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Craniofacial/Pediatric

Split-thickness Plantar Skin Graft for Foot Syndactyly

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Summary: For the treatment of syndactyly, the submalleolar or inguinal area is the common donor site for skin grafts. However, high skin tension of the submalleolar area could potentially delay wound healing or cause scarring. Skin grafts from the inguinal area cause pigmentation. In this study, we have harvested split-thickness skin grafts from the plantar area to treat syndactyly and evaluated the healing course and aesthetic outcome. We analyzed 13 recipient and nine donor sites in eight patients, aged 13–68 months (average 25 months), with syndactyly of the foot. The minimum follow-up was 14 months, and average follow-up period was 22.3 months. Aesthetic outcomes including color and texture match, wound healing of donor site using Vancouver Scar Scale, and complications of both sites were assessed in all patients. At the recipient sites, the graft survived well, and the lack of pigmentation of the graft led to good color match. At the donor sites, hypertrophic scar and high scar scale were seen around postoperative month 3, but were momentary, as all donor sites matured to a flat and soft scar. Morbidity of split-thickness skin graft from the plantar region is limited. It causes minimum scarring of the nonexposed area. Moreover, because it does not cause pigmentation, the split-thickness skin graft technique is a reasonable option for the treatment of syndactyly. *(Plast Reconstr Surg Glob Open 2023; 11:e5498; doi: 10.1097/GOX.0000000000005498; Published online 22 December 2023.)*

PRESENTATION OF IDEA AND TECHNIQUE

Syndactyly is commonly treated by local flaps to the bottom of the interdigital space and full-thickness skin grafts. However, the issue remains where to seek the donor site of the skin grafts; skin grafts from the submalleolar area have a high degree of tension that can lead to disfigurement and hypertrophic scars, whereas those from the inguinal area often mismatch in pigmentation.

As the plantar skin is devoid of pigmentation, the split-thickness skin graft technique is a reasonable choice to treat syndactyly. Additionally, the color and texture of the donor and recipient sites are similar at the grafting site. Most importantly, the sole is a highly unexposed area.

We firstly performed split-thickness skin grafting from the plantar area to treat syndactyly and validated the healing course, outcome, and results at both the donor and recipient site.

Under tourniquet control, the syndactyly was split using a rectangular flap to reconstruct the bottom of the interdigital space. After the suture of the flap, the raw surface left at the side of the digits was measured to determine the size of the split-thickness skin graft from the medial plantar. At the donor site, saline was injected subcutaneously and intradermally using a 5-mL syringe with a lock and a 27-gauge needle until the skin became stiff and tight. (**See Video 1 [online],** which shows surgical technique to harvest split-thickness skin graft from the plantar area.) The split-thickness skin graft was then harvested manually using a No. 15 scalpel, with an extremely thin layer of dermis present with the stratum corneum. Occasionally, the skin was turned over to check and ensure similar density throughout the graft. The donor was then covered with ointment and polyurethane foam dressings [ALLEVYN Non-Adhesive (Smith and Nephew, Hertfordshire, UK)]. The harvested skin grafts were put to the recipients and were tied over as classical style. No postoperative restrictions were placed for activities, but the surgical sites were covered by bandages over gauze and were kept dry. The

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dressing of both recipient and donor sites were opened for the first time on postoperative day 14, unless signs of infection or contact dermatitis were observed. After completion of epithelialization, taped compression using Micropore (3M, St. Paul, Minn.) was indicated for up to 3 months postoperatively.

Eight patients (with nine donor sites and 13 recipient sites) have undergone this procedure at our institution between September 2020 and March 2022 (five male infants; mean age: 25 months; age range: 13–68 months). (**See Video 2 [online],** which shows patient characteristics.) The average follow-up period was 22.3 months (range: 14–27 months).

