Original Article

Title:

A report of three cases which required tibialis anterior tendon resection to recover delayed wound healing after total ankle arthroplasty in patients with rheumatoid arthritis

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Abstract

Delayed wound healing is one of the severe complications after total ankle arthroplasty (TAA). Especially, once tibialis anterior (TA) tendon is exposed from tendon sheath of extensor retinaculum, wound healing will be critically intractable. We report three cases (mean age 75.3 years old) of delayed wound healing after TAA cured by resection of TA tendon in patients with rheumatoid arthritis (RA). All three cases underwent TAA through an anterior approach, with careful suture of extensor retinaculum in wound closure. Ankle joint was fixed with splint and avoid weight bearing for three weeks after surgery. Delayed wound healing with TA tendon exposure was observed, and initially treated by debridement, basic fibroblast growth factor spray, and negative pressure wound therapy, which all failed to obtain wound healing. Finally, complete resection of TA tendon lead to rapid wound healing. In all cases, ankle dorsal flexion was compensated by other extensors, with maintained range of motion and muscle strength (manual muscle testing 3 to 4) compared to pre-operation at 1 year after TAA operation. Resection of TA tendon may be considered as one of the salvage treatment options of severe delayed wound healing in TAA with anterior approach, especially in elderly patients.

Introduction

Total Ankle Arthroplasty (TAA) is one of the useful treatments options for osteoarthritis (OA) or rheumatoid arthritis (RA) of the ankle. However, patients sometimes suffer from severe delayed

wound healing after TAA with anterior approach, especially in the case when tibialis anterior (TA) tendon is exposed [1]. Here, we report three cases which required TA tendon resection to recover delayed wound healing after TAA in patients with RA. This study was conducted in accordance with the ethical standards of the Declaration of Helsinki, and it was approved by the Institutional Ethical Review Board at Osaka University Graduate School of Medicine (approval number; 14219, 18258). Written informed consent for publication was obtained from patients included in the study.

Case presentation

An 80-year-old woman who was diagnosed as RA (Steinbrocker classification Class III Stage IV) and scleroderma, visited our hospital by her severe right ankle pain. Her preoperative Japan Society for surgery of the foot (JSSF) RA foot and ankle scale was 42 points (full score 100 points). Plain radiographs showed severe joint space narrowing in her right ankle joint, and diagnosed as terminal ankle arthritis (Figure 1a and 1b). TAA was performed through an anterior approach, by 10cm longitudinal skin incision between TA tendon and extensor halluces longus muscle (EHL) tendon (Figure 1c and 1d) [1]. After implantation using a mobile-bearing ankle prosthesis (FINE Total Ankle System; Teijin-Nakashima Medical) [1] (Figure 1e and 1f), wound closure with careful suture of extensor retinaculum was performed, although her extensor retinaculum showed marked fragility. Ankle joint was fixed with splint and weight bearing was avoided for three weeks after surgery. At 14

days after TAA, delayed wound healing in the middle portion was observed. Then, treatment by the debridement of wound and basic fibroblast growth factor (bFGF) spray was started. However, at 24 days after TAA, TA tendon was exposed from the wound (Figure 2a). Treatment with negative pressure wound therapy (NPWT) (Figure 2b) led to wound expansion without forming granulation (Figure 2c). Tendon sheath and retinaculum of TA was ruptured, and TA tendon was bulged toward anterior direction. Plastic surgeon suggested to avoid dermatoplasty because of the hypovascularity and high skin tension. Finally, we decided to resect TA tendon at 104 days after TAA. We extracted TA tendon with forceps, and resected TA tendon about 7cm in length (Figure 3a and 3b). After resection, rapid and satisfactory wound healing was observed (Figure 3c). One year after TAA, she was able to walk without assistance (Figure 4a), and her JSSF RA foot and ankle scale improved from 42 to 78 points (Table 1). She was able to dorsiflex her ankle by other extensors such as EHL, and her range of motion (Figure 4b, 4c, 4d, and 4e) or dorsal flexion muscle strength (manual muscle testing 4 level) of ankle was maintained from pre-operation to post-operation (Table 1). Concerning longitudinal arch, pre-operative and post-operative (post-op 3 years) assessment by standing lateral radiograph were as follows. Calcaneal pitch angle (17° vs. 16°), Hibbs angle (144° vs. 142°), and Meary's angle (0° vs. 2°). Taken together, no apparent change of longitudinal arch was observed after resection of TA in mid-follow up.

