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ORIGINAL ARTICLE

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Partial tarsal arthrodesis for rheumatoid feet

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Abstract Partial intertarsal joint arthrodesis was performed on 12 feet of 11 patients as a surgical treatment for planovalgus deformity of the foot and lesions of the intertarsal joints caused by rheumatoid arthritis. Single arthrodesis was performed on the talocalcaneal joint in eight feet, two of which underwent simultaneous total ankle arthroplasty, and on the talonavicular joint in two feet. Double arthrodesis was done on the talocalcaneal and talonavicular joints in one foot and on the talonavicular and calcaneocuboid joints in one foot. Screws or staples were used for fixation. Patients were followed for 2 years to 8 years 7 months (average 4 years 3 months). Osseous fusion was achieved in all feet, and satisfactory pain relief was obtained in all cases except one. We performed this surgery in patients who were relatively active, and the results indicated that arthrodesis of a small number of joints that caused pain and deformity was effective in reducing pain and correcting the deformity. We concluded that partial tarsal arthrodesis should be performed on a limited number of joints during the early stages of planovalgus deformity of the foot because more joints are found to be fixed during the advanced stages. However, progression of the osteoarthritis was found in the neighboring joints. Close follow-up observation is needed.

Key words Arthrodesis · Intertarsal joint · Rheumatoid arthritis · Talocalcaneal joint · Talonavicular joint

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Introduction

It has been reported that the intertarsal joints of the midfoot and hindfoot are frequently affected in patients with advanced rheumatoid arthritis.[1,2] However, there have been few studies on the treatment of intertarsal joints, and no therapeutic procedure has been established, whereas treatment of rheumatic forefoot deformities and ankle lesions has been well documented. We have performed arthrodesis of the talocalcaneal joint or transverse tarsal joints as a surgical treatment for articular destruction and planovalgus deformity of the foot due to rheumatoid arthritis since 1994. In this study, we retrospectively investigated the outcomes of this technique to evaluate its efficacy as a surgical intervention for the rheumatic foot.

Subjects and methods

A follow-up study was carried out on 12 feet of 11 patients who had consecutively undergone partial tarsal arthrodesis in our hospital since 1994: three feet in three men and nine feet in eight women aged 28 to 65 years (average 53 years) (Table 1). Direct examination was performed for all patients. The duration of illness ranged from 5 to 43 years (average 16 years).

Surgical operations performed in the past were bilateral total knee arthroplasty in three patients, resection arthroplasty of the metatarsophalangeal joints in both feet in three patients, unilateral or bilateral wrist arthroplasty or synovectomy in four patients, total elbow arthroplasty in one patient, and synovectomy of the shoulder in one patient. Three patients who had undergone resection arthroplasty complained of tarsal pains 7–10 years after the surgery. Three patients had undergone no previous surgery.

Partial tarsal arthrodesis was performed on patients in advanced stages of rheumatoid arthritis; eight feet were in stage 4 and four in stage 3 according to Steinbrocker's criteria. On a functional basis, four feet were in class 3 and

