

## ORIGINAL ARTICLE

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## Indications of total ankle arthroplasty for rheumatoid arthritis: evaluation at 5 years or more after the operation

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**Abstract** The postoperative results of total ankle arthroplasty (TAA) were surveyed, and the indications of TAA for rheumatoid arthritis (RA) were examined. We have performed TAA in properly selected patients with indication of ankle joint destruction due to RA. The subjects were 18 RA patients (20 joints) who underwent TAA between April 1988 and April 1996. Type-ND or type-TNK Bioceram was used without cement for possible revision of TAA. No destruction of large joints was found in 8 patients, and TAA was used as part of multiple arthroplasty in 10 patients. After the operation, decrease in or disappearance of joint pain was obtained, and range of motion and improved ability to walk were secured. The clinical results were superior to those obtained for 17 joints of 17 patients who underwent ankle arthrodesis during the same period. However, a radiolucent zone was observed on X-ray examination in every case, after 8 years on average (range 5–12 years) after operation. Under present conditions, ankle arthrodesis should be used for younger patients. When no destruction of the hip or knee joint is found and the patient is 65 years of age or older, we believe TAA is indicated. In cases of multiple arthroplasty or with bilateral ankle joint destruction, TAA appears to be useful if patients are young, considering their better life expectancy and quality of life.

**Key words** Rheumatoid ankle · Surgical indication · Total ankle arthroplasty (TAA)

### Introduction

Patients with late-stage rheumatoid arthritis (RA) accompanied by joint destruction of the lower extremity exhibit serious difficulty in walking. Reconstructive surgeries of lower extremity function such as total hip arthroplasty (THA) and total knee arthroplasty (TKA) are used for such patients. Although the prevalence of ankle arthropathy is not low in RA patients, cases in which surgical treatment is used for this arthropathy are few compared with hip and knee arthropathy. However, when ankle joint destruction is refractory to conservative treatment and causes difficulty in walking, surgical treatment is required. For treatment of ankle joint destruction in RA, ankle arthrodesis<sup>1,2</sup> is selected in many cases. In addition, destruction and ankylosis including the middle foot region are found in some patients with ankle joint RA, and cases of bilateral disorder are also not a rare occurrence. Ankle arthrodesis relieves pain in these cases, but does not necessarily improve activities of daily life (ADL). Total ankle arthroplasty (TAA), by which the range of motion (ROM) of the ankle joint can be secured, is greatly advantageous, but associated problems such as questionable long-term durability remain. Postoperative results of TAA without cement performed considering the possibility of revision or reoperation were surveyed, and indications of TAA for RA were studied.

### Subjects and methods

The subjects were 20 joints of 18 RA cases that underwent TAA between April 1988 and April 1996. The subjects comprised 1 male and 17 females, whose average age at the time of the operation was 59.8 years (range, 43–72 years), and their period of duration of RA was 15.1 years on average (4–32 years) (Table 1). Each patient exhibited difficulty in walking due to ankle pain or deformity, and surgery was performed only with sufficiently informed consent. Operation was performed by cementless fixation in all patients using an implant of type-ND Bioceram<sup>3,4</sup> (13 joints) or an

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**Table 1.** Background data of the patients

|   | Total ankle arthroplasty (TAA) ( <i>n</i> = 18) |                                     | Arthrodesis ( <i>n</i> = 17) |
|---|---|-------------------------------------|------------------------------|
|   | Ankle joint disorder ( <i>n</i> = 8)            | Multi-arthroplasty ( <i>n</i> = 10) |                              |
| Sex, male/female                        | 1/7   | 0/10                                | 2/15                         |
| Age, mean ± SD (years)                  | 61.3 ± 9.8*                                     | 59.3 ± 8.1                          | 51.9 ± 7.8                   |
| Disease duration, mean ± SD (years)     | 13.1 ± 8.2                                      | 17.2 ± 11.8                         | 16.8 ± 12.8                  |
| Wrist joints, Larsen grade:             |   |                                     |                              |
| III                                     | 4 cases   | 0 cases                             | 6 cases                      |
| IV                                      | 4 cases   | 5 cases                             | 9 cases                      |
| V                                       | 0 cases   | 5 cases                             | 2 cases                      |
| Hip joint or knee joints, Larsen grade: |   |                                     |                              |
| ≧II                                     | 8 cases   | 0 cases                             | 5 cases                      |
| III                                     | 0 cases   | 0 cases                             | 8 cases                      |
| ≧IV                                     | 0 cases   | 10 cases                            | 4 cases                      |

