외측 상완 유리 피판을 이용한 양측 제1수지간 중증 화상 반흔 구축의 재건

윤태근 · 은석찬

분당서울대학교병원 성형외과학교실

Lateral Arm Free Flap Reconstruction in a Patient with Severe Burn Scar Contracture of the Bilateral First Web Space

Taekeun Yoon, M.D., Ph.D. and Seokchan Eun, M.D., Ph.D.

Department of Plastic and Reconstructive Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seoul, Korea

An anatomically normal first web space is essential for optimal prehensile movements of the thumb and hand. A 28-year-old woman presented with severe scarring and contractures of the first web space of both hands, following a flame burn injury sustained 25 years prior to presentation. First web space contracture may occur secondary to severe injuries, burns (as observed in our patient), or congenital hand anomalies. A significant amount of additional skin is required to release a severe first web space contracture. Reconstruction of wide areas of contractures using only local flaps is challenging. Among other free flaps used in clinical practice, the thinned lateral arm free flap provides flexible vascularized tissue for reconstruction of the skin after severe first web space contracture release. Reconstruction using lateral arm free flaps facilitated thumb abduction and opposition (which were initially difficult) and improved hand function in our patient. (**J Korean Burn Soc 2021;24:46-49**)

Key Words: Burns, Free tissue flaps, Hand deformities, Acquired, Microsurgery

INTRODUCTION

First web space contractures usually complicate palmar, dorsal, and whole hand burns. Contractures limit thumb abduction and opposition and therefore affect overall hand function; loss of grasp and key pinch are significant contracture-induced functional impairments [1]. Surgery is essential for correction of first web space aduction contractures. In most cases, first web space contractures result in scar-induced exaggerated thumb aduction, which necessitates surgery. Various surgical ap-

proaches have been proposed for the management of web space contractures. Skin grafting, local flaps including Z- and Y-V plasty, microsurgical free flap reconstruction, and bone traction are commonly used strategies in these patients [2,3]. We report the use of a lateral arm free flap in a patient with bilateral first web space contractures. Our case report highlights the advantages of a thinned lateral arm flap over other techniques used for the reconstruction of severe first web space contractures.

CASE REPORT

A 28-year-old woman presented with a history of a flame burn injury of both hands, sustained 25 years prior to presentation. Examination showed scarring and severe contractures of the first web space of both hands with pain on movement and significantly restricted hand function (Fig. 1). Preoperative evaluation was performed to determine the degree of contracture and affected struc-

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Corresponding author: Seokchan Eun, Department of Plastic and Reconstructive Surgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine, 82 Gumi-ro, 173 beon-gil, Bundang-gu, Seongnam 13620, Korea
Tel: 82-31-787-7223, Fax: 82-31-787-4055
E-mail: sceun@snu.ac.kr

Fig. 1. Image showing preoperative burn scar contractures of the bilateral first web space in our patient. Severe web space contractures involving both hands are observed, following a burn injury 25 years prior to presentation. Hand functions, including thumb abduction and opposition are limited. (A) Dorsal view. (B) Palmar view.

tures and to confirm the extent of the defect that required skin coverage. First web space contracture release was aimed at restoration of the normal distance between the first and second metacarpophalangeal joints and correction of the angle between the first and second metacarpals to 40° . We performed free flap reconstruction to prevent recurrent first web space contracture. Under general anesthesia, sterile pneumatic tourniquets were applied to the bilateral arms to ensure a bloodless surgical field. A zigzag incision was created in the skin dorsally from the free margin of the web space to the anatomical snuff box. The cephalic vein branches were separated to ensure uninterrupted drainage of the thumb. The fascia between the extensor pollicis longus and extensor digitorum of the index finger was incised from the web to the carpometacarpal joint of the thumb, and the radial artery was identified. The first dorsal interosseous muscle was detached from its origin, and the transverse head of the adductor pollicis was also detached from the palmar aspect of the third metacarpal; we performed careful dissection to preserve the deep motor branch of the ulnar nerve. The neurovascular bundles of the thumb and index fingers were also preserved. The first palmar metacarpal artery showed fibrosis and was sacrificed. Following release of the first web space contracture, we designed an ipsilateral arm flap of sufficient width to cover the defect. We confirmed the width by placing the flap pattern after web space release to ensure sufficient length of the pedicle. A thinned lateral arm fasciocutaneous flap was elevated based on the depth of the released first web space, to achieve three-dimensional reconstruction of the web space. The free flap was inserted into the first web