Table 1. Clinical and radiographic results

Case	Age	Sex	Side	Stage	Class	Procedures	Follow-up duration (months)	Clinical results (AOFAS Ankle Hindfoot Score)							Radiographic measurements			
								Pre-op				Post-op			Pre-op		Post-op	
								Pain	Function	Alignment	Total	Pain	Function	Alignment	Total	CP	T1MA	CP	T1MA
1	30	F	Right	3	2	TC	24	0	31	5	36	10	19	5	34	12	42	11	14
	28	F	Left	3	2	TC	51	0	31	5	36	30	19	5	54	12	40	17	10
2	56	F	Left	4	2	TC	29	20	30	5	55	30	27	10	67	9	10	7	23
3	65	F	Right	4	2	TC	59	20	35	5	60	30	23	10	63	11	39	10	21
4	51	M	Left	4	2	TC	72	20	33	5	58	30	31	10	71	21	19	21	19
5	63	F	Left	4	3	TC	73	20	32	5	57	40	36	10	86	12	12	11	6
6	58	F	Right	4	2	TC	103	0	23	5	28	40	18	5	63	11	38	8	19
Case 1–6																			
Mean	50.1						58.7	11.4	30.7	5.0	47.1	30.0	24.7	7.9	62.6	12.6	28.6	12.1	16.0
SD	14.0						25.3	9.9	3.5	0.0	12.3	9.3	6.4	2.5	14.8	3.6	13.2	4.7	5.8
7	59	F	Left	4	3	TAA, TC	28	20	29	5	54	30	37	10	77	5	1	5	25
8	45	F	Left	4	3	TAA, TC	36	20	7	0	27	30	31	5	66	14	13	12	19
9	62	F	Right	3	2	TN, CC	43	0	25	10	35	40	32	10	82	13	6	11	18
10	58	M	Right	3	2	TN	48	20	28	5	53	40	37	10	87	14	17	14	19
11	65	M	Left	4	3	TN	67	20	28	5	53	40	28	5	73	4	18	6	16
Case 1–11																			
Mean	53.3						52.8	13.3	27.7	5.0	46.0	32.5	28.2	7.9	68.6	11.5	21.3	11.1	17.4
SD	12.2						22.3	9.4	7.0	2.0	11.9	8.3	6.8	2.5	14.1	4.2	13.9	4.4	5.1

SD, standard deviation; TC, talocalcaneal arthrodesis; TAA, total ankle arthroplasty; TN, talonavicular arthrodesis; CC, calcaneocuboid arthrodesis; CP, calcaneal pitch; T1MA, talo-1st metatarsal angle

eight in class 2, indicating that the patients retained high activity despite their advanced stages of rheumatoid arthritis. Isolated arthrodesis was performed on the talocalcaneal joint in eight feet, two of which underwent simultaneous total ankle arthroplasty. Isolated arthrodesis of the talonavicular joint was performed in two feet. Double arthrodesis was done on the talocalcaneal and talonavicular joints in one foot and on the talonavicular and calcaneocuboid joints in one foot. Postoperative follow-up periods ranged from 2 years to 8 years 7 months (average 4 years 3 months).

The surgical technique for the talocalcaneal arthrodesis was as follows: An arch-shaped skin incision was made immediately above the sinus tarsi. The posterior facet of the talocalcaneal joint was exposed, and the synovial membrane and remaining cartilage were curetted. Staples were used for fixation in the three early cases, and AO screws were employed in the five later cases to fix the posterior region of the bottom of the calcaneus or the dorsal region of the neck of the talus. The other joints were also fixed with AO screws. After the operation, a plaster cast was applied for 4–6 weeks. Partial loading was started during the second week, and full loading was allowed after 1 month.

Preoperative and current clinical conditions were evaluated based on the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale.[3] Radiographic examination included weight-bearing anteroposterior (AP) and lateral views of the foot and weight-bearing AP views of the ankle. Weight-bearing subtalar views were also obtained for eight feet.[4] The fusion rate was obtained from the X-ray images, and the progression of the osteoarthritic changes was assessed in joints adjacent to the fixed joints. The calcaneal pitch and the talo-first metatarsal angle[5,6] were measured from the weight-bearing lateral radiographs of the foot obtained preoperatively and at follow-up. The calcaneal pitch was the angle between the tangent line of the inferior border of the calcaneus and the line from the inferior border of the calcaneus to that of the medial sesamoid. The talo–first metatarsal angle was the angle between the axes of the talus and the first metatarsal.