At the donor site, the average raw surface was 3.8 cm^2 (range: 1.5–8.8 cm^2). By postoperative day 14, epithelialization was complete in seven of nine cases. We evaluated the donor site with vascularity, pigmentation, pliability, and height, using the Vancouver Scar Scale. Although temporary hypertrophic scarring was observed at postoperative month 3 (**See Video 2 [online],** which shows scarring of the donor site evaluated by the Vancouver Scar Scale), all donor sites showed soft, flat, and matured scars (**See Video 2 [online],** which shows other donor sites).

At the recipient site, the full graft survived in all cases. In one case, hypertrophic scar was seen at postoperative month 3, which matured by postoperative month 6. No contracture of the skin graft was seen during the follow-up (**See Video 2 [online],** which shows other recipient sites). Throughout the follow-up period, there was no pigmentation in any of the cases.

A 13-month-old boy presented with syndactyly of the right second and third toe (Fig. 1). The interdigital space was reconstructed with a rectangular flap from the dorsum, and a split-thickness skin graft from the right medial plantar (Fig. 2). By postoperative month 12, the interdigital space had reconstructed deeply without contracture or pigmentation. Because the donor-site skin has characters similar to those of the side of the toe, both color match and texture match are excellent (Fig. 3). The donor scar matured with softness and without vascularity, pigmentation, or height (Fig. 4). No complications were observed at the two sites.

DISCUSSION

Webster reported the first full-thickness skin extraction from the sole for the palm in 1955.[1] Since Le Worthy reported split-thickness skin graft from the sole to the palm in 1963, split-thickness skin grafting from the plantar to the palmar surface has been reported in several studies.[2–5] Bunyan and Mathur reported that plantar skin had less (3%) recurrence of contracture compared with from the thigh (37%) or full-thickness skin grafts (9%) in their series of 478 cases.[4] However, there is no existing report highlighting the usefulness of this technique for syndactyly of the foot or describing the detailed course of scar maturation at the donor site. Hence, we conducted this study to address these areas.

So far, skin grafts for syndactyly were commonly from the submalleolar or inguinal area (**See Video 2 [online],** which shows comparison of donor sites). The issue of the submalleolar area is that the skin tension is quite tight, and only a limited amount can be taken. For example, the average graft size in this study was 3.7 cm^2, which can be calculated as a spindle shape of 1.2 cm width and 4.7 cm length. For a toddler, 1.2 cm from the submalleolar area is quite large, and high tension often leads to wound opening or wide scars. Our largest graft was 8.8 cm^2, which would not be available from the submalleolar area. Contrarily, there is no limitation on the amount of skin from the inguinal area, but pigmentation leads to color mismatch. A split-thickness skin graft from the plantar area solves these problems effectively.

Takeaways

Question: Is split-thickness plantar skin graft suitable for foot syndactyly?

Findings: Thirteen recipient and nine donor sites in eight patients were analyzed. Split-thickness plantar skin graft did not cause pigmentation at the recipient site, which led to aesthetic outcome. Hypertrophy of the donor site was momentary and all matured to flat and soft scars.

Meaning: The split-thickness skin graft technique is a reasonable option for the treatment of syndactyly.

Fig. 1. Case presentation. A rectangular flap was marked at the dorsal face to reconstruct the bottom of the interdigital space.

Fig. 2. Donor site of the split-thickness skin graft at the plantar area and the graft.

Fig. 3. Twelve months postoperatively, the interdigital space had reconstructed naturally without any pigmentation.

The plantar area does not cause pigmentation even when harvested as a split-thickness graft. The fact that the dressing sites can be included in one foot is also more acceptable in children. The nonrequirement of donor sutures and skin grafts may also reduce the operative time.

However, because the skin graft did not cause pigmentation, one patient developed a color mismatch due to dorsal skin pigmentation. A "gradation skin graft," which Sasaki et al named, from the plantar instep area is cephalic side pigmented and caudal side unpigmented.[6] This option could be considered in such a case. As a limitation, the assessment of the contracture in the long-term course of growth is lacking.

Fig. 4. Donor site with mature scar.

This series provides a proof of healing process of the split-thickness graft from the plantar and suggests a new option to treat syndactyly of the foot.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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