Mod Rheumatol (2004) 14:488–493
DOI 10.1007/s10165-004-0345-y

CASE REPORT

Michio Minami · Sadatoshi Kato · Kazuhiko Hirachi
Masahiro Nagai

A total wrist arthroplasty in rheumatoid arthritis: a case followed for 24 years

Received: March 4, 2004 / Accepted: July 26, 2004

Abstract We report a case of rheumatoid arthritis treated with a total wrist arthroplasty. A Meuli-type total wrist arthroplasty was performed on the left wrist in 1979. We have treated the patient's rheumatoid arthritis with disease-modifying antirheumatic drugs (DMARDs) (Actarit 100 mg and Mijoribine 50 mg) and nonsteroidal anti-inflammatory drugs (NSAIDs) for a total of 26 years before and after the total wrist arthroplasty. The activity of the rheumatoid arthritis has been kept at a low level. The operated wrist was followed up for 24 years postoperatively. It is thought that the antirheumatic treatments over a long period have been very successful in preventing the destruction of the operated wrist.

Key words Long-term follow up · Rheumatoid arthritis (RA) · Total wrist arthroplasty

Introduction

Rheumatoid arthritis (RA) commonly involves the wrist joint, causing pain and instability. Destructive changes in the wrist seen on roentgenograms and the possibility of tendon rupture are indications for surgical intervention. Surgical options vary from synovectomy in early presentation to arthrodesis in later stages of instability and deformity.

Interest in arthroplasty of the wrist joint was stimulated early by the one-piece silicone interposition device designed by Swanson et al.[1] The total wrist arthroplasties of Meuli[2,3] and Volz[4,5] failed to win wide acceptance, partially because of the easier silicone device and partially owing to their limited success. These results dampened enthusiasm for further clinical studies and inhibited the refinement of arthroplastic techniques. Thus cautioned, many surgeons returned to refining the options of arthrodesis. This report of the satisfactory outcome of a total wrist arthroplasty with a long-term follow up is the first to our knowledge.

M. Minami (✉) · S. Kato · K. Hirachi · M. Nagai
Hokkaido Orthopedic Memorial Hospital, 7-1 Hiragishi,
Toyohira-ku, Sapporo 060-0937, Japan
Tel. +81-11-812-7001; Fax +81-11-823-9567
e-mail: mminami@abox6.so-net.ne.jp

Case report

A 33-year-old woman complained of pain and swelling in both wrist joints. Rheumatoid arthritis was diagnosed and she was treated with NSAIDs for 7 years. At the age of 40, she came to our clinic with severe pain in the left wrist. The wrist was swollen and tender to touch on the radiocarpal and midcarpal joints. The distal ulnar head was dorsally subluxated and tender to touch, with a piano key sign. The range of motion of the left wrist was 60° (30° in extension and 30° in flexion) with pain. Supination and pronation were almost normal, but were painful in maximal rotations. Roentgenograms of the left wrist showed stage IV in Larsen's classification (Fig. 1). The patient's right wrist was only slightly swollen, was not tender to the touch, and had a full range of motion. Roentgenograms of the right wrist were almost normal (Fig. 2). A physical examination showed an ESR of 32 mm/h, CRP(+), and RA(±). The patient had a job as a registrar in the market and wished to continue working. She therefore rejected arthrodesis of her left wrist. We performed a total wrist arthroplasty with a Meuli wrist prosthesis (Fig. 3) on June 9, 1979.

In the operation, the left wrist was exposed between the third and forth dorsal compartments. The distal ulnar head was resected, and rheumatoid synovitis of the radiocarpal, midcarpal, and distal radioulnar joints was removed. The articular cartilage of the radius, the lunate, the triquetrum, and the proximal scaphoid were minimally excised. We then made holes in the base of the second and third metacarpal bones to insert the stems of the carpal components. The proximal stem was inserted into the medullary cavity of the radius. The distal and proximal implants were reduced by the spherical middle component (Fig. 4). Both implants were seated with cement. We obtained intraoperative

Fig. 1. Roentgenograms of the left wrist

Fig. 2. Roentgenograms of the right wrist

roentgenograms to ensure the proper alignment and seating of the implants. The dorsal capsule and retinaculum were snugly sutured. The left wrist was immobilized with a short arm splint for 10 days (Fig. 5A,B) and then active exercise was started. The left wrist was checked periodically.

