Poor experience with a hinged endoprosthesis (WEKO) for the metacarpophalangeal joints

All 28 prostheses removed within 2 years in 8 patients having rheumatoid arthritis

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Submitted 02-07-02. Accepted 03-01-03

ABSTRACT We prospectively assessed the outcome of implanting a hinged prosthesis in destroyed metacarpophalangeal (MCP) joints (Larsen stage III-V). We implanted 28 cementless, axis-coupled total endoprostheses with hinging (WEKO prosthesis, Implant-Service GmbH, Hamburg, Germany) in 8 women (mean age 62 (47–80) years) suffering from rheumatoid arthritis. The mean follow-up period was 15 (12–18) months, and the evaluation was based on objective criteria, including joint motion, ulnar deviation of the long fingers, grip strength, radiographic migration and torsion of the prostheses, as well as the patients' subjective satisfaction. 12 months postoperatively, the mean arc of flexion was 30 (22–35)°, and the mean extension lag was 43 (40–48)°. Although no ulnar deviation was seen in 2 fingers, it was < 10° in 3, between 10° and 20° in 7 of the fingers, and more than 20° in 16. None of the patients could clench their fist firmly. We found prosthesis migration in 20 and torsion in 19 fingers. 2 years postoperatively, we had to remove all of the prostheses due to functional failure.

Various prosthetic models have been developed for rheumatoid finger joints (Beckenbaugh et al. 1976, Adams et al. 1990), since the coupled metal/metal prosthesis designed by Brannon and Klein in 1959. However, rather than a normally functioning joint, the outcome of total endoprosthetic replacement of the MCP joints thus far has been relief of pain with poor motion. The Swanson silicone-elastomer interpositional spacer is the most commonly used implant for metacarpophalangeal joint arthroplasty (Beevers and Seedhom 1995). With this implant, various complications can occur, such as a return of the ulnar drift, implant fracture or considerable variability of joint motion (Beckenbaugh et al. 1976, Blair et al. 1984a). We tried therefore a new prosthetic design, a hinged total prosthesis for the MCP joints, and present the outcome.

Patients and methods

We inserted 28 MCP joints with a cementless axis-coupled implant (WEKO prosthesis, Implant-Service GmbH, Hamburg, Germany) in 28 MCP joints of 8 women having rheumatoid arthritis, mean age 62 (47–80) years. In all patients, hand function was severely impaired by deformities and pain, and the joints operated on showed considerable destruction, radiographic stage III–V (Larsen et al. 1977).

The prosthesis consists of 5 components, 2 medullary sockets for fixing the prosthesis in the metacarpal bone and the proximal phalanx of the finger, a prosthesis prong, a prosthesis head, and the axis for coupling the head and the prong (Figure 1). The medullary sockets are made in 6 sizes, the prosthesis itself is available in one standard size. The med-

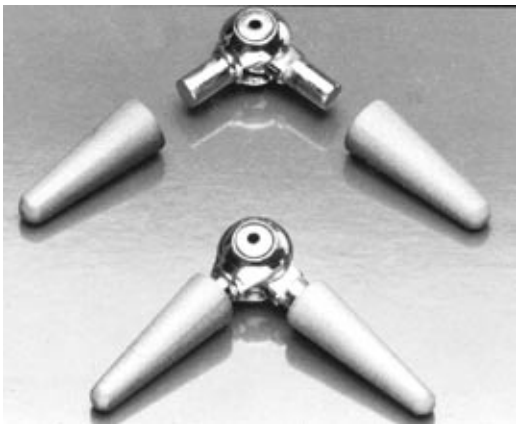

Figure 1. Metacarpophalangeal prosthesis: The prosthesis consists of two medullary sockets for fixing the actual prosthesis in the metacarpal bones and the proximal phalanx of the finger, a prosthesis prong, a prosthesis head, and the axis for coupling the head and the prong.

ullary sockets are made of titanium and are porous-coated. In addition, the sockets, except the smallest size, have a slot at the tip, through which spongiosa can be inserted. The articular components are made of a chrome-cobalt alloy with a titanium-niobium coating. The joint permits a range of movement in extension/flexion of +5/90° and a total radial/ulnar movement of 4°–6°.

Surgery was performed via a longitudinal dorsal approach, according to the manufacturer's instruction. In some cases, the extensor hood was reefed to stabilize and position the extensor tendon.

Postoperatively, the hand was immobilized in a palmar forearm plaster splint for 2–3 days, after which the patients used a dynamic splint for 6 weeks. Physiotherapeutic exercises for the fingers were performed out of the splint, without any limitation of movement.

All patients were examined 12 months after surgery, and told to return if they had any complaints. The follow-up examinations included measurements of motion, determination of ulnar deviation, measurement of grip strength in kPa (1 kPa = 10^3N m^{-2}), using a grip meter, and radiographic examinations. They were asked to rate their pain as none, moderate or severe, and to fill in a patient's questionnaire about whether they were very satisfied, satisfied or dissatisfied with the outcome of the operation.

Results

Clinical evaluation

Preoperatively, all of the patients had a subluxation or dislocation of the MCP joints with marked ulnar deviation. The average active flexion was 30 (15–40)°, and the average extensor lag was 55 (40–100)°.