In other cases (case 2 and 3) shown in Table 1, the treatment course showed similar results. In case 2,

debridement and Z-plasty of TA tendon was performed to reduce skin tension, and following NPWT treatment failed to obtain wound healing (Figure 5a). In case 3, debridement was performed two times, and treated by bFGF spray although failed to obtain wound healing (Figure 5c). In both cases, satisfactory wound healing was observed after TA resection (Figure 5b and 5d).

Discussion

Delayed wound healing is one of the most frequent and severe complications after TAA, and RA (19.3%) showed higher rate of delayed wound healing compared to osteoarthritis (OA) (5.0%) in a previous report (81 RA cases and 119 OA cases) [2]. Especially, once TA tendon is exposed, wound healing will be seriously delayed [1]. The reasons for this, physical stress by TA tendon, hypovascularity of foot and ankle, and anti-angiogenic effect by tenomodulin (TNMD) may be considered.

In anterior approach of TAA, TA and EHL tendon lies direct under the skin incision after releasing extensor retinaculum. When extensor retinaculum became fragile by RA or glucocorticoid treatment, TA and EHL tendon may bulge toward anterior direction and apply pressure to the wound even after careful suture of extensor retinaculum. To avoid this pressure, shifting skin incision more laterally from the center of TA and EHL tendon may be considered.

In addition, foot and ankle are relatively hypovascular compared to other orthopaedic surgical site.

Moreover, glucocorticoids have an inhibitory effect on vascular endothelial growth factor (VEGF) production [3], which may lead to hypovascularity and delayed wound healing. In addition, longer operation time is reported as one of the risk factors of delayed wound healing [4], so shortening operation time by familiarizing with TAA may be also important.

TNMD is a type II transmembrane protein expressing in tendons, which exerts a positive effect on tendon-derived progenitor cells self-renewal and proliferation [5]. On the other hand, TNMD inhibits expression of VEGF and shows anti-angiogenic properties [6]. Thus, TNMD may play a role to keep tendons as intact and hypovasclular. However, once tendon sheath and extensor retinaculum are ruptured, TNMD may work harmful in wound healing.

Concerning alternative treatment such as skin flap, Gross et al. reported in 1001 primary TAA, 1.9% of patients had flap procedure following soft tissue defects [7]. Among them, 21.2% of patients had flap failures and 10.6% of patients had subsequent below-the-knee amputations. Thus, flap reconstruction may be one of hopeful salvage procedures, although it requires microvascular surgery techniques and has limitations.

Previous report demonstrated that there was no significant difference in clinical outcomes between operative and non-surgical treatment in TA tendon ruptures, although elderly low demand patients tended to be treated non-surgically and young active patients tended to be treated operatively [8]. This may be partially due to the compensation of other extensors such as EHL or extensor digitorum longus.

These muscles arise from proximal fibula, tibia, or interosseous membrane, and are inserted into phalanges. The contraction of these muscles leads to ankle dorsiflexion. However, recent report showed that surgical intervention provides better functional outcomes than conservative management, although even surgical treatment is sometimes associated with mild dorsiflexory weakness [9]. Taken together, TA resection may be considered as final salvage treatment of low demand elderly patients with high risk of delayed wound healing such as RA, but not for young active patients.

In conclusion, although this is a small series and short follow-up study, resection of TA tendon may be considered as a salvage treatment option of severe delayed wound healing in TAA with anterior approach, especially in elderly patients.

Conflict of interest

None.

Figure Legends

Figure 1. The plain radiographs of right ankle with preoperative (a) anteroposterior and (b) lateral view. (c) Skin incision of anterior approach and (d) ankle joint approach between tibialis anterior tendon and extensor halluces longus tendon. The plain radiographs of postoperative (e) anteroposterior and (f) lateral view.

Figure 2. (a) Tibialis anterior tendon was exposed at 24 days after operation. (b) Negative pressure wound therapy was performed. (c) Expanded open wound.

Figure 3. (a) Resected tibialis anterior tendon. (b) Blank after resection. (c) Cured wound.

Figure 4. At 1 year after total ankle arthroplasty. (a) Gait without assistance. (b) Active plantar flexion of operated side ankle. (c) Active dorsal flexion of operated side ankle. (d) Active plantar flexion of unoperated side ankle. (e) Active dorsal flexion of unoperated side ankle.

Figure 5. Course of wound healing in case 2 [(a) pre-resection and (b) post-resection of tibialis anterior tendon] and in case 3 [(a) pre-resection and (b) post-resection of tibialis anterior tendon].

