

# Partial Second Toe Pulp Flap Transfer for the Coverage of Great Toe Hemipulp Flap Donor Site

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**Summary:** The great toe hemipulp flap transfer is a viable reconstructive method for finger pulp defect. However, early functional recovery of the donor foot is essential for returning to daily life activities, and functional and aesthetic restoration of the donor site remains challenging. We present a case in which the great toe hemipulp flap donor site was reconstructed with pedicled partial second toe pulp flap transfer, aiming for early recovery of the donor foot and aesthetically and functionally satisfactory donor-site reconstruction. A 62-year-old man underwent left little finger-pulp crush amputation in Tamai zone 2 and received free great toe hemipulp flap transfer. For the defect following flap harvest, the partial second toe pulp flap was elevated and transferred. The donor site of the partial second toe pulp flap was primarily closed. The postoperative course was uneventful, and the patient started walking on postoperative day 2. Postoperatively, the sensory recovery of the transferred flap was excellent, and the reconstructed great toe was functionally and aesthetically satisfactory. The pedicled partial second toe pulp flap transfer may be a viable alternative for the coverage of great toe hemipulp flap donor site. (*Plast Reconstr Surg Glob Open* 2022;10:e4152; doi: 10.1097/GOX.0000000000004152; Published online 28 February 2022.)

**T**oe transfer is a versatile tool for finger reconstruction, with the ability to provide tissue that is similar to the finger defect.<sup>1</sup> However, although several modifications have been made to the procedure in an effort to minimize donor-site morbidity and improve the cosmesis and function of the hand, donor-site complications such as gait disturbance and pain remain a concern.<sup>2</sup> After toe transfer surgery, early recovery of the donor foot is essential for performing daily activities, and functional and aesthetic reconstruction of the donor site is important.<sup>3</sup> Conventionally, skin grafting has been used for donor-site coverage, but the procedure generally requires a period of wound immobilization and often results in prolonged wound healing. Although free flaps may enable flexible reconstruction for each defect, they are commonly too bulky and need a long operative time. Moreover, simultaneous free flap transfer requires two microsurgeon teams and microscopes.<sup>3</sup>

In this report, we present the reconstruction of the great toe hemipulp flap donor site with pedicled partial

second toe pulp flap transfer for early recovery of the donor foot and for aesthetically and functionally satisfactory donor-site coverage.

## CASE REPORT

A 62-year-old man underwent left little finger-pulp crush amputation in Tamai zone 2, and the amputated finger was lost. The distal phalanx was exposed, and we performed free great toe hemipulp flap transfer for the finger-pulp defect. After harvesting a great toe hemipulp flap measuring 35×22 mm from the left foot, the volar subcutaneous vein of the left second toe was identified and marked using a near-infrared vein visualization device (AccuVein AV400, Cold Spring Harbor, N.Y.) (Fig. 1). Then, under tourniquet, the partial second toe pulp flap measuring 25×17 mm was elevated, incorporating the vein. A subcutaneous tunnel was created beneath the first web, and the flap was threaded through the tunnel and transferred to the defect following the great toe hemipulp flap harvest. (See figure, Supplemental Digital Content 1, which displays the technique: a subcutaneous tunnel is created beneath the first web, and the flap is threaded through the tunnel. <http://links.lww.com/PRSGO/B948>.) The donor site of the partial second toe

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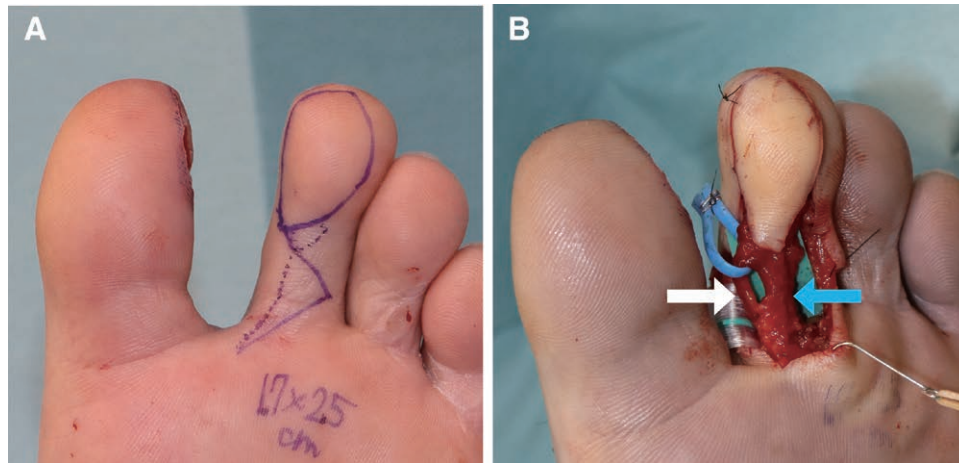
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**Fig. 1.** A, After harvesting the great toe hemipulp flap from the left foot, the volar subcutaneous vein of the left second toe is identified using AccuVein and marked. B, A partial second toe pulp flap measuring 25×17 mm is elevated, incorporating the subcutaneous vein (blue arrow) and neurovascular bundle (white arrow).

pulp flap was primarily closed. The postoperative course was uneventful, and the patient started walking on postoperative day 2. The transferred partial second toe pulp flap survived entirely without any complications such as venous congestion or wound dehiscence (Fig. 2). The patient did not experience gait disturbance. The Semmes–Weinstein monofilament test results of the transferred flap and donor second toe pulp were 3.84 (contralateral great toe pulp: 3.84) and 4.31 (contralateral second toe pulp: 4.08), respectively, at the 6-month follow-up.