At 12 months postoperatively, the average active flexion was 30 (22–35)°, and the average extensor lag was 43 (40–48)°. Preoperatively, the ulnar deviation was average 50 (25–90)°, and all patients showed good correction immediately after surgery, but again at 12 months, the average ulnar deviation was 20 (0–50)°.

None of them could make a strong fist preoperatively, the grip value being average 17 (5–30) kPa. It was the same after surgery, 18 (5–35) kPa.

Radiographic evaluation

Immediately after the operation, the implants were in a correct position radiographically in all patients (Figure 2). At 12 months postoperatively, 20/28 of the prostheses had migrated, and torsion was seen in an additional 19 cases.

Subjective outcome

In the first postoperative weeks, all patients were satisfied with the cosmetic outcome of the operation, which was mainly because of correction of the ulnar drift. Preoperatively, 4/8 patients complained of severe pain, 4/8 had moderate pain. 12 months postoperatively, 5/8 patients had no pain, 2/8 moderate and 1/8 complained of severe pain. 6 of these 8 patients were dissatisfied with the outcome.

Further clinical course and complications

2 superficial wounds developed minor problems, but healed uneventfully without complications. No deep wound infections occurred. As a result of the rotation in 19 and migration in 20 of the prostheses after 12 months, revision surgery had to be performed in 19 cases, due to an increase in functional loss. During the next 6 months, a drastic clinical and functional deterioration occurred in the remaining 9 prostheses, with a reduction in flexion and an increase in ulnar drift, corresponding radiographically to an increase in malrotation

Figure 2. 3 weeks postoperatively: Correct alignment and positioning of the prostheses.

Figure 3 a. Note severe destruction of the MP-joints showing subluxation and ulnar drift.

b. Joint prostheses after 12 months with severe subsidence of the medullary socket in the ring finger with bone resorption around the prosthesis and cortical erosion by the medullary socket placed in the metacarpal bone. Not recurrence of ulnar drift of all digits with torsion of the medullary sockets and of the prostheses stems in the sockets.

and migration of the prostheses. This meant that revision surgery became necessary also in these patients (Figure 3). In all 28 cases, the prostheses were removed and a Swanson spacer was inserted. Intraoperatively, we found marked black staining of the surrounding soft tissue and bone due to titanium wear.

Discussion

In rheumatoid arthritis with severe joint destruction, a hinged prosthesis may be needed for better stability. The prosthesis first developed by Brannon and Klein (1959) had a coupling and the initial results looked promising. However, later on, motion decreased and extensor lag increased. In a long-term study by Blair et al. (1984b), the final average motion was only 24°, in addition to which a recurrence of ulnar deviation was seen in half of the patients, and half of the prostheses fractured. In many cases, the radiographic findings showed bone resorption and migration (Blair et al. 1984). The results with the hinged prosthesis developed by Griffiths and Nicolle (1975) have also been disappointing.

The prosthesis we used was cementlessly implanted with plasma-coated titanium medullary sockets. The coupling is by a loose hinge made of a cobalt-chrome alloy with a titanium-niobium coating as an articular center-piece, to provide lateral stability for correction of the ulnar deviation. The loose hinge mechanism allows not only slight abduction and adduction, but also the possibility of a minor three-point change during flexion in accordance with the physiology, which should reduce the forces exerted on the prosthesis and hope fully prevent loosenings and prosthesis fractures. However, all the 28 prostheses we inserted migrated and rotated rapidly and had to be removed. Möller et al. (1999) reported an osteointegration rate of 98% for the titanium fixture of the prosthesis developed by Lundborg et al. (1993) which has also a constrained design. In that study, a fracture rate of the spacer of 25% was seen after 28 months. In our opinion, the differences between the two designs is the silicone spacer of the Lundborg prosthesis, that is not strong enough to transmit the high forces acting on the MCP joint of the titanium screws, which may explain the high rate of osteointegration and high fracture rate of the spacer.

It should be ointed out that although the sockets were malrotated, we found good osteointegration in all of the cases, so that removal was difficult and, in some cases, could only be done after fenestration of the bone with considerable loss of bone. In our patients, the longest implantation time of the prosthesis was 2 years. This short time clearly explains why we found no prosthesis fractures, as reported with other prosthesis designs (Griffiths and Nicolle 1975, Derkash et al. 1986, Schmidt et al. 1998).

The extent to which new prosthesis designs will imitate the complex mechanics of the MCP joints (Chao et al. 1976) and thus reduce the forces acting on the prosthesis remains to be seen. We do not believe that a prosthesis without coupling, like the carbon prosthesis presented by Cook et al. (1999), is satisfactory for patients with rheumatoid arthritis, because the stabilizing soft tissues necessary for this design are destroyed in rheumatoid arthritis. The most reliable long-term results to date have been obtained with the silicone implants used throughout the world (Beckenbaugh et al. 1976, Schmidt et al. 1998), with high patient satisfaction despite various complications—e.g., fracture, bone resorption, foreign body reaction and a recurrence of the preoperative deformity (Swanson 1972, Worsing et al. 1982).

No competing interests declared.

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