The patients with ankle joint disorder include 1 aged 43 years; after removal of this case, the mean age was  $69.3 \pm 8.3$  years and significantly higher than that of patients who underwent multiple arthroplasty and ankle arthrodesis ( $*P < 0.05$ )

Many patients who underwent ankle arthrodesis in the control group were relatively young, and the disease stage of the most advanced region in hip and knee joints on X-ray examination varied

upgraded version of it, type-TNK Bioceram (7 joints), from May 1994 onward. Postoperatively, external fixation with a PTB cast was performed for 6 weeks, but a window was opened on the back of the ankle in the second week after surgery, and patients were started on passive ROM exercise and walking with partial weight bearing. From the eighth week, walking with full body weight was allowed. We reviewed the background data of the patients, their functional life expectancy, pre- and postoperative clinical results, and changes in X-ray findings. ADL was evaluated using the subdivided Steinbrocker's classification. Clinical results were evaluated according to the standards for foot disease treatment evaluation proposed by the Japanese Orthopedic Association (JOA score).<sup>5</sup> In the JOA score, eight items (pain 20 points, deformity 30, ROM 10, stability 10, gait ability 10, muscle strength 5, sensory 5, and ADL 10 points) are included, with 100 points given to the normal foot. In addition, we reviewed the postoperative clinical results obtained for 17 joints of 17 cases, which had undergone ankle arthrodesis between April 1986 and April 1996, to compare them with the postoperative clinical results for TAA. Student's *t* test was used to judge the significance of differences between the two groups.

## Results

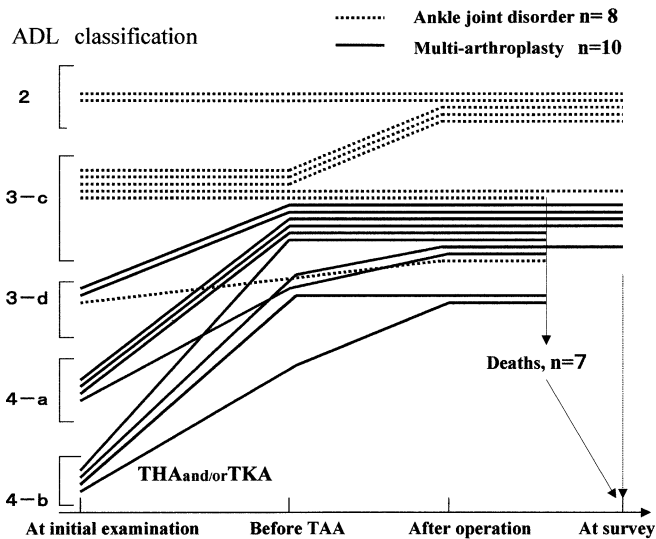
### Background data of patients

The subjects were patients with long duration of disease and wrist joint disorder with late-stage RA of Larsen grade III or higher as revealed by X-ray examination. They were divided into two groups by degree of joint destruction in the lower extremities (see Table 1), that is, 8 patients with ankle joint disorder and progressive wrist joint disorder but without destruction of hip or knee joint on X-ray examination and 10 patients who underwent TAA as part of multiple arthroplasty for destruction of large joints. For the patients with ankle joint disorder, other than a 43-year-old woman