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Figure 1

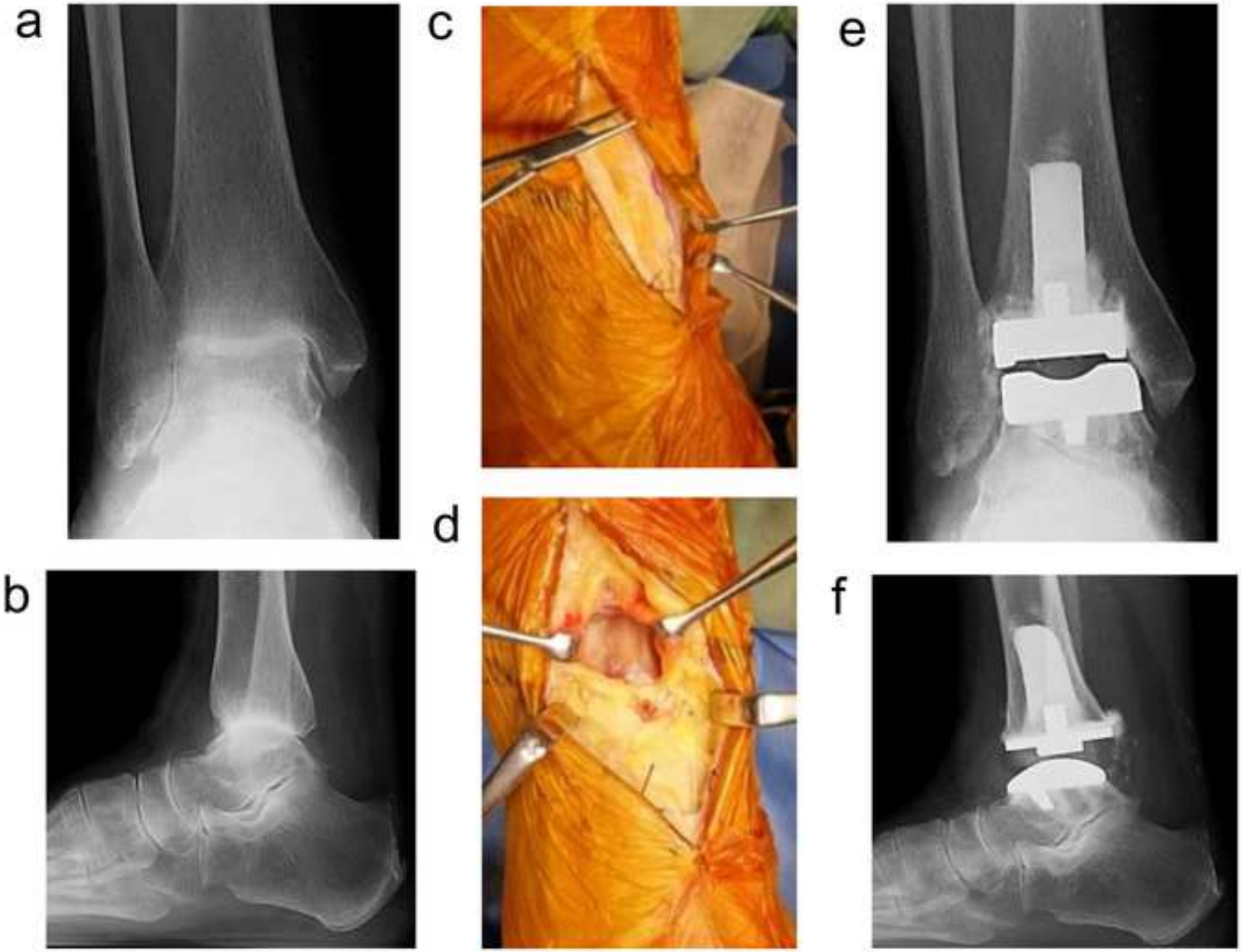

Figure 2

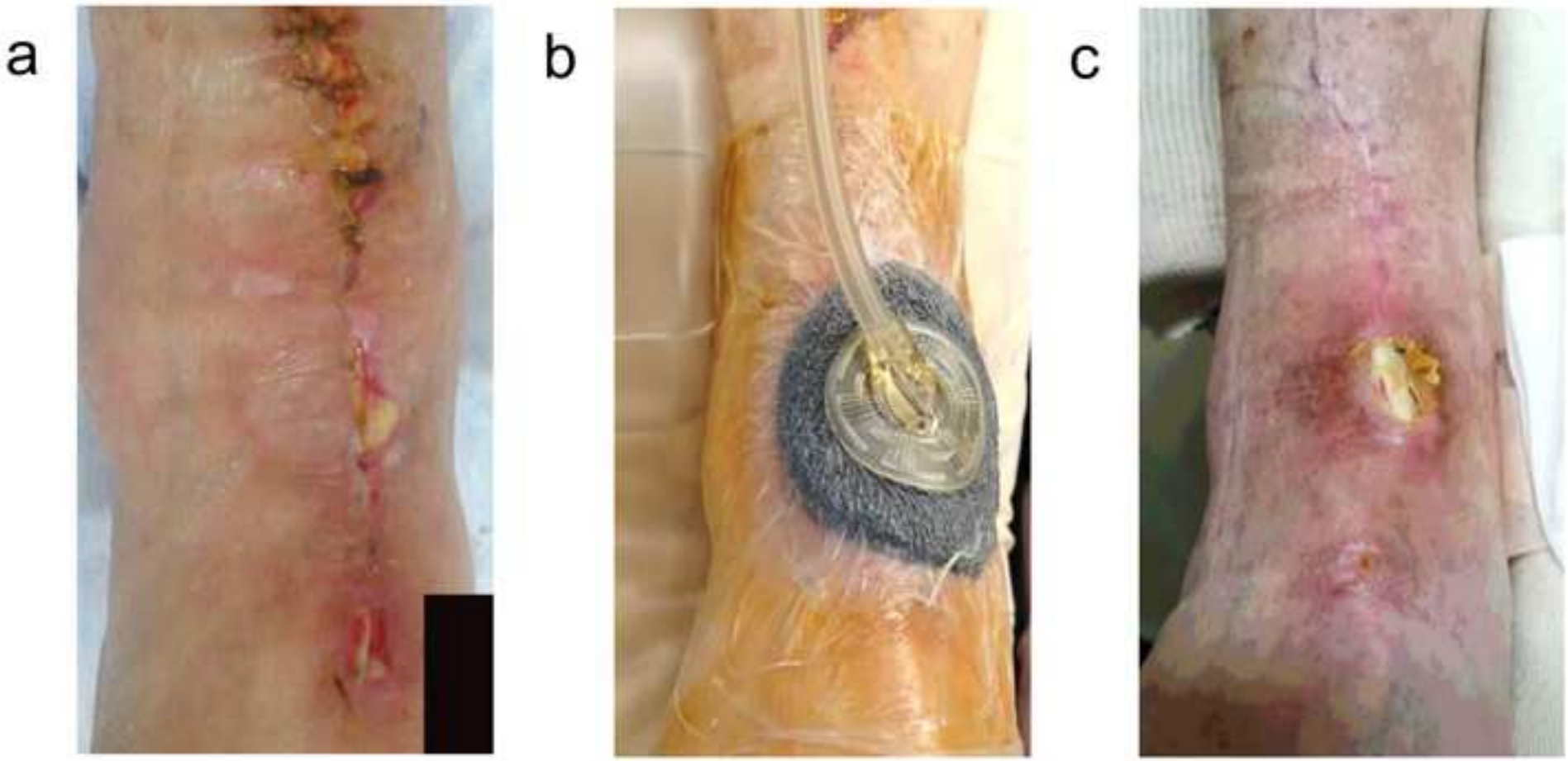

Figure 3

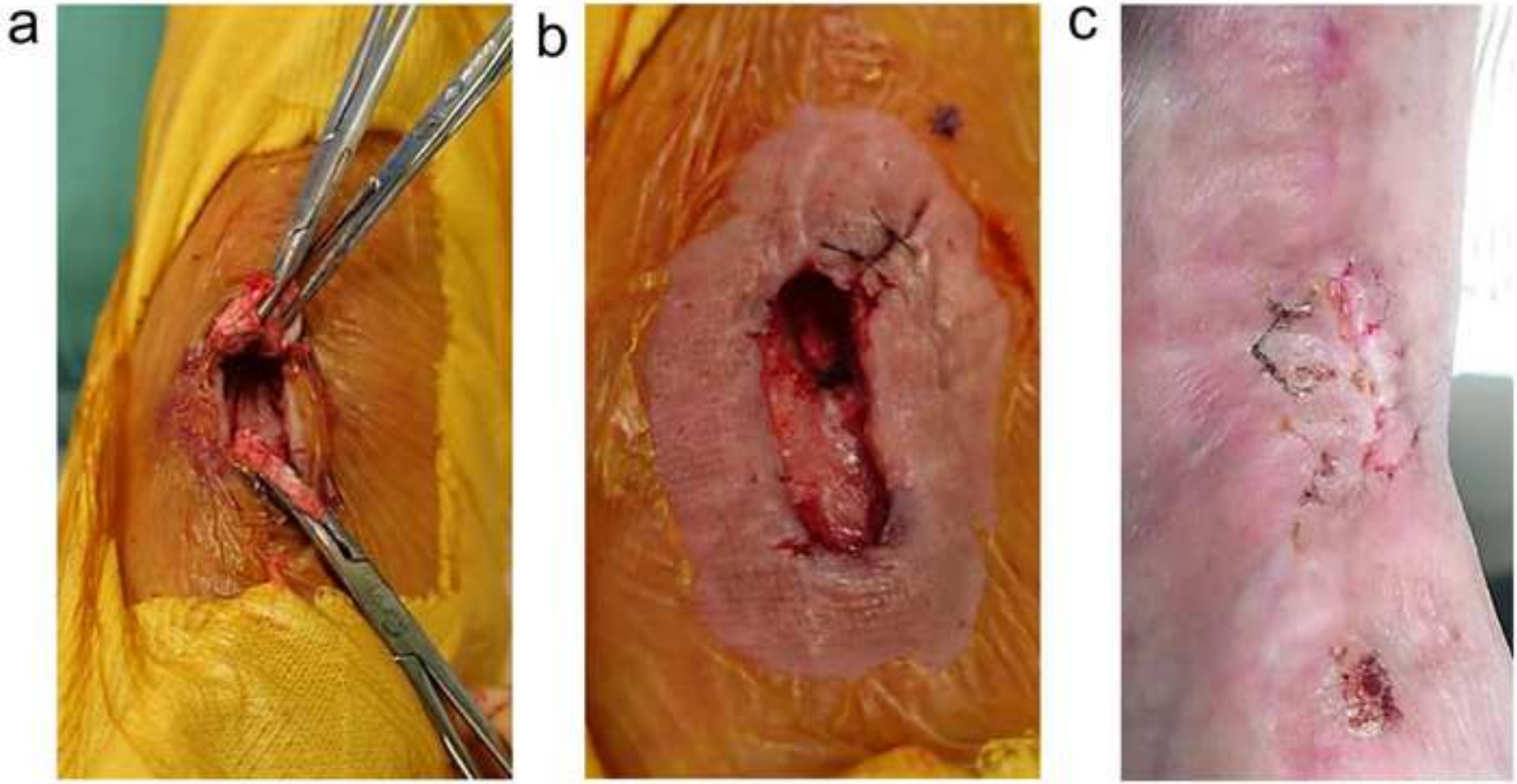

Figure 4

Figure 5

Table 1. Clinical characteristics of 3 cases

Variable	Case 1	Case 2	Case 3
Age (years)	80	70	76
Gender	Female	Female	Female
Preoperative diagnosis	RA	RA	RA
Duration of disease (years)	4	30	15