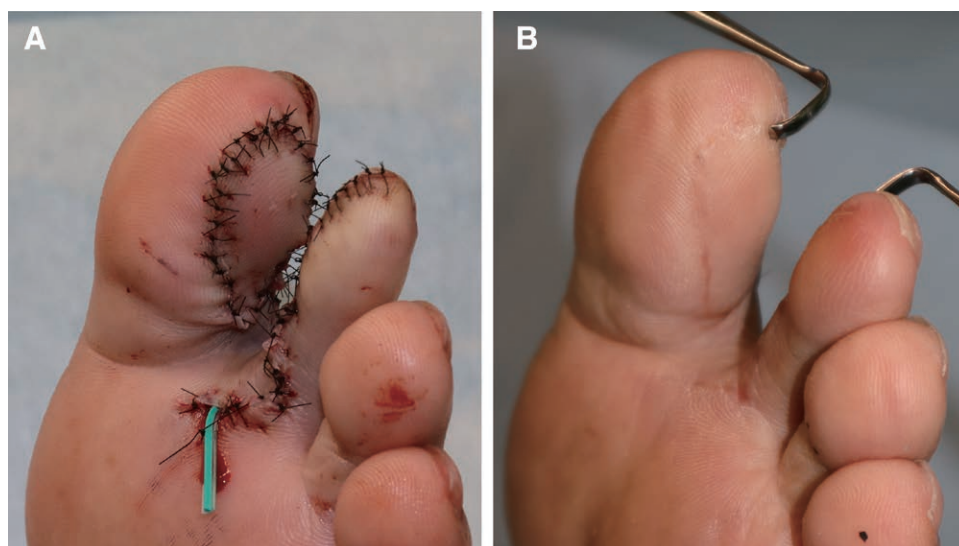
### DISCUSSION

Partial second toe pulp flap transfer is a versatile option for pulp defect coverage that can offer similar tissue as the defect.<sup>4</sup> Although flap size may be limited,

up to three-fifths of the width of the glabrous second toe pulp can be harvested and the donor site can be primarily closed. Donor-site morbidity of the flap is minimal, and it seldom causes gait disturbance postoperatively.<sup>4</sup>

To the best of our knowledge, no report has described the partial second toe pulp flap transfer for the coverage of a great toe hemipulp flap donor site.

This procedure has several advantages. First, by incorporating the toe digital nerve into the partial second toe pulp flap, the great toe pulp defect can be reconstructed using a sensate flap. This facilitates the functional recovery of the donor great toe.<sup>5</sup> Second, the color- and texture-match is excellent because the defect can be reconstructed in the “like-with-like” manner. The partial second toe pulp flap offers durable glabrous pulp



**Fig. 2.** A, The flap is transferred to the defect following the great toe hemipulp flap harvest. The donor site of the partial second toe pulp flap is primarily closed. B, Photograph taken 6 months after the operation. The flap survived entirely without any complication and the patient did not experience gait disturbance. The reconstructed foot is functionally and aesthetically satisfactory.

skin for the reconstruction of the great toe pulp defect, which facilitates aesthetic reconstruction of the donor great toe.<sup>6</sup> Third, the donor flap can be harvested from the nearby surgical field and transferred as a pedicled flap. Thus, vascularity of the transferred tissue may be more stable compared with that of free flap transfer or skin grafting. This may facilitate a shorter period of wound immobilization and allow early recovery of the donor great toe and early return to daily activities.<sup>3</sup> In our case, the patient started walking on postoperative day 2, and careful observation of the transferred partial second toe pulp flap revealed no signs of venous congestion. Our procedure enabled early recovery of the donor foot and functionally and aesthetically satisfactory reconstruction of the great toe.

The drawbacks of this procedure include the relative difficulty in identifying the volar subcutaneous veins of the second toe, because the veins are tenuous and have several branching patterns.<sup>7</sup> The pedicled partial second toe pulp flap may be successfully elevated without incorporating identifiable veins by preserving the fine tissue surrounding the toe digital artery and nerve. The perivascular tissue will likely provide venous outflow, resembling the hemodynamics of an antegrade homodigital neurovascular island flap.<sup>5</sup> However, unstable venous drainage may cause venous congestion and partial necrosis of the flap, resulting in delayed wound healing. In our case, therefore, using a near-infrared vein visualization device, we identified the volar subcutaneous vein of the second toe before incision and could incorporate the vein into the flap to ensure venous outflow. The device displays a map of the subcutaneous veins on the skin surface in real time and enables identification and marking of them, which eliminates the guesswork in finding the veins after skin incision.<sup>6</sup>

The increased time required for great toe reconstruction may be another drawback of this method compared with skin grafting. However, when performed simultaneously with the microvascular anastomosis of the great toe hemipulp flap, this procedure would not substantially affect the total operative time.

Although this procedure requires additional donor compromise in the toe aside from the great toe hemipulp and, thus, may have an increased risk of potential

complications, we believe the compensation can be acceptable, considering the minimal donor-site morbidity of the partial second pulp flap and excellent outcome of the reconstructed great toe.<sup>4,6,8</sup>

Although further clinical applications are required to confirm the feasibility and reproducibility, partial second toe pulp flap transfer may be a viable alternative for the coverage of great toe hemipulp flap donor site.

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*The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from the study participant, including consent to participate and to publish the findings.*

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