who strongly requested undergoing TAA, the mean age was  $69.3 \pm 8.3$  years, which was older than that of the patients who underwent multiple arthroplasty. The patients who underwent multiple arthroplasty included 5 of mutilans type<sup>6</sup> with Larsen grade V wrist joints, 3 with THA and TKA in 4 joints, 4 with 3 joint arthroplasties and 3 with 2 joint arthroplasties. TAA was performed bilaterally in 2 patients, on the right side in 6 and on the left side in 10 patients. Of these, 1 patient had undergone ankle arthrodesis on the opposite side. On X-ray examination of the ankle joint, Larsen grade III disease was found in 2 joints, grade IV in 14 joints, and grade V in 4 joints. Ankle arthrodesis was more frequently used for younger patients, and the disease stage of the most severely affected region in the hip and knee joints varied from Larsen grade II to grade IV.

### Prognosis of function and survival

Changes in ADL focused on the patient's ability to walk are shown in Fig. 1. In the cases of multiple arthroplasty, TAA was performed as part of THA or TKA or both to maintain acquired walking ability. In the first examination, eight cases were rated as lower than class IV and were essentially unable to walk. With performance of multiple arthroplasty on the premise that RA inflammation is controlled by administration of disease-modifying antirheumatic drugs and rehabilitation is performed, practical walking became possible, and TAA was subsequently used for improvement of difficulty in walking due to ankle joint destruction. The patients with ankle joint disorder were rated as class 3-c and could walk outdoors, with the exception of one patient rated class 3-d who could only walk indoors. TAA was used to improve ability to walk. Remarkable improvement in ADL was found in seven cases. However, other than two cases that remained in class 3-d, ability to walk including outdoors had been acquired and maintained. Seven patients, mostly those with multiple arthroplasty exhibiting poor ADL, died of pneumonia, renal insufficiency, or other



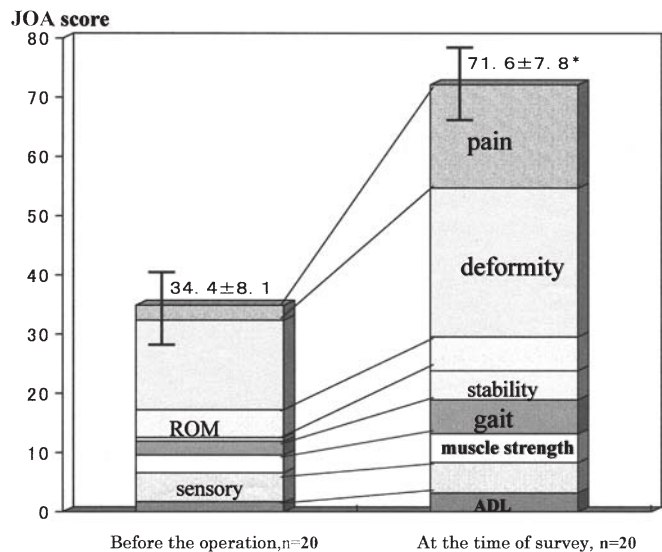
**Fig. 1.** Changes in activities of daily life (ADL) from the first examination, to before total ankle arthroplasty (TAA), after TAA, and at time of survey. Classified by subdivided Steinbrocker's classification: class 2, almost independent in ADL; class 3-c, independent outdoor walking; class 3-d, independent only for indoor walking; class 4-a, walking with support; class 4-b, wheelchair confined. One patient with ankle joint disorder had little ability to walk even after operation, and five who underwent multiple arthroplasty had died by the time of survey. *THA*, total hip arthroplasty; *TKA*, total knee arthroplasty

causes by 7 years and 9 months after TAA on average (range, 5–11 years).