Results

Osseous fusion was achieved in all feet. Satisfactory pain relief was also obtained in all feet with the exception of the right foot of case 1 (mutilans type). In this foot, valgus deformity of the ankle joint progressed postoperatively. Based on the AOFAS scale, the mean pain score changed from 13.3 points before operation to 32.5 points at follow-up, showing a marked improvement (Table 1). From a functional aspect, most patients had shown a quite limited range of motion preoperatively, and only a slight decrease was observed after operation. In contrast, activities, walking ability, and stability were slightly improved. As a result, there was no significant change in the function score. Alignment was also improved. The mean values of the total scores eventually increased from 46.0 to 68.6.

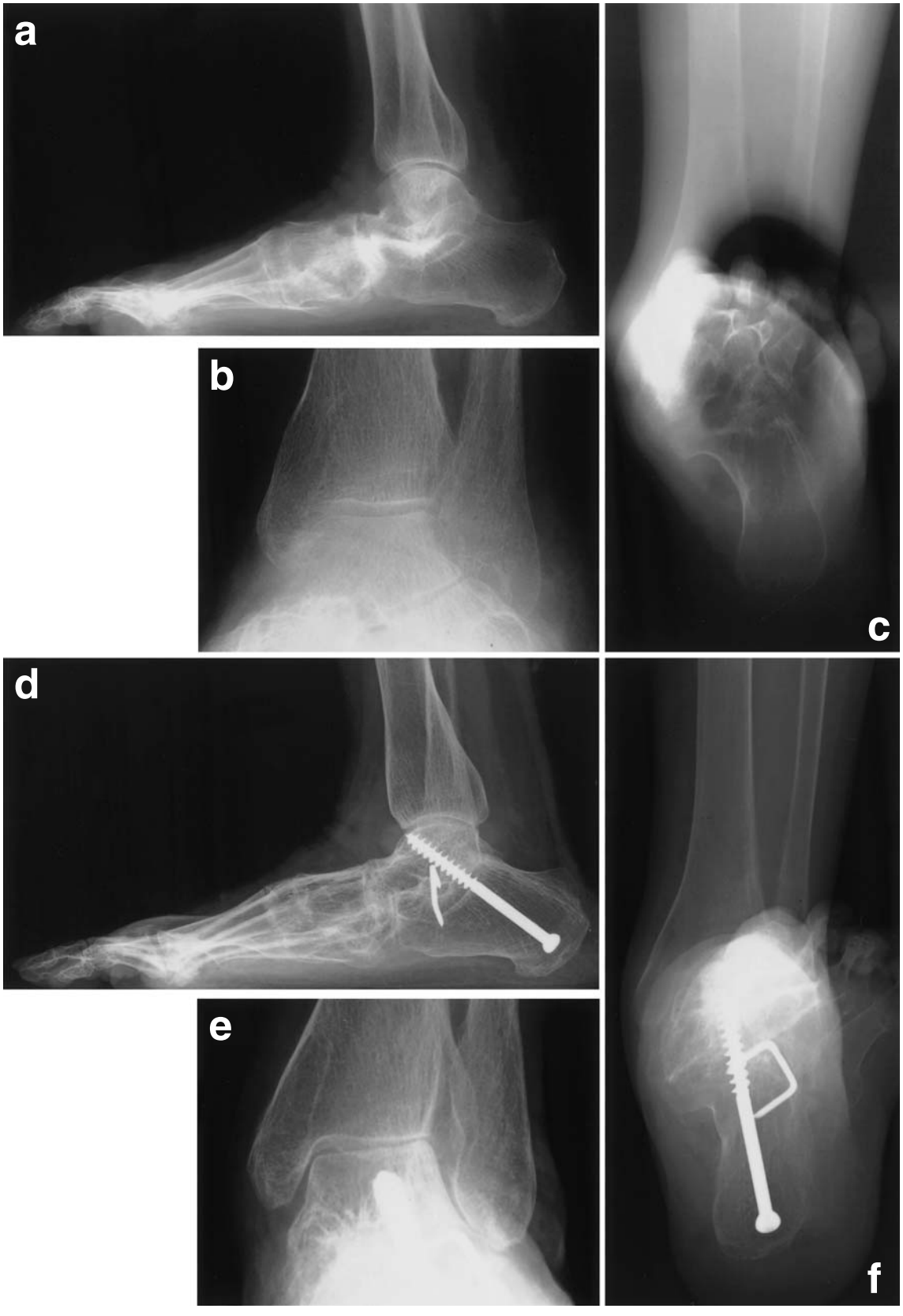

Fig. 1. Progression of osteoarthritis in the ankle in case 5, a 63-year-old woman with isolated talocalcaneal arthrodesis. **a–c** Preoperative radiographs. **a** Weight-bearing lateral view of the foot. **b** Weight-bearing anteroposterior (AP) view of the