Figure 6 shows the roentgenograms obtained during the 16 years following the operation. There was no loosening or

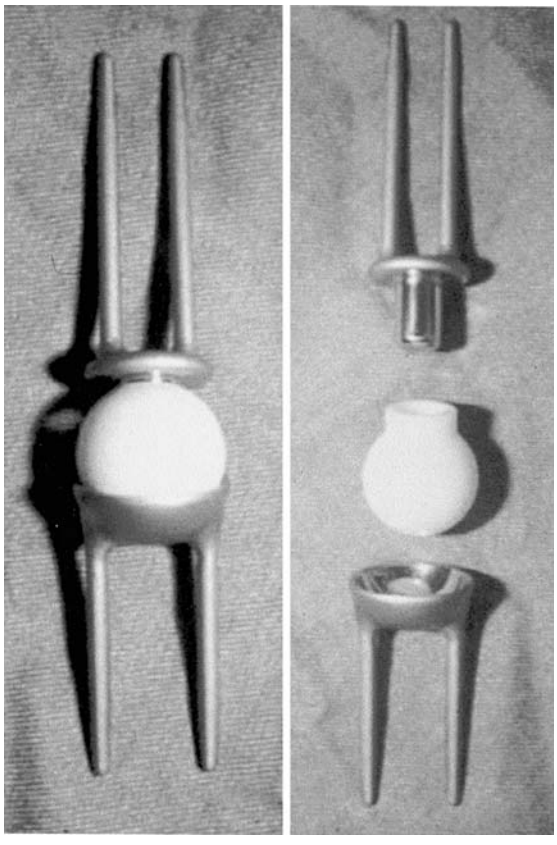

Fig. 3. Meuli's prosthesis

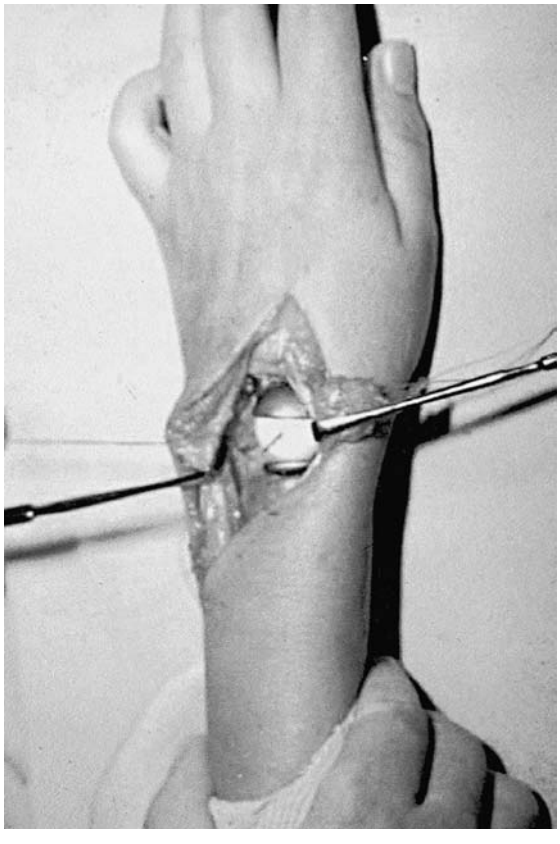

Fig. 4. Intraoperative photograph

Fig. 5. **A** Postoperative roentgenogram (anteroposterior view). **B** Postoperative roentgenogram (lateral view)

Fig. 6. Roentgenogram of the left wrist at the 16-year postoperative follow-up

Fig. 7. The ulnar deviation of the left wrist

dislocation of the implants, excluding ulnar deviation. In a postoperative follow-up after 24 years, the left wrist had deviated ulnally by 23° (Fig. 7). The patient could radially deviate her left wrist by 3°, extend it by 40°, and flex it by 30°. Pronation was 80° and supination was 70° without pain (Fig. 8). At this time, her ESR was 28 mm/h, CRP (+), and RA(−). After surgery, there was no recurrence of synovitis, and no destructive changes were shown on the roentgenograms of the left wrist joint, indicating that the treatment had been a success (Fig. 9). There was no synovitis of the right wrist, which has a full range of motion, and no destruction was seen in roentgenograms (Fig. 10).