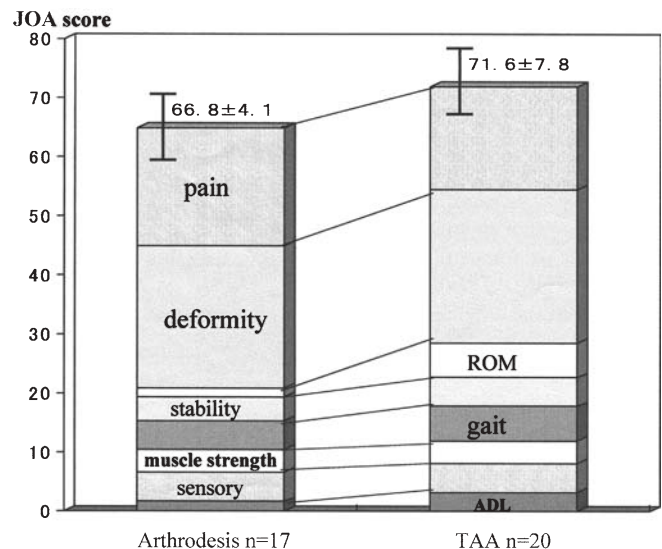
### Clinical results

Postoperative clinical results are shown in terms of transition in the JOA score in Fig. 2. For patients who died, evaluation was made based on findings before the development of viscous organ derangement that caused death. The period of postoperative observation was 8 years and 2 months on average (5–12 years). Before the operation, ability to walk and ADL were poor because of marked ankle pain and instability, and JOA score was  $34.4 \pm 8.1$  points on average. In the postoperative survey, ability to walk and ADL improved, accompanied by alleviation or disappearance of pain and recovery of stability, and JOA score significantly increased to  $71.6 \pm 7.8$  points on average. Slight pain during walking remained in 6 joints.

Although there was no significant change in ROM (the sum of plantar flexion and dorsiflexion averaged  $25^\circ \pm 9^\circ$  preoperatively versus  $26^\circ \pm 7^\circ$  at the time of this review), ROM was maintained at a level sufficient for walking and going up and down stairs. The postoperative clinical results of 20 joints treated by TAA were compared with 17 joints treated by ankle arthrodesis during the same period (Fig. 3). Ankle arthrodesis is usually performed in relatively younger patients or patients who cannot be treated by TAA because of advanced deformity or bone destruction. Compared to the mean JOA score of  $66.8 \pm 4.1$  points obtained by ankle arthrodesis, TAA was slightly less successful in improving pain, but yielded significant improvement in ROM and ADL items, including going up and down stairs



**Fig. 2.** Clinical results before operation and at the time of survey according to the standards for evaluation of results of treatment of foot diseases of the Japanese Orthopedic Association (JOA score). ROM, range of motion; ADL, activities of daily life. The mean of 34.4 points before operation significantly improved to a mean of 71.6 points at the time of survey after operation ( $*P < 0.01$ )



**Fig. 3.** Comparison of the postoperative results of TAA and postoperative results of arthrodesis in 17 ankles in 17 patients with RA who underwent surgery before April 1996. In TAA cases, improvement in ROM and ADL was marked. Scores for TAA cases were higher than those for arthrodesis cases, although not significant

and wearing shoes; although the differences were not statistically significant, the score for the postoperative clinical results obtained by TAA was higher.

### Complications

Three joints were found to have intraoperative ankle joint fracture of the medial malleolus as a complication, which healed with prolonged external fixation. Two joints showed

**Fig. 4.** X-ray findings in case 1. Before operation, the patient had fracture and severe destruction of the left ankle joint that was rated Larsen grade V (left). Six years after ankle arthrodesis, bone fusion was good (right)



delayed wound healing but did not require any surgical treatment. Postoperative radiography demonstrated the component setting to be inverted position in four joints. There have been no cases of deep infection or fracture in the postoperative prognosis to date. One patient with RA of mutilans type was radiographically found to exhibit progression of loosening with the lapse of time, resulting in relapse of pain in the ankle joint 8 years after the operation. While we were considering reoperation, the patient died of interstitial pneumonia, in the ninth year after the operation. No reoperation has been performed up to the time of this review.

