

1 Reconstruction of lateral forefoot using reversed medial plantar flap  
2 with free anterolateral thigh flap

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22 **Running head:** Plantar repair with reversed medial plantar and free ATL flaps

23

24

**Abstract**

25 Skin defects of the heel have been frequently reconstructed using the medial  
26 plantar flap; however, forefoot coverage remains a challenge, because the  
27 alternatives for flap coverage are very limited. In this article, we describe a  
28 case of reconstruction with a distally based medial plantar flap together, with a  
29 free anterolateral thigh flap that were transferred successfully. The advantages  
30 of this flap are that it: does not reduce the vascular supply to the foot because  
31 of the reconstruction of medial plantar vascular systems, reduces the risk of flap  
32 congestion, minimizes donor site morbidity, and enables the transport of  
33 structurally similar tissues to the plantar forefoot. We believe that this technique  
34 is a reasonable reconstructive option for large lateral plantar forefoot defects.

35

36 Level of Clinical Evidence : Level 4

37

38 Key words: lateral forefoot reconstruction, reversed medial planter flap, free  
39 anterolateral thigh flap, interposing flap, weight-bearing region.

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## INTRODUCTION

45 The medial plantar flap provides structurally similar tissue to the plantar foot,  
46 posterior heel, and ankle defects with its thick glabrous plantar skin and  
47 shock-absorbing fibrofatty subcutaneous tissue. <sup>(1)</sup> Regarding forefoot wound  
48 reconstruction, the development of a distally based retrograde-flow medial  
49 plantar island flap enables resurfacing of the soft tissue defects located as distal  
50 as the metatarsal heads. <sup>(2,3)</sup> However, this convenient flap involves several  
51 problems and disadvantages, including venous congestion, donor-site deformity,  
52 and reduction of the foot circulation.

53 We present a case of lateral forefoot reconstruction using a distally based  
54 medial plantar flap in addition to a free anterolateral thigh flap, resulting in a  
55 successful outcome along with the resolution of these problems.

56

## CASE REPORT

57 A 53-year-old male was referred to our office complaining of nevus on the  
58 distal-lateral plantar weight-bearing region of the right foot, which had enlarged  
59 over a 1-year period. The patient had 4 nevi measuring 0.8 × 0.7cm to 1.5 ×  
60 0.7cm, revealed to be malignant melanoma by the histological analysis of a  
61 biopsy specimen (Figure 1).

62 The operation consisted of an en bloc resection with a 2-cm margin,

63 containing the plantar fascia (Figure 2). He also underwent inguinal lymph  
64 node resection, as sentinel inguinal lymph node examination revealed  
65 metastasis. The defect after resection of the melanoma was repaired with an  
66 island reversed median plantar flap measuring 5x4cm. The flap seemed to be  
67 congestive (Figure 3). The donor defect was covered with a free anterolateral  
68 thigh flap with a 6x5-cm elliptical skin island (Figure 4). The T portion of the  
69 descending branch of the lateral circumflex femoral vessel was interposed with  
70 the transected medial plantar vessel, and we connected one artery and two  
71 veins by end-to-end anastomosis (Figure 5, 6). Consequently, congestion of  
72 the reversed median plantar flap improved, because the interrupted medial  
73 plantar vessel resumed normal blood flow.

74 The viability of the skin flaps was favorable without infection or necrosis, and  
75 no additional surgery was required (Figure 7). Three weeks later, he was  
76 discharged on foot.

## 77 DISCUSSION

78 Skin defects of the sole have been commonly reconstructed using the medial  
79 plantar flap, which uses skin from a non-weight-bearing area of the sole,  
80 providing excellent texture sole replacement.<sup>(1)</sup> However, forefoot coverage  
81 remains a challenge, because the alternatives for flap coverage are very limited.  
82 Small forefoot ulcers with intact toes can be resurfaced using a digital artery flap,

83 and medial plantar defects can be covered with laterally based fasciocutaneous  
84 flaps. <sup>(4)</sup> However, the coverage of large forefoot defects, especially those  
85 located in the lateral area, is challenging. To resolve this problem, the distally  
86 based medial plantar island flap has been developed and described in forefoot  
87 soft tissue replacement in chronic plantar ulcerations, burn contractures, and  
88 following excision for malignancy. <sup>(5)</sup>

