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# Synovial Metallosis After Ceramic Total Ankle Arthroplasty Treated With a Total Talar Prosthesis: A Case Report

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ABSTRACT

Total ankle arthroplasty is a useful surgical procedure for osteoarthritis of the ankle, but aseptic loosening of components is an issue. We report here a case of aseptic implant loosening with metallosis after total ankle arthroplasty using the TNK ankle (Kyocera, Kyoto, Japan), which occurred despite the components being ceramic. We also report favorable results from our method of treatment using a total talar prosthesis in the revision surgery. During the revision surgery, synovial metallosis was found, probably related to superficial damage to the screw affixing the tibial component to the bone. Because both the tibial and talar components were loose, all the components and the remaining talar bone were removed. A new tibial component and a custom-made alumina-ceramic total talar prosthesis was inserted. Pain relief was achieved and maintained through the latest follow-up visit at 42 months after revision surgery. Dorsiflexion of the ankle improved from 0° to 5° and plantarflexion remained unchanged from its preoperative range of 20°. The American Orthopaedic Foot & Ankle Society ankle-hindfoot score improved from 38 to 80 points. To the best of our knowledge, this is the first reported case of an alumina-ceramic total ankle prosthesis loosening caused by metallosis resulting from screw abrasion. Favorable treatment results were obtained by using a total talar prosthesis in the revision surgery.


Total ankle arthroplasty (TAA) is 1 of the treatment options available to patients who suffer debilitating pain related to osteoarthritis of the ankle (1). Among the many implants available, TNK ankle (Kyocera, Kyoto, Japan) has demonstrated good clinical results (2). The TNK ankle is made of alumina-ceramic, which Takakura et al (2) claimed to be superior to metal for prosthetics. They observed callus formation covering the ceramic prosthesis and claimed that it helped to fix the prosthesis firmly. Theoretically, implants made of ceramic can avoid metallosis, which is an unneglectable cause of aseptic loosening. Takakura et al (3) reported that only 3 of 72 cases required subsequent revision in average postoperative follow-up of 5.2 years. But, few studies to date have dealt specifically with TNK ankle or aseptic loosening after TAA using the TNK ankle (2–7).

We here report a case of aseptic implant loosening with metallosis following TAA using the TNK ankle. We also report our treatment results using a total talar prosthesis in the revision TAA.

## Case Report

An 84-year-old Japanese female with osteoarthritis of the ankle underwent TAA using a TNK ankle at a regional hospital in 2007 (Fig. 1). The procedure ameliorated the pain until 2013, when the pain increased in intensity, prompting the patient's visit to our hospital in November 2013. Radiographic examination revealed talar component subsidence and a radiolucent line around the tibial component (Fig. 2). The patient had no significant medical history. The preoperative blood test showed negative C-reactive protein value and normal white cell count. We diagnosed the condition of the ankle as aseptic loosening of unknown cause.

In this case, bone stock of talus seemed insufficient for revision of talar component. We discussed a revision TAA with the patient, who

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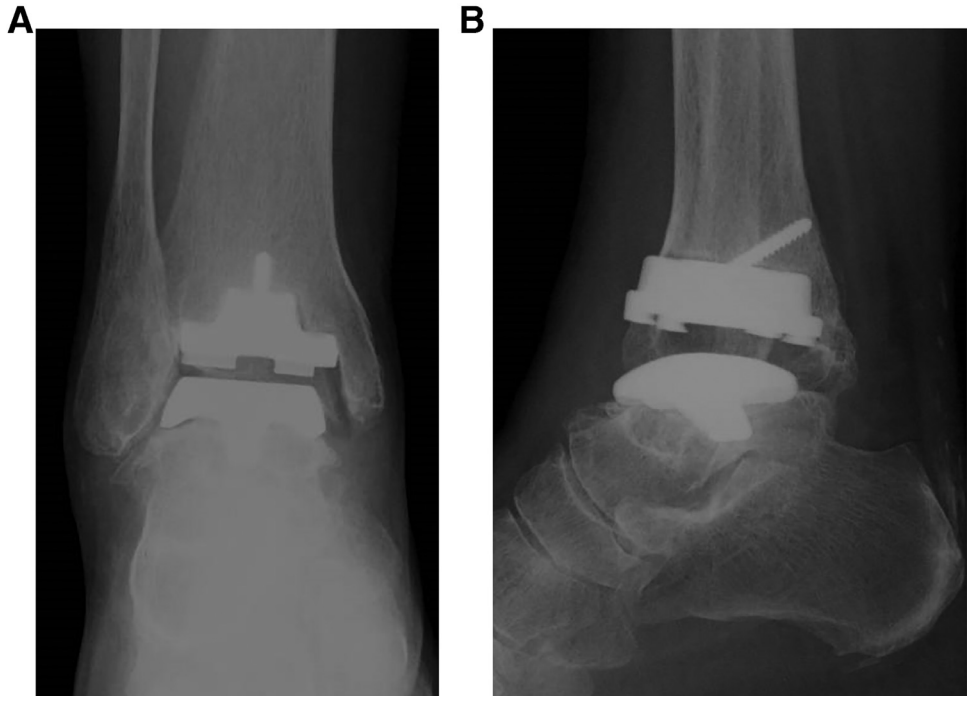