#### Changes in X-ray findings

The preoperative X-ray findings indicated prominent narrowing of joint space and joint destruction classified as Larsen grades III to V. Because TAA could not be used for cases of severe deformity, we performed radiographic measurements before the operation, and found that the antero-posterior (AP) mortice angle,<sup>7</sup> defined as the angle, between the distal one-third of the longer axis of the tibia and its joint surface, was  $91.2^\circ \pm 6.1^\circ$  and the lateral mortice angle was  $82.4^\circ \pm 4.1^\circ$  (see Fig. 5, later in article). Furthermore, with ankle joint destruction, more cases indicating valgus were apparent in AP view images. As indicated in the following case presentation, a radiolucent zone was seen all around the tibial component in every case at the time of survey. The width was less than 1 mm in 5 joints, more than 1 mm but less than 2 mm in 11 joints, and not less than 2 mm in 4 joints. Sinking of the talar component was found in 3 joints.

Measurements were made for the postoperative mortice angle using the lower surface of the tibial component as the joint surface. The AP mortice angle was  $86.3^\circ \pm 6.8^\circ$ , not including the four joints in which the component was set in an inverted position of  $74.1^\circ \pm 5.1^\circ$ . The lateral mortice angle was set at a satisfactory position of  $81.3^\circ \pm 5.2^\circ$ . At the time of this review, the diagnosis of obvious loosening was present only in the aforementioned single case in which the component exhibited a definite motion with the mortice angle differing by more than  $2^\circ$  from that obtained immediately after the operation.

### Case presentation

Results of X-ray examination of representative cases are shown.

#### Case 1

A 47-year-old woman (at the time of operation) with ankle joint disorder, Larsen grade IV wrist joint, and grade I knee joint. The left ankle joint exhibited severe bone destruction accompanied by fracture, and she had marked difficulty in walking. Considering her age, ankle arthrodesis was performed in May 1995. Six years later, she is without pain and can walk outdoors easily (Fig. 4). In cases accompanied by bone deficiency or deformation due to severe joint destruction, TAA is technically impossible.

#### Case 2

A 62-year-old woman with ankle joint disorder. For treatment of difficulty in walking due to left ankle joint destruction, left TAA was performed in January 1990. Eleven years after operation, a radiolucent zone in the tibial component and sinking of the talar component are present (Fig. 5), but she can walk easily outdoors with only slight ankle pain.

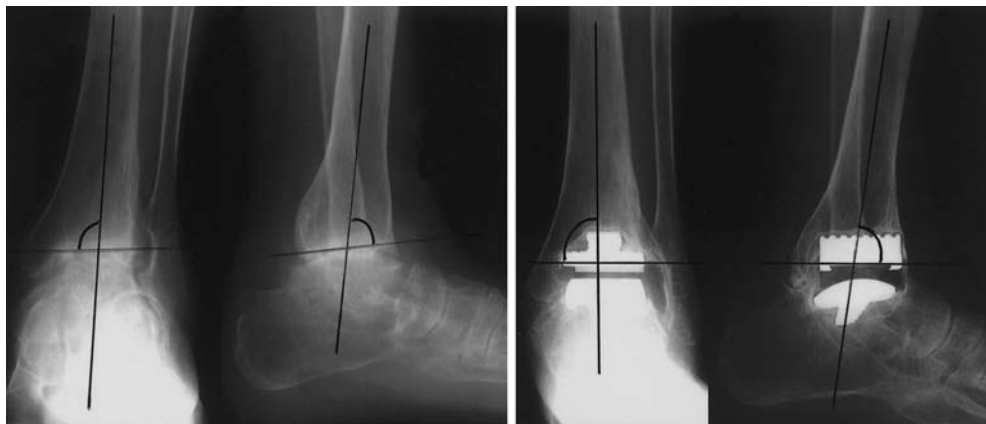
#### Case 3

A 43-year-old woman with ankle joint disorder had difficulty in walking due to left ankle destruction. At the strong request of the patient, left TAA was performed in April 1992. Ten years after operation, a radiolucent zone is present in the tibial component but bone sclerosis is seen in the surrounding region (Fig. 6). She is without pain and walks with a stable gait.

