Flexible hinge toe implant arthroplasty for rheumatoid arthritis of the first metatarsophalangeal joint: long-term results

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Abstract We report the long-term clinical results and survival rate of the implant in flexible hinge toe implant arthroplasty of the first metatarsophalangeal joint, combined with a shortening oblique osteotomy of the metatarsal neck in the lateral toes, in patients with rheumatoid arthritis. Between 1983 and 1990, arthroplasty was performed on 97 feet in 66 patients. Twenty-seven patients died; follow-up information was available for 60 feet in the remaining 39 patients, who were followed for an average of 12 years. Twenty-nine patients (74%) were satisfied with the outcome after surgery, 7 were satisfied but had some pain or recurrent deformities, and 3 were unsatisfied. Radiologically, visible fracture was identified in nine implants. Four implants were removed because of infection (n = 2) or recurrent deformity (n = 2); no implant was removed because silicone synovitis developed. With revision as the endpoint, the implant survival rate was 93% at 10 years, and with radiographic implant fracture as the endpoint, the implant survival rate was 87% at 10 years. Shortening oblique osteotomy of the lateral toes appeared to decrease the rate of implant fracture and should be performed concomitantly with implantation when rheumatoid forefoot deformities are being reconstructed.

Key words Metatarsophalangeal joint · Rheumatoid arthritis · Silicone elastomers · Joint prosthesis

Introduction

Rheumatoid arthritis produces characteristic deformities of the forefoot, consisting of hallux valgus, clawing of the lateral toes, and dorsal dislocation of the metatarsophalangeal joints. Over the years, a number of techniques have been devised to correct these deformities. The current treatment of choice is excision of the metatarsal heads, with or without removal of the base of the phalanges.3,6,14

Our approach to reconstructing forefoot deformities in patients with rheumatoid arthritis is based on preservation of metatarsophalangeal joint function. In the lateral toes with mild or moderate joint destruction (Larsen grades I, II, and III16) a shortening oblique osteotomy of the metatarsals is performed. With severe joint destruction (Larsen grades IV and V), the metatarsal head is resected. Arthrodesis of the first metatarsophalangeal joint is performed as a rule when resection arthroplasty in the lateral toes is performed. When shortening oblique osteotomy in the lateral toes is indicated, the great toe is managed as follows: in young patients with mild joint destruction in the great toe (Larsen grades I and II) and in patients who are able to ambulate well, Mitchell’s osteotomy is done.17 In older patients, or in patients with moderate or severe joint destruction (Larsen grades III, IV, and V), a flexible hinge toe prosthesis is implanted.

The recovery period after silicone implant arthroplasty of the first metatarsophalangeal joint with resection arthroplasty in the lateral toes has been reported to be shorter than that with other reconstructive procedures.25 However, several mid-term follow-up studies reported a high and increasing rate of implant failure, which led to abandonment of the procedure.8,13,18 Additionally, silicone synovitis now is a well recognized complication of silicone implant wear.1,16,23,30

In this study, we determined long-term results in patients with rheumatoid arthritis who had undergone flexible hinge toe implant arthroplasty of the first metatarsophalangeal joint, combined with shortening oblique osteotomy of the metatarsal neck in the lateral toes. Particular attention was paid to the survival rate of the implant.

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Operative technique

Surgery was performed with the patient under general or regional anesthesia with tourniquet hemostasis. The first metatarsophalangeal joint was exposed through a medial approach. The medial capsule of the first metatarsophalangeal joint was incised in a V-shaped fashion, leaving a distally based flap on the proximal phalanx for later closure and correction of the valgus deformity. The lateral capsule and tendons of the adductor hallucis were released when severe valgus deformity was present. The head of the metatarsal was excised distal to the metatarsal flare, and the medial bony prominence was also removed. Using Swanson’s rasp and reamer, rectangular intramedullary canals were created, and an implant of appropriate size was selected, using sizers. A 3-0 Dacron suture was passed through 0.7-mm drill holes made in the medial portion of the metatarsal to secure the medial capsular flap. After irrigation, the implant was inserted using the no-touch technique. The medial capsular flap was closed securely.