Steinbrocker' s stage / functional class	Ⅳ / Ⅲ	Ⅳ / Ⅲ	Ⅲ / Ⅲ
Comorbidity	Scleroderma	N.P.	N.P.
Prednisolone dose (mg/day)	10.0	None	5.0
MTX dose (mg/week)	6.0	8.0	8.0.
Biologics usage	None	None	None
Operation time (min)	193	233	148
Air tourniquet time (min)	160	156	108
Intraoperative complications	N.P.	N.P.	N.P.
The day when TA tendon was resected (days after TAA)	104	27	40
Dorsal flexion ROM (Pre-op/Post-op 1year, degree)	10 / 10	0 / 0	15 / 10
Plantar flexion ROM (Pre-op/Post-op 1 year, degree)	40 / 45	20 / 20	30 / 25
Dorsal flexion MMT (Pre-op/Post-op 1 year)	4 / 4	3 / 3	4 / 4
JSSF RA foot ankle scale (Pre-op/Post-op 1 year)	42 / 78	45 / 55	36 / 76

RA, rheumatoid arthritis; N.P., nothing particular; MTX, methotrexate; TA, tibialis anterior; TAA, total ankle arthroplasty; ROM, range of motion; MMT, manual muscle testing; JSSF, Japanese society for surgery of the foot.