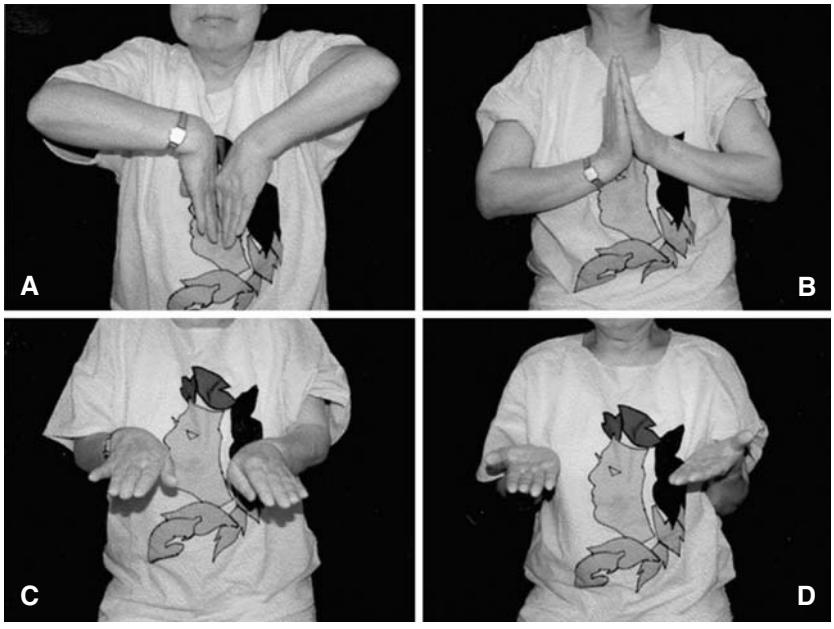

Fig. 8. **A,B** The motion of the left wrist (extension–flexion).**C,D** The motion of the left wrist (pronation–supination)

Fig. 9. **A** Roentgenogram at the 24-year postoperative follow-up (anteroposterior view). **B** Roentgenogram at the 24-year postoperative follow-up (lateral view)

Discussion

Themistocle Gluck performed the first total wrist arthroplasty in 1890 on a 19-year-old man whose wrist was destroyed by tuberculosis. The Meuli prosthesis was designed primarily for rheumatoid wrists and used a modification of a ball and socket prosthesis analogous to total hip prostheses.[3,6] Both designs used a metacarpal component with two prongs that were to be inserted into the 2nd and 3rd metacarpal medullary cavities. The third generation of wrist prosthesis is represented by the trispherical, biaxial, and MWP (3rd revision of the Meuli design) prostheses.[6] All utilize offsets of the articulating surfaces relative to the proximal and distal stems to ensure that the center of rotation of the prosthesis is aligned with the physiological center of rotation in the head of the capitate. The trispherical prosthesis incorporates a pinned universal joint

Fig. 10. Roentgenograms of the right wrist

mechanism that minimizes the chance of dislocation while providing adequate joint motion (85° flexion, extension, and 10° of radioulnar deviation). The metacarpal component also has two stems that are inserted into the 2nd and 3rd metacarpal bones. The radial component has an ulnar offset of the articular surface to aid the accurate positioning of the center of rotation. Beckenbaugh's prosthesis is a representative of a biaxilar total wrist prosthesis. It has an ellipsoid design that is semiconstrained, and a porous coating on the prosthetic stems.[7] In 2003, Rizzo and Beckenbaugh[8] reported on 17 wrists which had been implanted with a biaxial total wrist prosthesis with a long metacarpal stem. These patients were followed up for 73.9 months on average, and the authors reported that all of the postoperative outcomes were better than in previous reports, and complications were minor. The MWP III[9] (Meuli prosthesis) retains two radially offset stems for the 2nd and 3rd metacarpal in the design of the distal component. The proximal stem is offset slightly toward the radial side. This is made of a titanium-6–aluminum-7–niobium wrought alloy prostasal-100 (Sulger Orthopedics, Winterphur, Switzerland). The surface is rough-blasted. The head of the ball is coated with titanium nitride. Cooney et al.[10] reported 20 excellent, 10 good, 2 fair, and 6 poor outcomes in 38 wrists fitted with the Meuli prosthesis. Eight reoperations, 4 arthrodeses, and 4 revisions were carried out for malpositioning or prosthetic loosening. One revision was performed for bony ankylosis.