A shortening oblique osteotomy of the metatarsal neck was performed in the lateral toes. In almost all patients, a few millimeters of the proximal stump was also resected, parallel to the line of the original osteotomy. The distal head fragment was tilted 90° plantarward, using the collateral ligament as a hinge, and the plantar scar tissue was separated subperiosteally. Any osteophytes that had developed on the plantar aspect of the metatarsal head were also resected. The second through fifth metatarsals were managed similarly. The length of the metatarsals of the lateral toes was adjusted, making the second metatarsal bone the longest, followed by the third, fourth, and fifth. It was important to adjust the length of each toe. After these procedures, the stumps of the osteotomized bone were closed and fixed longitudinally with a 1.2-mm diameter Kirschner wire from the distal phalanx to the metatarsal shaft, sliding up the distal fragment at the osteotomized site. A shoe-type cast was applied for about 3 weeks postoperatively. Weight-bearing was started 1 week after surgery. An arch support with a metatarsal bar was worn for 2 or 3 months until bony fusion was complete.

Subjects and methods

Between 1983 and 1990, arthroplasty of the first metatarsophalangeal joint was performed on 97 feet in 66 patients with rheumatoid arthritis (60 women and 6 men), using a flexible hinge toe implant (Dow Corning Wright, Arlington, TN, USA). The average age of the patients was 57 ± 11 years (range, 29 to 84 years). An average of 12 years postoperatively (range, 9 to 15 years), 39 of the original 66 patients completed a questionnaire; the remaining 27 patients had died. The patients’ subjective reports were corroborated by correspondence with relatives or the patient’s primary physician. No patient who died had undergone reoperation. Follow-up evaluation was available for 60 feet in the 39 patients (38 women and 1 man). The average age at the time of operation was 52 ± 11 years (range, 29 to 79 years). The average interval from the diagnosis of rheumatoid arthritis to the time of operation was 17 ± 8 years (range, 5 to 39 years). Eighty-two percent of patients had undergone total knee and/or hip arthroplasty.

All patients were interviewed regarding gait pain, type of shoes worn, and degree of satisfaction with the operation results. Recurrent callus formation and passive range of motion in the metatarsophalangeal joint of the great toe were recorded. Weight-bearing anteroposterior and lateral radiographs were taken of 58 feet; 2 feet were excluded because of infection. The hallux valgus angle and the first-second intermetatarsal angle were measured on the preoperative, immediate postoperative, and most recent radiographs. The length of the great toe was also measured. Any bony reactions on the osteotomized stumps or bone/implant interface were noted. When the distance between the proximal and the distal bony edge of the great toe was less than 50% of the height of the midsection of the implant, this was regarded as sinking of the implant.

The integrity of each implant was graded on the basis of gross radiographic appearance, using a modified Granberry’s classification system, according to the following scale: grade 0, no evidence of deformation or fracture; grade 1, deformation or suspected fragmentation; and grade 2, visible fracture of the stem or the hinge. An implant that appeared deformed radiographically was assumed to have had a mechanical failure, while one that had a normal radiographic appearance was considered undamaged. Peimer et al. have described the radiographic characteristics of silicone synovitis, which include endosteal scalloping and widening from cortical resorption. Any such findings were recorded.

Statistical analysis

All data values are expressed as means ± SD. Differences between means were assessed using two-tailed unpaired t-tests. A P value of less than 0.05 was considered statistically significant. The survival rate of the implants was calculated using the Kaplan-Meier method.

Results

Clinical evaluation (Fig. 1)

Preoperatively, all 97 feet had caused mild to severe pain. At the follow-up, 46 of 58 feet were pain-free.