between 2002 and 2013. The primary end point was revision for any reason. The mean follow-up period was 7 years (range, 2–13 years). In addition, radiological examination was done for evidence of prosthetic loosening 5 years postoperatively. Implant survival was estimated using the Kaplan-Meier method. Secondary outcome measures included range of motion, visual analog scale pain scores, hand grip strength, and patient-related outcome measures.

Results Cumulative implant survival after 8 years was 81% for Biax, 94% for Remotion, and 95% for Maestro implants. Radiographic loosening was present in 26% of wrists with the Biax design, 18% of those with Remotion, and 2% of those with Maestro. Visual analog scale pain scores and patient-related outcome scores improved significantly for all TWAs. Improved hand grip strength was noted for all TWAs except for the Universal 2. Range of motion improved somewhat, especially for the Biax and Maestro TWAs.

Conclusions Good midterm to long-term results were achieved in patients undergoing TWA. Radiographic loosening did not necessarily correlate with implant survival rates, but rather to severe arthritic destruction of the wrist preoperatively. All TWA implants studied offered a high level of patient satisfaction. *(J Hand Surg Am. 2015;40(12):2380–2387. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic III.

Key words Osteoarthritis, rheumatoid arthritis, total wrist arthroplasty.

TOTAL WRIST ARTHROPLASTY (TWA) is an evolving procedure that may offer pain relief with preservation of functional range of motion in patients with wrist arthritis. Previous designs such as the Biax (DePuy Orthopedics, Warsaw, IN) have demonstrated improved range of motion as well as satisfactory pain relief but also a high frequency of prosthetic loosening.[1–6] In 8 of 11 cases, the cause of failure was distal component loosening.[3] Three currently used TWAs are the Universal 2 (Integra Life Sciences, Plainsboro, NJ), Remotion (Stryker, Kalamazoo, MI), and Maestro (Biomet, Warsaw, IN). Unlike the Biax, which has a carpal component with a central stem and an antirotational peg, these implants fix the carpal component with screws. They also have a modular metal-on-polyethylene articulation. Results after TWA with Maestro[7] and Universal 2[8,9] have been reported in small series of patients with midterm follow-up. Studies exist with larger patient cohorts for the Remotion prosthesis,[10–12] but studies comparing

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different implants are sparse. In a retrospective series, Cooney et al[13] compared the Biax, Remotion, and Universal 2 TWA implants. A study from the Norwegian Arthroplasty Register[6] assessed revision rates for the Biax, Elos, and Gibbon TWA implants. However, only 52% of the TWAs performed were reported in that Register.

The aim of the current study was to assess implant survival and radiographic loosening in a consecutive series of 219 cases with up to 13 years' follow-up, all operated on at a Swedish tertiary referral center by the same surgeon. Implants used were Biax, Universal 2, Remotion, and Maestro. Secondary outcome measures included visual analog scale (VAS) pain scores, patient-related outcome measures, range of motion, grip strength, and tip and key pinch strength.

MATERIALS AND METHODS

The study was approved by our regional ethical committee in Uppsala, Sweden. We obtained verbal and written informed consent from patients in accordance with the Helsinki Declaration. The study was registered in Swedish Public Trials Registry FoU i Sverige Registration number 101841. All TWAs performed at the university hospital in Örebro, Sweden between 2002 and 2013 were included. Indications for TWA were painful radiocarpal arthritis (rheumatoid arthritis [RA] or osteoarthritis [OA]) and x-ray findings corresponding to Wrightington grade 2 to 4.[14] Revision arthroplasties were excluded. A total number of 219 primary arthroplasties were performed in 189 patients (30 patients with bilateral TWA). We used 4 types of prosthesis during this period: Biax (2002−2008), Remotion (2004−2013), Universal 2 (2005−2008), and Maestro (2006−2013). The Biax TWA is an ellipsoidal device with a polyethylene sliding core. Proximal and distal metal parts are porous-coated. The Biax is no longer manufactured. The Remotion TWA has an articular component made of polyethylene articulating with a cobalt chrome-molybdenum alloy. The Universal 2 TWA uses a cobalt chrome radial component and a titanium carpal component. The articulation is ellipsoidal, and the carpal ball component is made of ultra−high-molecular-weight polyethylene. The Maestro TWA consists of a proximal component polyethylene articular surface and a modular carpal component. We used the following criteria to consider a patient for TWA: no signs of infection in the wrist, no skin problem around the wrist, and no need to use crutches for walking. We made the decision to perform TWA after discussion with the patient assessing the amount of pain in the wrist and the need to maintain wrist motion, stressing the need to avoid heavy loading postoperatively. Consecutive TWAs at our institution between 2002 and 2013 were included in the study, and the senior surgeon (K.P.) performed all operations.

Surgical technique

A straight dorsal, longitudinal incision is used; the fourth extensor compartment is incised in a Z-shaped manner; and the joint is incised via a longitudinal T-incision to the joint capsule. The distal radius is exposed subperiosteally in a radial direction and the brachioradialis insertion as well as the first and second dorsal compartments are released. We believe that a careful subperiosteal dissection with meticulous technique is of paramount importance to achieve a stable articulation. All surgical procedures were performed according to the manufacturer's instructions. Only the Biax TWA's distal components were cemented. Implant position is assessed using intraoperative radiography. We did not use locking or multidirectional screws. For the first 2 weeks postoperatively an orthosis was used, first continuously, and then intermittently under the guidance of a hand therapist, with intervening mobilization exercises. Lifting of heavy objects was discouraged (maximum load, 10 kg); otherwise, the patient was allowed to use the wrist fully without an orthosis.

Clinical evaluation

Preoperatively and 1 and 5 years postoperatively, the following outcome measures were registered: pain (VAS scores at rest and with activity); hand grip strength (in kilograms); key pinch strength (in kilograms); tip pinch strength (in kilograms); range of motion (flexion, extension, radial deviation, ulnar deviation, pronation, and supination); Canadian Occupational Performance Measure (COPM) performance and satisfaction; Disabilities of Arm, Shoulder, and Hand (DASH) score; and Patient-Rated Wrist Evaluation (PRWE) score.

All patients rated wrist pain, both at rest and during activity, according to a VAS in which 0 represents no pain and 10 represents the worst pain imaginable. Measurements of grip strength were done by a physiotherapist using a hydraulic hand dynamometer (North Coast Medical, Inc, Gilroy, CA). For key pinch strength and tip pinch strength measurements, a pinch gauge was used (North Coast Medical Inc). A physiotherapist recorded range of motion using a goniometer. Patients completed the Swedish validated translations of the questionnaires for COPM,[15] DASH,[16] and PRWE.[17] The COPM is an individualized outcome