ankle. **c** Weight-bearing subtalar view. Eversion of the calcaneus is seen, but no lesions are observed in the ankle. **d–f** At 6 years 1 month after operation. **d** Weight-bearing lateral view of the foot. **e** Weight-bearing AP view of the ankle. **f** Weight-bearing subtalar view. The calcaneal pitch decreased slightly from 12° to 11°, and the talus–first metatarsal angle changed from 12° to 6°, indicating an improvement. The calcaneal valgus is improved, but narrowing of the joint space is observed on the outside of the ankle. The patient is currently satisfied with the result and reports no complaints regarding the ankle lesions, but regular follow-up is still needed

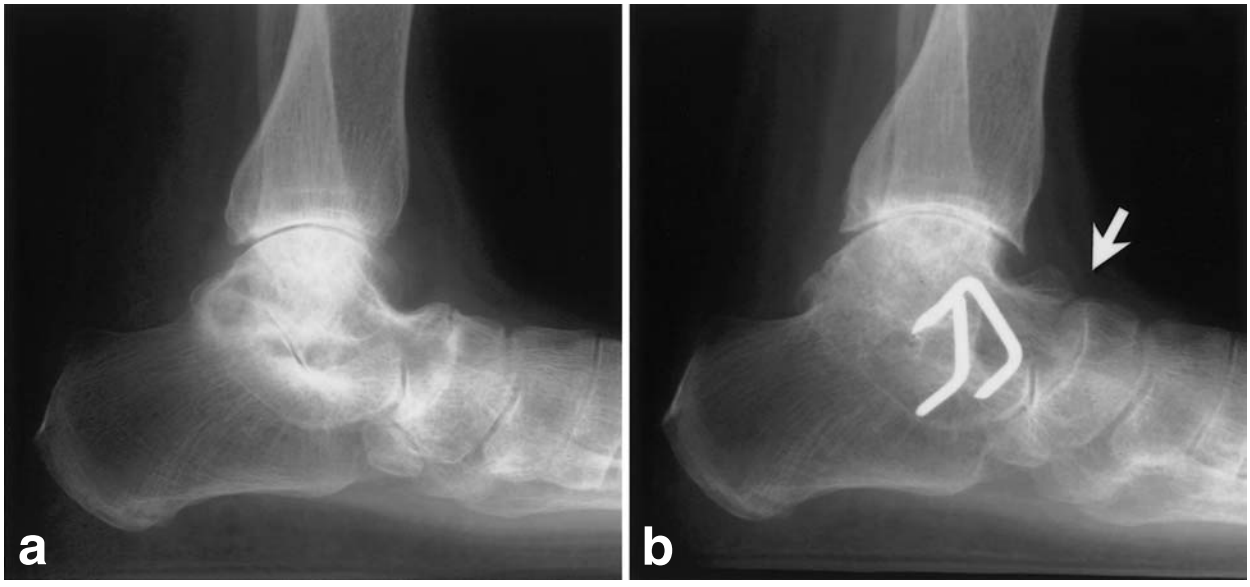

Fig. 2. Improvement of the talonavicular joint in case 3, a 65-year-old woman with isolated talocalcaneal arthrodesis. **a** Preoperative radiograph. Narrowing of the joint space is seen in the talocalcaneal and talonavicular joints. **b** At 4 years 11 months after operation. The lesion in the talonavicular joint has diminished (*arrow*), although osteoarthritic change in the ankle is progressing

