

# Treatment of Toe-to-toe Defect with Arterial Skin Flap

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**Abstract:** Objective: To study the repairing effect of arterial skin flap on the toe defect. Methods: Six patients with hallux defect were treated in our hospital from February 2014 to February 2016. The skin flap of the thumb was used to repair the defect. Results: After the operation, the skin flap had symptom of venous crisis. One patient survived after the dressing and partial removal of the pedicle of the flap. The other 5 cases survived and the wounds were healed. The skin grafts in the donor site survived and the incision reached grade I healing. The average follow-up period was 10 months. The flap elasticity and texture were good. Patients' foot felt with burden, with normal walking, without obvious discomfort and without ulceration. Conclusion: The toe-to-toe defect is repaired with the arterial skin flap. The skin flap does not cause damage to the blood vessels, and the clinical result is ideal.

**Key words:** Skin flap; Hallux defect; Repair; Effect observation

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The position of hallux is prone to injury but there is a big difficulty in repairing. In the past, the treatment of foot skin and soft tissue defects is prone to the medial side of the neurotrophic skin flap repairing method. However, the flap rotation point and the length of cut limit affect repairing and cannot completely repair the toe defect<sup>1</sup>. This study observed the effect of the skin flap with the thumb artery on patients with toe defects.

## 1. Materials and Methods

### 1.1 General information

6 patients with toe defects were included in this study, where 5 patients were male and 1 patient was female. Their age ranged from 21 to 52 years, mean ( $38.2 \pm 2.3$ ) years. One case had cutting injury, two cases had heavy injury, and three cases had crushed their toes. The average hospital stay was ( $2.4 \pm 0.3$ ) h. Two cases had defects on right side toe and the rest on the left. The wounds were observed and diameter of soft tissue defect was ranged from ( $2.0 \times 1.7$ ) cm to ( $4.0 \times$

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3.0) cm. Two patients had a nail bed defect.

## 1.2 Treatment Methods

All patients were implemented with timely emergency repair treatment when admitted to hospital. The skin flap design includes finding the perforation point in thumb valve of preoperative patients by using the color Doppler ultrasound blood flow detector to the skin, and flap axis for the hallux was set to the dorsal midline and median line axis, the rotation point for metatarsophalangeal joint was 1.0-1.5 cm near the proximal. The flap length and width were 0.5 cm larger than the wound. Surgery with the subarachnoid block anesthesia helps patients to implement supine position. The tourniquet was applied at the thigh, and then proceeds with series of operations. The first cut was performed from the proximal flap to the deep fascia according to the design of the flap. According to the distribution of medial dorsal cutaneous nerve in the skin flap, surgeon accurately cut along the deep fascia of the flap. Then, The pedicle line were lifted and treated. The tendon tissue preservation was performed to facilitate the donor skin graft. In the pedicle, fascia tissue with width of 1.0-1.5 cm was retained. After removal of the flap, the tourniquet was loosened and the blood supply to the flap was carefully observed. After the condition was identified as good, the wound was repaired. The proximal end of the cutaneous nerve in the medial dorsal cutaneous of the flap was anastomosed to the stump of the toe. In the selected cases, the width of flap was ranged from (2.5 × 2.3) cm to (4.5 × 3.5) cm. The medial thickness of the skin of the calf was repaired and observed.

## 2. Results

After operation, the skin flap had symptom of venous crisis. One patient survived after wound dressing and partial removal of the pedicle of the flap. The other 5 flaps were survived and the wound was healed. The skin grafts in the donor site survived and the incision reached grade I healing. The average follow-up period was 10 months. The flap elasticity and texture were good. Patients' foot felt with burden, with normal walking, without obvious discomfort and without ulceration.

## 3. Discussion

The anatomical basis of the skin flap of the thumb artery was analyzed. During the operation, when the toe artery moved to the distal part of the toe, the dorsal branch have 2 to 3 branches, which located at 1/3 of the toe and near the middle section. Occurrence of variation in number and location of branches was less frequent. In other words, it is in high degree of consistency which is conducive to carry out a good flap design<sup>2-3</sup>. The blood supply to the skin flap of the hallux artery was derived from the dorsal branch arteries of the dorsal metatarsophalangeal joints and the common arteries of the dorsal metatarsophalangeal joints, which are connected to each other. In addition, 1 to 2 venules in each metatarsal space for each skin perforation artery were observed. The lower edge of the band that accompanied by a more constant artery of communication was supported for venous return and flap arterial blood for laying a good foundation.

In this study, the skin flap pedicle repair treatment was carried out for the toe-to-toe defect of the selected cases. In the course of the operation, the dorsal medial cutaneous nerve can effectively coincide with the recipient nerve<sup>4</sup>. At the end of the operation, the skin flap survived in all but one patient, and all the wounds healed. The causes of venous crisis in flap were analyzed and we found that postoperative swelling and flap pedicle suturing intensity may be related. In order to prevent necrosis of the skin flap after surgery, the following precautions should be noted: when designing and cutting the flap, the length and width of the wound should be larger than 0.5 cm to prevent the tension of the suture flap; the skin flap pedicle width should be sufficient to prevent blood circulation disorders; if the vascular crisis occurred in the

flap after the operation, surgeon should check whether the swelling on the pedicle is caused by pressure or not and removed all the stitches if necessary<sup>5</sup>. Compared with the previous repairing methods, the advantages of arterial skin flap repair include flap thickness, color and the area that is relatively close. Besides, the implementation of the flap surgery does not cause damage to blood vessels and arterial and the operation are relatively simple. Therefore, the clinical effect is very satisfactory.

In summary, the toe defect with arterial skin flap repairing treatment does not cause vascular injury and the clinical effect is ideal.

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