**Fig. 1.** Postoperative radiographs after primary total ankle arthroplasty using the TNK ankle. (*A*) Anteroposterior; (*B*) lateral.

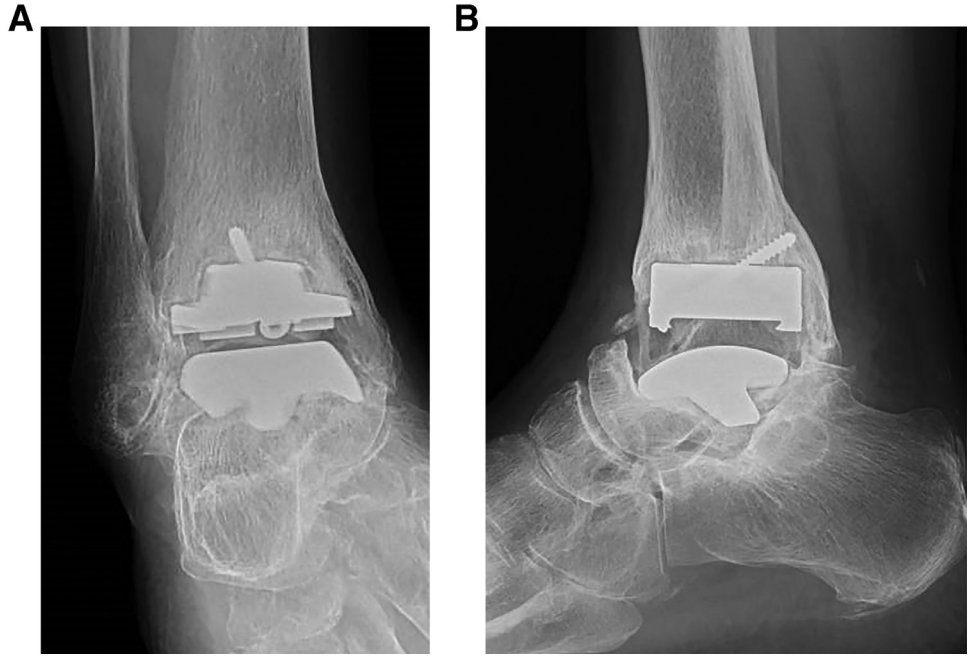


**Fig. 2.** Radiographs taken at 7 years after primary total ankle arthroplasty. (*A*) Anteroposterior; (*B*) lateral. The talar component subsidence and radiolucent line around the tibial component are visible.

decided to undergo the procedure; we used a total talar prosthesis as the talar component.

Based on computed tomography scans of the contralateral talus, a custom-made alumina-ceramic total talar prosthesis was fabricated. With the patient under general anesthesia, an anterior approach was made through the same incision used in the initial surgery. Pneumatic tourniquet on the thigh was used during the surgery. Both the tibial and talar components were loose, and, surprisingly, synovial metallosis was evident (Fig. 3). The titanium screw affixing the tibial component to the bone had loosened; when it was removed, there was evidence of abrasion on the surface of its body (Fig. 4). After removal of all the implants and the remaining talar bone, a new tibial component was affixed with cement. For the talar side, a total talar prosthesis was manually inserted (Fig. 5).

