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## Case Report

# One-stage reconstruction of the massive overlying skin defect combined with total loss of extensor tendon in zones V and VI using a reverse pedicled radial forearm tendinocutaneous flap: A case report

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## ABSTRACT

Our case report involved a 36-year-old man who sustained injury during manual labor caused by a machine press. The patient had extensive fourth-degree burns in the right dorsal hand with total loss of extensor tendons in zones V and VI of the index, middle, and ring finger. We performed a reverse radial forearm tendinocutaneous flap (the radial artery flap permits the inclusion of three “strips” of vascularized tendons: brachioradialis, flexor carpi radialis, and palmaris longus) to cover his hand defects. Six months after the operation, the active extension of the index, middle, and ring metacarpophalangeal joints had recovered well. The patient is satisfied with the outcome.

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## Introduction

Repair of soft tissue defects on the dorsum of the hand with accompanying tendon defects is a challenge in clinical practice. Conventional repair of such wounds requires skin flap transplantation at stage I, followed by free tendon transfer at stage II. The pitfall of the two-stage approach is delayed recovery of hand function due to the long treatment course, joint stiffness due to long-term immobilization, and tendon adhesion.<sup>1</sup> Taylor and Townsend reported the first dorsal foot flap with extensor digitorum brevis tendon transfer in treating a large area of skin and subcutaneous defects in the dorsal hand and achieved satisfactory results.<sup>2</sup> Subsequently, the technique was applied to treat more complex dorsal hand injuries and achieved satisfactory results. That leads to choosing a skin flap with tendon transfer for wound repair at stage I, which has become a treatment trend.<sup>3,4,5</sup>

Hiroshi Yajima introduced a case series including 6 patients with soft tissue defects combined with extensor or flexor tendon loss of the hand who was reconstructed by radical forearm flap with palmaris longus and flexor carpi radialis tendons. Out of 6 patients, five were satisfied with the motor functions.<sup>6</sup> Adani reported results in 12 patients treated with a completely vascularized single-stage approach. A free dorsalis pedis tendinocutaneous flap was used in 7 patients, while a radial forearm tendinocutaneous island flap was transferred in 5 patients. All flaps survived, and the transferred tendons were functioning well. The author suggested the use of forearm tendinocutaneous flaps in cases of reconstruction of one or two extensor tendons, while the dorsalis pedis flap can be employed in the reconstruction of tendinocutaneous defects of the dorsum of the hand, which require the use of three or four tendons grafts.<sup>4</sup> We report a case of using a reverse radial forearm tendinocutaneous to repair soft tissue and extensor tendon defects in zones V and VI of the right hand's index, middle, and ring fingers with satisfactory results.

We obtained the patient's written informed consent to reconstruct his right hand using the reverse radial forearm tendinocutaneous flap. This manuscript follows the STROBE Guidelines, and written informed consent was obtained from the patient to publish this manuscript and the accompanying images.

## Case report

A 36-year-old male patient without prior medical or surgical history was injured by a machine press. The patient had extensive 4th degree burns in the right dorsal hand with total loss of extensor tendon in a zone V and VI of the index, middle, and ring fingers (Fig. 1). We applied VAC with a semi-permeable membrane on the dorsal hand defect in one week to prepare the wound bed for the operation. After three following days of daily dressing changes, the wound surface was ready without signs of infection. On October 22, 2022, we debrided the extensive necrotic tissue from the burn (see in Supplementary Material) and performed pedicled flap coverage of the right hand with a reverse radial forearm tendinocutaneous flap (Fig. 2).

### Operative technique

A reverse pedicled radial forearm flap comprised a skin island 8 x 8 cm in size combined with the vascularized brachioradialis, flexor carpi radialis, and palmaris longus tendons with 10 cm in length. We dissected underneath these tendons to keep them intact with the skin island. To reconstruct ruptured extensor tendons, we used the Pulvertaft weave technique to suture the palmaris longus, flexor carpi radialis, and brachioradialis tendons to the index extensor, middle extensor, and ring extensor, respectively (see in Supplementary Material). The skin defect was covered by the skin island. An 8 x 8 cm split-thickness skin graft was used for donor site coverage.

### Outcome and rehabilitation

The patient was discharged 14 days postoperatively without complications. Splinting was applied to the wrist with the proximal interphalangeal joint free for 4 weeks. The patient began active MP flexion exercises up to 30° 7 days postoperatively. MP flexion was increased to 50 and 70° at the



**Figure 1.** Initial burn injury on the patient's right dorsal hand.



**Figure 2.** The reverse radial forearm tendinocutaneous flap was harvested.



**Figure 3.** Functional and aesthetic outcome at 9 months postoperatively. A: Full active finger flexion (same as pre-operation), B: Full active finger extension.

end of the 2nd and 3rd week, respectively. During the 4th to 6th week, full fisting was initiated, composite wrist and active digital extension without the splint. In 6th week, the patient started an active assisted range of motion, stretching, and progressive resistance exercises. The patient returned to work at 6 months postoperatively. After 9 months of follow-up, the patient's functions and aesthetic results were achieved in both donor and recipient sites. The patient could grip and grasp normally and performed metacarpophalangeal joint rotation with 90° of flexion and 25° of plantar extension (Fig. 3). The patient was satisfied with the overall results.

## Discussion

One-stage completely vascularized tendinocutaneous flap to reconstruct soft tissue defects with tendon loss on the dorsum of the hand gradually became a preferred option because of its advantages over other surgical approaches.<sup>3,4,5,6</sup> One of the most common complications of non-vascularized tendon grafts is tendon adhesion,<sup>7</sup> which could lead to functional limitation.<sup>8</sup> On the contrary, the blood supply to the tendon sheath in the composite flap results in rapid healing and is less likely to develop adhesion after tendon transplantation, which helps restore the function of the finger.<sup>4,6</sup> Our patient did not develop any symptoms of tendon adhesion. The patient was able to work 6 months postoperatively. One more advantage of completely vascularized tendon transfer over non-vascularized tendon grafts is shorter treatment duration and the number of operations. More than 50% of patients were unsatisfied with the results because of prolonged treatment.<sup>8</sup>

We found in our case that the proximal and distal parts of three strips of vascularized tendons, including brachioradialis, flexor carpi radialis, and palmaris longus, have similar characteristics to the extensor tendons structure in zones V and VI, respectively. That allows the primary reconstruction of tendons and sagittal bands, which prevent lateral migration of the extensor digitorum communis tendon and subsequent metacarpophalangeal extension loss.<sup>9</sup> The pitfall of our technique is the possibility of reduced wrist flexion strength. That needs to be discussed thoroughly with the patients and kin preoperatively.

## Conclusion

For soft tissue defects on the dorsum of the hand with tendon defects, one-stage transfer of the reverse radial forearm tendinocutaneous flap (the radial artery flap permits the inclusion of three “strips” of vascularized tendons) can yield satisfactory outcomes in appearance and extensor function.

## Patient consent statement

Written informed consent was obtained from the patient to publish this case report and accompanying images.

## Ethical approval

Not required.

## Declaration of generative AI in scientific writing

None.

## Declaration of Competing Interest

None.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.jpra.2023.11.015](https://doi.org/10.1016/j.jpra.2023.11.015).

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