JPRAS Open 23 (2020) 75–79

Contents lists available at ScienceDirect

JPRAS Open

journal homepage: www.elsevier.com/locate/jpra

Case report

Extensor tendon repairing with a rolled deep temporal fascial graft and a free temporoparietal fascial flap as a gliding bed: A case report ☆

Takashi Kurabayashi*, Yasutoshi Suzuki, Hirotaka Asato

Department of Plastic and Reconstructive Surgery, Dokkyo Medical University, 880 Kitakobayashi, Mibu, Shimotsuga, Tochigi 321-0293, Japan

ARTICLE INFO

Article history:
Received 25 November 2019
Accepted 28 November 2019
Available online 25 December 2019

Keywords:
Hand trauma
Tendon injury
Deep temporal fascial graft
Temporoparietal fascial flap

ABSTRACT

Reconstruction of combined skin and tendon loss in an injury of the dorsum of the hand is a challenging problem because it is required to achieve adequate excursion of the tendon. We herein report our case of extensor tendon repair for a dorsal hand injury using a rolled deep temporal fascial (DTF) graft and a free temporoparietal fascial flap. The patient regained satisfactory hand function with minimal donor site morbidity. DTF utilization as tendon grafts spares another incision for tendon grafting. Furthermore, one can integrate all the donor sites into the temporal region by choosing the scalp as a donor site for skin grafting. Patients can benefit from this procedure, which provides a functional reconstruction of the hand and leaves only inconspicuous donor site scars.

☆ The work was presented at the first Congress of the Asian Pacific Federation of Societies for Reconstructive Microsurgery in 2012.

* Corresponding author.
E-mail address: m-kura@dokkyomed.ac.jp (T. Kurabayashi).

https://doi.org/10.1016/j.jpra.2019.11.007

Introduction

Reconstruction of combined skin and tendon loss in an injury of the dorsum of the hand is a challenging problem because it is required to achieve adequate excursion of the tendon. Fascial flaps meet the requirement for a repair gliding system to facilitate tendon and joint mobility because they provide a thin, flexible, and mobile reconstructive substrate with a reliable vascular supply. While several fascial flap options have been reported to date, Carty et al. recommended a free temporoparietal fascial (TPF) flap for defects involving the dorsum of the hand.[1] They found this flap to be one of the most useful, robust, and versatile of all fascial flaps.

Regarding tendon reconstruction, the palmaris longus and extensor digitorum longus of the toe are commonly used. However, we believe that deep fascial grafts have great potential utility in tendon reconstruction. We herein report our case of extensor tendon repair for a dorsal hand injury using a rolled deep temporal fascial (DTF) graft and a free TPF flap. This procedure can provide a functional reconstruction of the hand leaving only inconspicuous donor site scars in the temporal region.

Case report

A 28-year-old man was transferred to our facility with loss of the fifth extensor and overlying skin over the dorsum of his left hand due to an avulsion injury with an industrial saw during timber processing. He had no significant medical history. The wound had been covered with the xenogenic acellular dermal matrix as primary treatment. He then underwent delayed primary reconstruction 18 days postinjury.

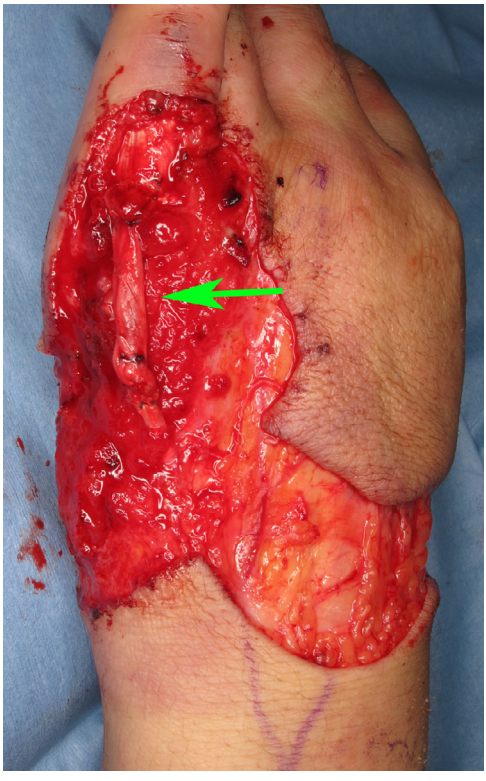

Fig. 1. The lack of extensor tendon of the little finger was repaired with the rolled DTF graft (arrow).