Fig. 2. Postoperative photographs. Image showing the lateral arm free flap elevated with a skin paddle and reconstructed by inset at the first web space defect. An external fixator is applied to each hand to maintain the first web space. (A) Left hand. (B) Right hand.

space defect, and the snuff box area was accessible for anastomosis. The pedicle, posterior radial collateral artery and venae comitans were anastomosed end-to-side with the radial artery and end-to-end with a cephalic vein branch, respectively. After wound closure, an external skeletal distractor was used to maintain the first web space. The same procedure was performed on the other hand (Fig. 2). Both free flaps survived without complications, and the distractors were removed three weeks postoperatively. The patient is being followed up over two years and has shown no complications, with satisfactory resolution of the web space contracture (Fig. 3). She is able to perform thumb abduction and opposition (which were previously difficult) and has shown improved hand function.

Fig. 3. Two-year postoperative photographs. Image showing successful engraftment of the lateral arm free flaps into the first web spaces bilaterally without any complications. The distance between the first and second metacarpophalangeal joints and the angle between the first and second metacarpals are restored. No signs of postoperative contracture recurrence are observed. (A) Left hand. (B) Right hand.

DISCUSSION

Post-burn first web space contractures are commonly observed in clinical practice, and reconstruction is challenging, with early relapse. Prevention of post-reconstruction recurrence is important. In addition to management of skin defects, it is important to correct the factors associated with contractures. With regard to tissue coverage, skin grafting alone is not commonly used for reconstruction after release of severe web space contracture because of the high risk of recurrent contracture. Post-burn web space contractures tend to be considered a simple two-dimensional issue; however, this complication requires three-dimensional reconstruction. Local flaps lack the volume that is necessary to cover the defects observed after contracture release and frequently form a tent over the web space [3,4]. Additionally, local flaps used for hand reconstruction procedures are limited in length. Contractures involving the palmar aspect of the hand require a flap measuring at least 10 cm in length. Moreover, dorsal local flaps may not easily reach the most proximal extent of the palmar defect. Furthermore, dorsal flaps usually create a deeper web space, which decreases palm width; therefore, dorsal flaps are functionally and cosmetically deficient. Distal pedicled flaps are commonly selected for web space skin

reconstruction, although they are associated with several drawbacks; these flaps usually require at least a two-stage operative procedure and therefore, restrict mobility. Furthermore, distal pedicled flaps tend to overfill the defect created after contracture release. A distal-based radial forearm flap can be used as an island flap but only in patients in whom the palmar arch is intact. This flap cannot be used in patients in whom the web space contracture results from direct web space or palmar injury that interrupts the retrograde flow to the radial artery [4,5].

Free flap reconstruction after contracture release provides good quality coverage and enables a choice of potential donors and designs in patients with severe web space contracture. However, many free flaps are excessively bulky for hand defects. The skin of free flaps elevated from the arms, forearms, and foot tends to resemble that of the hands and is thinner than that of the trunk; however, flaps elevated from each site are associated with specific drawbacks. The free dorsalis pedis flap is a representative flap derived from the foot and provides excellent skin coverage but creates a secondary defect, necessitating surgery on the upper and lower extremities and precludes early mobilization of patients and is therefore rarely used [6,7]. The lateral arm free flap has relatively few limitations. It is a fasciocutaneous flap containing skin on the lateral aspect of the arm and proximal aspect of the forearm and facilitates reconstruction of the first web space after contracture release, without much difficulty. Its color, texture, and thickness are similar to that of the skin on the dorsum of the hand, and it enables primary donor site closure, with only a linear scar at the donor site [8]. Although a wide flap can be harvested, the flap required after first web space contracture release should not exceed 6×11 cm. The pedicle length can range from 6~8 cm depending on the length of skin elevated distally, length of the flap, and how long dissection is continued proximally. The lateral arm flap can function as a sensate flap. The skin of this flap is innervated by the lower lateral cutaneous nerve of the arm; a branch of the cutaneous radial nerve can be anastomosed to the nerve to provide sensation in the web space. The lateral arm flap is useful for functional and cosmetic reconstruction of the first web space, with minimal donor site morbidity [8,9].

In this case, first web space reconstruction was successfully performed using a lateral arm free flap in a patient with burn scar contractures of the bilateral hands. This case report highlights that free flaps are effective for reconstruction of the first web space, following severe burn contractures and that a thinned lateral arm flap is recommended for this purpose.

DECLARATIONS

The study was approved by the Institutional Review Board of Seoul National University Bundang Hospital (No. B-2110-716-701) and performed in accordance with the principles of the Declaration of Helsinki. The patient provided written informed consent for the publication and the use of her images.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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