Fig. 3. Isolated talonavicular arthrodesis in case 10, a 58-year-old man. **a, b** Preoperative radiographs. **a** Weight-bearing AP view of the ankle. **b** Weight-bearing lateral view of the foot. **c, d** At 4 years after operation. **c** Weight-bearing AP view of the ankle. **d** Weight-bearing lateral view of the foot. Progression of osteoarthritic change is observed in the naviculocuneiform joint, but there was no foot pain

Radiography of feet treated with isolated talocalcaneal arthrodesis revealed that the mean calcaneal pitches before operation and at follow-up were 12.6° and 12.1°, respectively, showing a slight decrease postoperatively. On the other hand, the mean talo–first metatarsal angle was 28.6° before operation and decreased to 16.0° at the follow-up, indicating that plantar flexion of the neck of the talus was reduced (Fig. 1).

As for osteoarthritic changes in the adjacent joint, 6 of 10 ankles were affected; exceptions were two ankles that underwent simultaneous total ankle arthroplasty. Osteoarthritis of the talonavicular and naviculocuneiform joints developed in five feet (Fig. 1). However, one foot showed diminished articular destruction, as shown in Fig. 2. Symptoms associated with osteoarthritis in neighboring joints were not severe. Mild pain was present in only two ankles.

Discussion

Akagi et al. investigated the relation between lesions in the hindfoot and activities of daily living in patients suffering from long-term rheumatoid arthritis.[7] They reported that a flatfoot deformity resulting from intertarsal joint destruction caused only mild complaints and did not markedly affect lower limb dysfunction. Our patients, however, had complained of pain and walking disturbance due to lesions of the intertarsal joints. The pain might have been related to the high activity of the patients.

Eight and four feet belonged to classes 2 and 3, respectively, although they were in advanced stages of rheumatoid arthritis (eight in stage 4; four in stage 3). In patients with severe arthropathy in the intertarsal joints, pain is rare if the level of activity is low, but high levels of activity can lead to the induction of pain because patients must use the affected joints.

The clinical outcome of arthrodesis was excellent in this study. Therefore, we suggest that arthrodesis be performed on a small number of joints that cause pain before deformity of the whole foot has progressed. Many studies have reported satisfactory results of talonavicular arthrodesis for rheumatoid arthritis[8–11] (Fig. 3). In contrast, no studies of isolated talocalcaneal arthrodesis limited to rheumatoid arthritis have been reported, although the technique has yielded favorable results for the treatment of osteoarthritis and trauma.[12,13] This might be due to the fact that the talocalcaneal joint is less frequently affected than the talonavicular joint in rheumatoid arthritis.[14]

Previous studies have suggested that fixation of the ankles accelerates the progression of osteoarthritic changes in the neighboring joints.[15,16] Indeed, it has been shown that talonavicular arthrodesis promotes osteoarthritis in the neighboring joints.[17,18] However, no detailed examination has been done on the talocalcaneal joint. In the present study, we demonstrated that the neighboring joints underwent osteoarthritic changes in patients with rheumatoid arthritis. The symptoms of osteoarthritis were relatively mild in these feet, but we consider it necessary to continue to follow these patients closely. Marked lessening of the destruction in the talonavicular joint was achieved in one foot by talocalcaneal arthrodesis (Fig. 2). The precise reason for this is not known, but it was suspected that elevating the neck of the talus by the bone transplantation might have had a good influence on the joint.

Radiographic measurements, in respect to the effects of arthrodesis on flatfeet, showed that the talo–first metatarsal angle was improved and the calcaneal pitch decreased. Our thinking is that bone transplantation to the sinus tarsi might elevate the neck of the talus (improving the talo–first metatarsal angle) and depress the frontal calcaneus (reducing the calcaneal pitch).

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