#### Case 4

This 60-year-old woman had undergone multiple arthroplasty and had a past history of bilateral THA and TKA.

**Fig. 5.** X-ray findings in case 2. Lines and quarter-round shapes show how mortice angle was measured. Before operation, the left ankle joint was rated Larsen grade IV (left). TAA was performed using a type-ND Bioceram implant. Eleven years after the operation, a radiolucent zone in the tibial component and sinking of the talar component are present (right)



**Fig. 6.** X-ray findings in case 3. The left ankle joint was rated Larson grade IV (left). TAA was performed using a type-ND Bioceram implant. Ten years after the operation, a radiolucent zone is present in the tibial component, but bone sclerosis is seen in the surrounding region (right)



Due to pain from destruction of the ankle joints bilaterally (Fig. 7a), outdoor walking had become difficult, and she underwent right ankle arthrodesis and left TAA simultaneously in August 1995. Six years after operation, setting is slightly inverted in the left TAA but no loosening is present (Fig. 7b). She can walk outdoors using a cane.

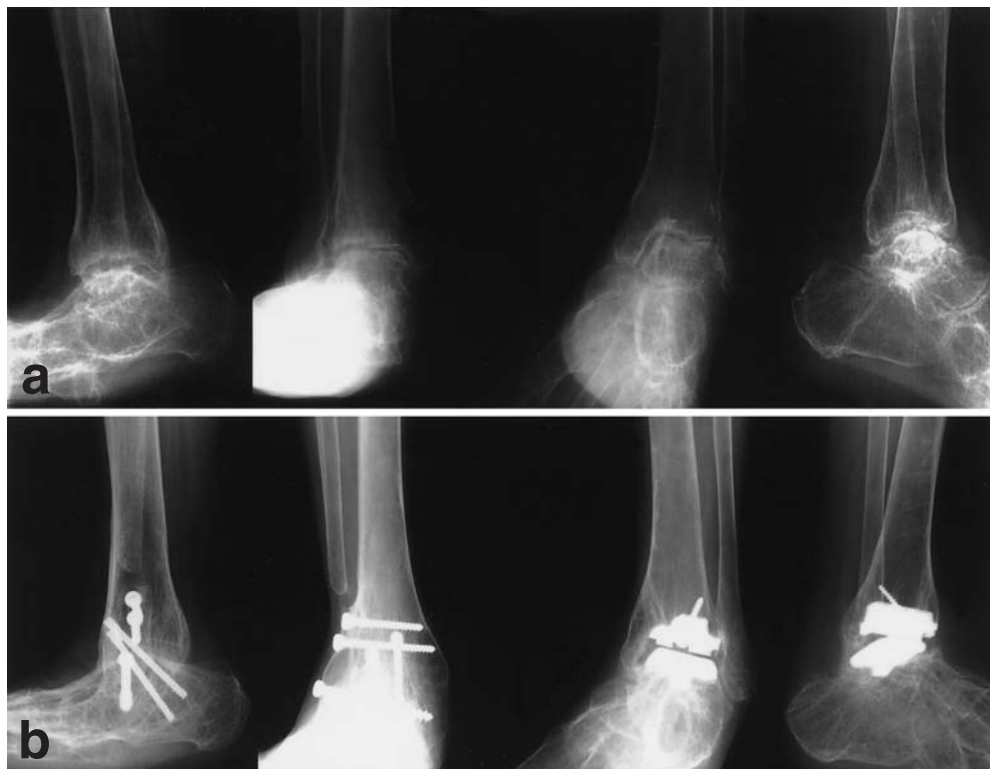
## Discussion

According to the classification of Ochi et al.,<sup>8</sup> the occurrence of ankle joint disorder in RA is low in the least erosive subset (LES), 58% in the more erosive subset (MES), and 79% in mutilating disease (MUD). These rates are almost the same as those for hip and knee joint disorders. However, cases in which surgical treatment is used are few compared with hip and knee joint disorders. Reconstructive surgeries of the lower extremities conducted in our institution during the 20-year period from May 1981 to April 2001 included THA for 187 joints, TKA for 475 joints, and forefoot arthroplasty for 92 feet. In contrast, operations for ankle joints were performed in relatively fewer cases, with TAA for 31 joints and ankle arthrodesis for 26 joints. One of the reasons why surgical treatment is less commonly applied to ankle joints is that destruction of ankle joints