Bacterial culture of surgical specimen was negative. According to the histopathological test of synovial tissue, deposition of metal particles

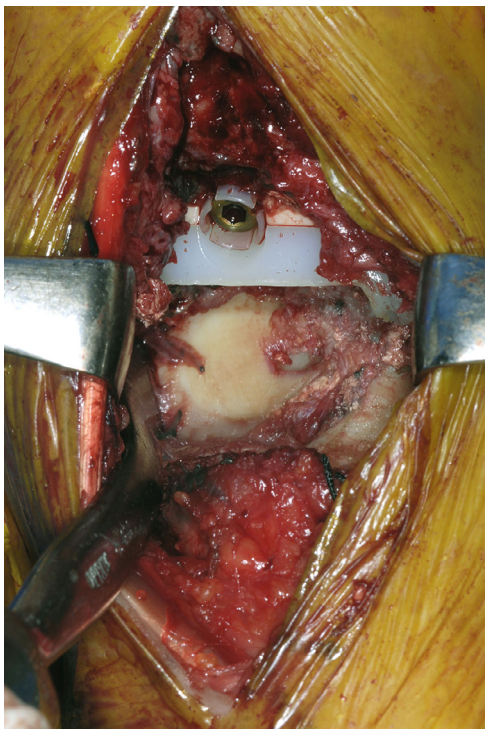

**Fig. 3.** Intraoperative photograph during revision total ankle arthroplasty. Both the tibial and talar components were loose, and synovial metallosis was observed in the ankle joint.

was evident, and the metal particles were scavenged by histiocytes, supporting our diagnosis of aseptic loosening resulting from metallosis.

Postoperative care consisted of immobilization with a short-leg cast for 3 weeks, with partial weightbearing from the second postoperative week and full weightbearing from the fourth week. Pain relief was achieved and maintained until the latest follow-up visit at 42 months after surgery. Regarding the range of ankle motion, dorsiflexion

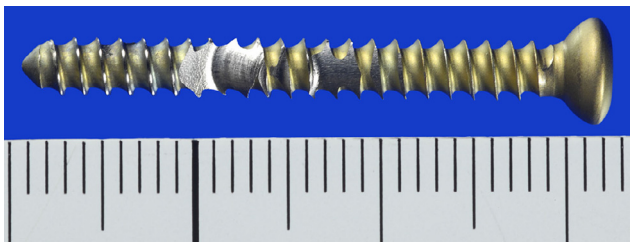

**Fig. 4.** Screw after removal. The titanium screw holding the tibial component to the bone showed evidence of abrasion.

improved from 0° preoperatively to 5° postoperatively; plantarflexion was preserved at its preoperative range of 20°. The American Orthopaedic Foot & Ankle Society ankle-hindfoot score improved from a preoperative value of 38 points (pain 20/40, function 13/50, alignment 5/10) to 80 points (pain 30/40, function 40/50, alignment 10/10) 30 months after the revision surgery.

## Discussion

Since Boutin (8) first introduced alumina-ceramic as a material for use in artificial joints in total hip arthroplasty, this material has demonstrated favorable clinical results by causing less damage to the bone and articular cartilage than metal. Regarding total ankle prosthesis, the TNK ankle, made of alumina-ceramic, has also demonstrated favorable long-term results, but the bond of alumina-ceramic to bone is still an issue (3). To achieve better initial fixation of the prosthesis to the bone, the tibial component of the TNK ankle was designed to allow screw fixation (3).

In the present case, the screw apparently caused the metallosis discovered during the revision surgery, a remarkable finding considering that metallosis is normally caused by abrasion arising from contact between metallic components. However, the main material of the TNK prosthesis is ceramic (9). The tibial component in our patient probably loosened slightly during use, causing the edge of the screw hole of the hard alumina-ceramic tibial component to contact and abrade the body