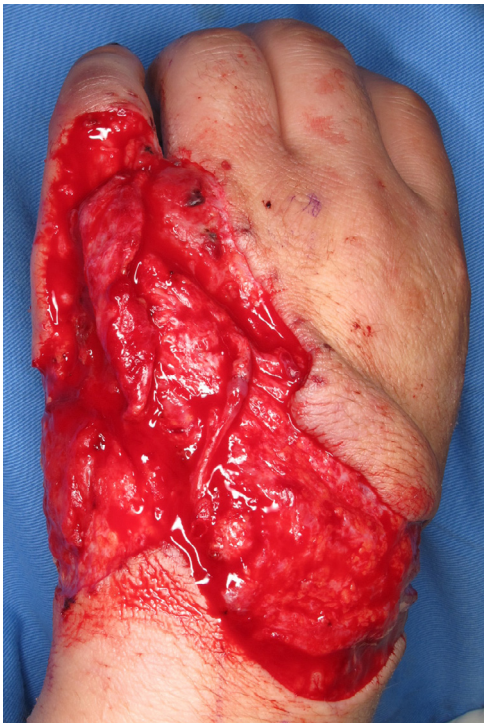

Fig. 2. The grafted DTF was draped around by the free TPF flap.

Operative details

Debridement to healthy tissue left a skin defect of 3.5 cm × 8.5 cm with a 4 cm loss of tendon. A 10 cm × 7 cm ipsilateral TPF flap was raised using a zigzag incision in the temporal region, and a 4 cm × 2 cm deep temporal fascia graft was harvested separately from the TPF flap. The DTF graft was folded in quarters along its length to be rolled into shape. The fifth extensor tendon was repaired with the rolled DTF graft. Both the proximal and distal ends were repaired by a four-strand technique, with two Tsuge stitches using 4–0 double-looped nylon sutures reinforced with a peripheral 6–0 nylon running suture (Fig. 1). The TPF flap was inset and revascularized by end-to-end anastomoses of the superficial temporal artery to the dorsal branch of the radial artery, the superficial temporal vein to the cephalic vein, and the posterior auricular vein to the basilic vein. The TPF flap was then inserted under the repaired tendon (DTF graft), and folded back to envelop the graft as a gliding surface (Fig. 2). A split-thickness (0.012 inches) skin graft harvested from the temporal region was applied over the TPF flap with a light-compression dressing.

Post-operative recovery

The TPF flap and the skin graft survived. Active flexion and passive extension were started with the wrist joint in extension 10 days postoperatively. Passive flexion was started 6 weeks postoperatively. Heavy work was allowed 12 weeks postoperatively.

One year postoperatively, the functional range of movement of the left little finger was satisfactorily restored, with a range of motion to −20° in extension and 60° in flexion at the metacarpophalangeal joint of the little finger (Fig. 3 and Supplementary Material 1). The donor sites in the temporal region were inconspicuous. He fully recovered and returned to the workplace with a performance in no way inferior to his preinjury performance.

Fig. 3. The ulnar side of the hand at one year postoperatively. (Left) In extension. (Right) In flexion.

Discussion

We used a rolled DTF for tendon reconstruction with a circumferential gliding bed of a free TPF flap. The functional range of movement of the finger was successfully restored. The donor sites in the hair-bearing scalp were not noticeable.