including the talocrural joint and the middle foot joint, may be accompanied by progression of contracture with time, often resulting in alleviation of pain. Another reason is that conservative treatment with an ankle supporter, insole, etc., is highly effective, and furthermore in ankle joint surgery stable results are not obtained as often as with THA or TKA.

For treatment of ankle joint destruction in RA, ankle arthrodesis is performed in many cases.<sup>1,9</sup> Pain relief and lifelong stability are obtained with ankle arthrodesis, but long-term arthrodesis badly affects surrounding joints such as the talocalcaneal joint and the middle foot joints,<sup>9,10</sup> which often causes renewed pain. In advanced RA, ankylosis of the talocalcaneal joint and middle joints is not rare,<sup>2</sup> and loss of ROM in cases of multijoint disorder including the knee joint and cases of bilateral ankle joint disorder can be a major cause of limitation of ADL. In ankle arthrodesis, moreover, a longer period was required for external fixation due to prolonged postoperative synostosis. Now, however, this problem is being solved, for example, with the use of an intramedullary nail.<sup>11</sup> TAA, which can maintain ROM, is very useful, but has a few problems, particularly its questionable long-term durability. Because a larger load per unit area is placed on the ankle joint than on the knee joint, support by ligaments is strong and setting of an artificial joint that can be sufficiently supported by cortical bone

**Fig. 7.** X-ray findings in case 4. Before the operation, the ankle joints were rated Larsen grade IV bilaterally (a). Right ankle arthrodesis and left TAA using a type-TNK Bioceram implant were carried out simultaneously. Six years after operation, bone fusion in the right ankle joint was good. Although the setting was slightly inverted in the left TAA, loosening has not been observed (b)



surrounding the joint is difficult, and because the likelihood of traumatic exposure is high, early loosening and sinking may occur when operation is not precisely performed.<sup>12</sup>

Almost 30 years have passed since Buchholz et al.<sup>13</sup> reported the development of TAA. However, reports on its clinical results<sup>4,14,15</sup> were obtained 5–10 years after the operation. Although implant and surgical procedures have been improved,<sup>12</sup> duration should be considered to be about 10 years under the present situations. We have therefore performed cementless implant fixation. With cemented TAA, greater bone loss may occur at the time of removal. When the operation is performed with cementless fixation, bone deficiency is minimal and ankle arthrodesis is also possible by combining bone grafting<sup>4</sup> in cases in which reoperation becomes necessary because of loosening or other problems. In cases of ankle joint disorder, which appear to be LES with mild destruction of a large joint, TAA has as a rule been used for elderly patients. In cases of mutilans type (MUD) disease and cases of MES, multiple arthroplasty is frequently required to maintain ability to walk, and TAA has also been used for relatively younger patients. Of 10 patients who had undergone multiple arthroplasty, 6 died at 7 years and 9 months on average after operation (range, 5–11 years). In surgical treatment of ankle joint destruction in RA patients, ankle arthrodesis should be selected for younger patients in consideration of the problems. For patients with severe deformation or bone deficiency, ankle arthrodesis must be selected. However, TAA, which can maintain ROM, is very valuable.

Patients with RA are known to have about 10 years shorter life expectancy on average than adults in general.

For the reasons noted here, we suggest that elderly patients over 65 years of age with ankle joint disorders without destruction of hip joints and knee joints may be good candidates for currently available TAA. For patients with bilateral ankle disorder and those requiring multiple arthroplasty, TAA seems appropriate even when patients are relatively young, considering their life span<sup>16</sup> and quality of life.

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