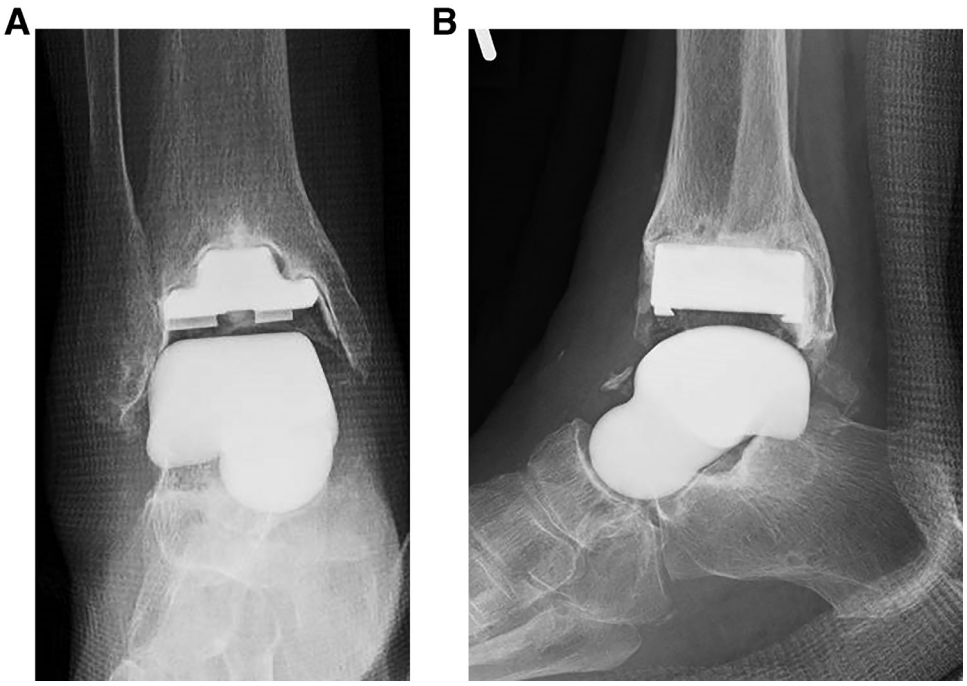


**Fig. 5.** Postoperative radiographs taken after the revision total ankle arthroplasty. (*A*) Anteroposterior; (*B*) lateral. A new tibial component was fixed with cement, and the total talar prosthesis was inserted after removal of all the implants.

of the screw itself, leading to metallosis. Metallosis then led to severe synovitis, causing pain and progressive loosening of the implant (10,11). We believe this estimation is supported by the previous report by Milosev and Campbell (12), in which acetabular ceramic components abraded the metal neck of stem components. Possible differential diagnosis includes local infection. In our case, negative preoperative blood C-reactive protein level and negative bacterial culture of surgical specimen seems to rule out infection. As another differential diagnosis, implant malposition at the initial surgery might be a cause of implant loosening.

To the best of our knowledge, the present report is the first to document a case of metallosis resulting from abrasion of a metallic screw by a ceramic component, and should serve as a warning that the fixation of a tibial component of the TNK ankle using the very screw designed to facilitate primary fixation can cause metallosis. As a method of treatment, salvage arthrodesis is generally chosen because of the difficulty of performing a revision TAA with a poor bony bed for talar component implantation (13); however, salvage arthrodesis requires a large bone graft to fill the gap, and the success rate is not very high (14). In our case, revision TAA was performed using an artificial talus instead of a normal tibial component. The artificial alumina-ceramic talus, the result of collaboration by Nara Medical University and Kyocera Co., Ltd. (15–17), is custom-made and prepared from a 3-dimensional computed tomography scan of the intact ankle. Taniguchi et al (18) used the artificial talus to treat 55 cases of idiopathic necrosis of the talus, reporting good results and no cases of implant removal during the average follow-up of 55.8 months. The curvature of the artificial talus was designed to accommodate the articular surface of the tibial component of the TNK ankle so that it could be used as its talar component (17). We successfully performed a total revision of the TNK ankle using the artificial talus as the talar component.

This procedure has several advantages over the salvage arthrodesis. First, ankle motion is preserved. Second, it makes fast-track rehabilitation possible. However, possible disadvantages are that no long-term results have yet been documented and massive bone loss might be a problem if implant removal is needed.

In conclusion, we reported here a case of TAA loosening probably caused by metallosis from abrasion of a screw. The advantages and disadvantages of using a screw for the initial fixation of an implant should be recognized. Favorable results in the revision TAA in our patient were obtained by using a total talar prosthesis.

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