Our experience here suggests that a nonvascularized fascia graft is sufficient for tendon repair. Although many vascularized tendon grafts have been described, none appear to be convincingly superior to conventional free tendon grafts and justify the need for any tedious dissection. Watanabe et al. reported the use of a DTF as a vascularized graft for the reconstruction of a tendon deficit.[2] They transferred a double-layered temporal fascial flap (TPF flap and DTF flap) to the dorsum of the hand, and inserted the rolled DTF into the tendon deficit. The significant difference between our procedure and the double-layered temporal fascial flap is the freedom in design. A DTF of a double-layered flap cannot be arranged independently from the TPF, while a free DTF graft of our method can. Evidence has accumulated that tendons can obtain nourishment from the surrounding synovial fluid within the synovial sheath system.[3,4] Adhesions are therefore no longer believed to be a necessary part of tendon or tendon graft healing because the nourishment provided by the synovial fluid appears to be adequate for intrinsic tendon healing. Manske et al. investigated the perfusion and diffusion pathways to the flexor profundus tendons of monkeys by measuring the uptake of tritiated proline.[5] They found that diffusion was the primary pathway for tendon nutrition. Furthermore, tendon healing has been demonstrated in an avascular environment by several researchers.[4,6,7] Collectively, a vascularized tendon graft appears to be unnecessary for tendon reconstruction, if there is a well-vascularized gliding bed.

DTF utilization as tendon grafts spares another incision for tendon grafting. If a vascularized TPF flap already provides a gliding bed, a large selection of tendon donor sites becomes available. We can,

thus, choose commonly used donor sites, such as the palmaris longus or extensor digitorum longus of the toe. However, by choosing the temporal region of the scalp as donor sites for the tendon and a skin graft, all the donor sites for reconstruction of a complex tendon injury can be integrated into the temporal region, where scars are invisible when covered by hair.

The tensile strength of the DTF may be inferior to that of commonly used tendon grafts such as the palmaris longus, the plantaris, and the extensor digitorum longus of the toe. Tendons have a tensile strength in the range, from 42 to 112 MPa.[8] In contrast, deep fasciae have a lower tensile strength of no more than 50 MPa, in the light of the strength of the fascia lata.[9] However, fibroblasts within fascia are highly adaptable to their environment, and show the capacity to remodel in response to the direction of various mechanical stimuli, producing biochemical responses.[10] Therefore, there is a strong possibility that the tensile strength of the grafted DTF will improve at the recipient site.

In conclusion, a combination of rolled DTF grafts and a free TPF flap as a circumferential gliding bed can be a promising procedure for extensor tendon repair of a dorsal hand injury. Patients can benefit from the use of this procedure, which provides a proper reconstruction of the hand and leaves only a hidden donor site scar.

Video that demonstrates dorsal and ulnar aspects of the hand at one year postoperatively in the hand.wmv

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi: 10.1016/j.jpra.2019.11.007.

References

1. Carty MJ, Taghinia A, Upton J. Fascial flap reconstruction of the hand: a single surgeon's 30-year experience. *Plast Reconstr Surg*. 2010;125(3):953–962.
2. Watanabe T, Iwasawa M, Kushima H, Kikuchi N. Free temporal fascial flap for coverage and extensor tendon reconstruction. *Ann Plast Surg*. 1996;37(5):469–472.
3. Gelberman RH, Vande Berg JS, Lundborg GN, Akeson WH. Flexor tendon healing and restoration of the gliding surface. An ultrastructural study in dogs. *J Bone Joint Surg Am*. 1983;65(1):70–80.
4. Lundborg G, Rank F. Experimental studies on cellular mechanisms involved in healing of animal and human flexor tendon in synovial environment. *Hand*. 1980;12(1):3–11.
5. Manske PR, Lesker PA. Nutrient pathways of flexor tendons in primates. *J Hand Surg Am*. 1982;7(5):436–444.
6. Manske PR. Flexor tendon healing. *J Hand Surg Br*. 1988;13(3):237–245.
7. Gelberman RH, Manske PR, Vande Berg JS, Lesker PA, Akeson WH. Flexor tendon repair in vitro: a comparative histologic study of the rabbit, chicken, dog, and monkey. *J Orthop Res*. 1984;2(1):39–48.
8. Elliott DH. Structure and function of mammalian tendon. *Biol Rev Camb Philos Soc*. 1965;40:392–421.
9. Gratz CM. Tensile strength and elasticity tests on human fascia lata. *J Bone Joint Surg Am*. 1931;13(2):334–340.
10. Kumka M, Bonar J. Fascia: a morphological description and classification system based on a literature review. *J Can Chiropr Assoc*. 2012;56(3):179–191.