This device appears unstable on X-rays of the site of a metacarpal fracture at the end of the prosthetic stem. The design and materials of the wrist total prosthesis have been developed very slowly. However, because of the high incidence of complications associated with total wrist arthroplasty, many patients consider total or partial carpal arthrodesis to be a preferable procedure. A total carpal arthrodesis provides stability and excellent relief of pain, and is readily achieved in wrists with advanced destruction. However, limited motion may be a problem if there is concomitant involvement of the shoulders or elbows.

A partial or limited arthrodesis may offer a sound alternative for the less advanced case. Preservation of a limited amount of motion at the wrist joint translates into an increased functional range of finger-tip motion. A radiolunate arthrodesis can stabilize the ravaged radiocarpal joint while preserving motion in the intercarpal joint. Less often, intercarpal fusion may be preferable to radiocarpal fusion. A similar effective procedure is the surgical development of a fibrous or "nonunion" arthroplasty. This arthroplasty is prepared by following a concavity in the distal radial articular surface into which a convexly prepared carpus is placed with or without the interposition of fascia or plastic sheeting. The prepared "nested" position is held with crossed K-wires for 2 weeks before mobilization is begun. Minamikawa[11] has introduced a similar promising interposition arthroplasty utilizing tendons.

The long-term results of total wrist arthroplasty are still miserably poor; it is unreliable in comparison with other surgical procedures for the rheumatoid wrist.

However, in the case reported here, because the activity of the rheumatoid arthritis has been successfully inhibited for a long time after surgery, articular destruction, bone atrophy, and osteoporosis of the operated wrist have not progressed.It is therefore thought that the axis of motion of the inserted prosthesis has been preserved at the level of the normal anatomical and biomechanical axis of wrist motion for 24 years postoperatively. In order to achieve good results from total wrist arthroplasty, there are some important factors to take into consideration. It can be presumed that the design and material of the wrist prosthesis itself will be further improved, but all cases of total wrist arthroplasty should be kept under close supervision, and the best available antirheumatic treatment should be continued after surgery.

Summary

A Meuli-type total wrist arthroplasty with a 24-year follow-up period was reported. This case has a longer follow-up period than any previous reports. The persistent and appropriate treatment for rheumatoid arthritis resulted in a decrease in pain and good movement in the operated wrist joint. However, a total wrist arthroplasty is still unreliable in comparison with the alternative arthrodeses available for the rheumatoid wrist. We expect total wrist implants to improve considerably in the future.

Acknowledgment The authors thank Ronald L. Linscheid, Department of Orthopedics, Mayo Clinic, Rochester, MN, USA, for his interest and guidance in this investigation.

References

1. Swanson AB, Swanson GG, Maupin KB. Flexible implant arthroplasty of the radiocarpal joint. Surgical technique and long-term study. Clin Orthop 1984;187:94–106.
2. Meuli HC. Arthroplasty of the wrist. Clin Orthop 1980;149:118–25.
3. Meuri HC. Meuli total wrist arthroplasty. Clin Orthop 1984;187: 107–11.
4. Volz RG. The development of a total wrist arthroplasty. Clin Orthop 1976;116:209–14.
5. Volz RG. Total wrist arthroplasty. A clinical review. Clin Orthop 1984;187:112–20.
6. Meuli HC, Fernandez DL. Uncemented total wrist arthroplasty. J Hand Surg [Am] 1995;20:115–22.
7. Beckenbaugh RD, Linscheid RL. Arthroplasty in the hand and wrist. In: Green DP, editor. Operative hand surgery. 3rd ed. Vol. 1. New York: Churchill Livingstone; 1993. p. 143–87.
8. Rizzo M, Beckenbaugh RD. Results of biaxial total wrist arthroplasty with a modified (long) metacarpal stem. J Hand Surg [Am] 2003;28:577–84.
9. Meuli HC. Total wrist arthroplasty. Experience with a noncemented wrist prosthesis. Clin Orthop 1997;342:77–83.
10. Cooney WP III, Beckenbaugh RD, Linscheid RL. Toal wrist arthroplasty. Problem with implant failures. Clin Orthop 1984;187: 121–8.
11. Minamikawa Y. Arthroplasty of the rheumatoid wrist without implant replacement (in Japanese). Rinschou Seikeigeka (Clin Orthop Surg) 1999;34:1117–23.