89 However, this convenient flap involves several problems and disadvantages.  
90 Firstly, venous congestion, which results in partial flap necrosis, may be an  
91 inherent disadvantage of a distally based medial plantar flap, due to the  
92 reversed venular valves. <sup>(1)</sup> Butler et al. reported that one of two distally based  
93 medial plantar island flaps required venous supercharging with an  
94 interpositional vein graft due to flap congestion. <sup>(6)</sup> The interposed vein graft  
95 also required coverage, usually performed by free skin grafting in the instep  
96 region. Free skin grafting upon the vessel is also a risk of vascular stoppage,  
97 especially if it is located on the sole. Butler and Chevray put forward several  
98 recommendations to improve vascular problems, including preservation of the  
99 perivascular fat of the pedicle, and skin grafting of the pedicle to avoid  
100 compression. <sup>(6)</sup>

101 Secondly, donor-site deformity, resulting in medial plantar contracture or/and  
102 hyperkeratosis, occurs in the skin graft, which sometimes causes walking  
103 disability. Medial plantar sensory disturbance caused by skin grafting directly  
104 upon nerve may also develop. <sup>(7)</sup> Thirdly, a distally based medial plantar flap  
105 requires the sacrifice of the medial plantar vascular system, which reduces the  
106 circulation of the foot. <sup>(8)</sup> The medial plantar perforator flap is nutritionally  
107 dependent only on the perforator of the medial plantar vessel; thus, the  
108 posterior tibial and medial plantar vessels are left intact. Forefoot skin defects  
109 located on the medial side can be reconstructed with this useful perforator flap  
110 without transecting the medial plantar artery. <sup>(7, 9)</sup> Regrettably, it cannot reach  
111 the lateral forefoot, because the pivot point of the perforator limits the area  
112 where the perforator flap can be transferred.

113 Blood flow of the distal foot including a reversed medial plantar flap can be  
114 maintained normally, owing to the reconstruction of the transected medial  
115 plantar vessel by interposing the descending branch of the lateral circumflex  
116 femoral vessel. In this meaning, this medial plantar flap is not strictly a distally  
117 based nor reversed flap.

118 All perforator flaps were available for resurfacing the instep donor-site and  
119 interposing the vessels for the interposing flap. In our case, we chose the

120 anterolateral thigh flap due to its advantages, including the fact that this flap  
121 provides a relatively thin skin paddle which is suitable for instep coverage, the  
122 descending branch of the lateral circumflex femoral vessel is of an enough size  
123 for micro-anastomosis and provides a sufficient length for interposing, and the  
124 lack of a need for position changing enables surgeries of flap harvest and  
125 recipient preparation to be performed by two separate teams next to each other.  
126 <sup>(10)</sup> This technique can be performed free of venous problems, and no vascular  
127 compromise of the foot develops with minimal donor site problems, which are  
128 potential advantages over conventional combination methods.

129 In conclusion, the distally based medial plantar flap with free anterolateral  
130 thigh flap is the primary choice for reconstruction, especially for large lateral  
131 plantar forefoot defects.

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159 preservation of posterior tibial vessels. *Ann Plast Surg* 38:598-603, 1997.

160

## LEGENDS

161 Figure 1: Preoperative view of the 4 nevi on the lateral forefoot.

162 Figure 2: Intraoperative view of the distal-lateral plantar weight-bearing region  
163 after tumor resection with a 2-cm margin. The wound and surrounding skin  
164 were stained with indocyanine green to examine sentinel lymph nodes.

165 Figure 3: Intraoperative view of the reversed median plantar flap. It seemed  
166 to be congestive.

167 Figure 4: View of the harvested anterolateral thigh flap.

168 Figure 5: Intraoperative view of transported anterolateral thigh flap. The T  
169 portion of the flap vessel was interposed with the transected medial plantar  
170 vessel.

171 Figure 6: Illustration of lateral forefoot reconstruction using reversed medial  
172 plantar flap with free anterolateral thigh flap.

173 Figure 7: View of the reconstructed foot 3 months after surgery, showing a  
174 favorable result.

175

176



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5

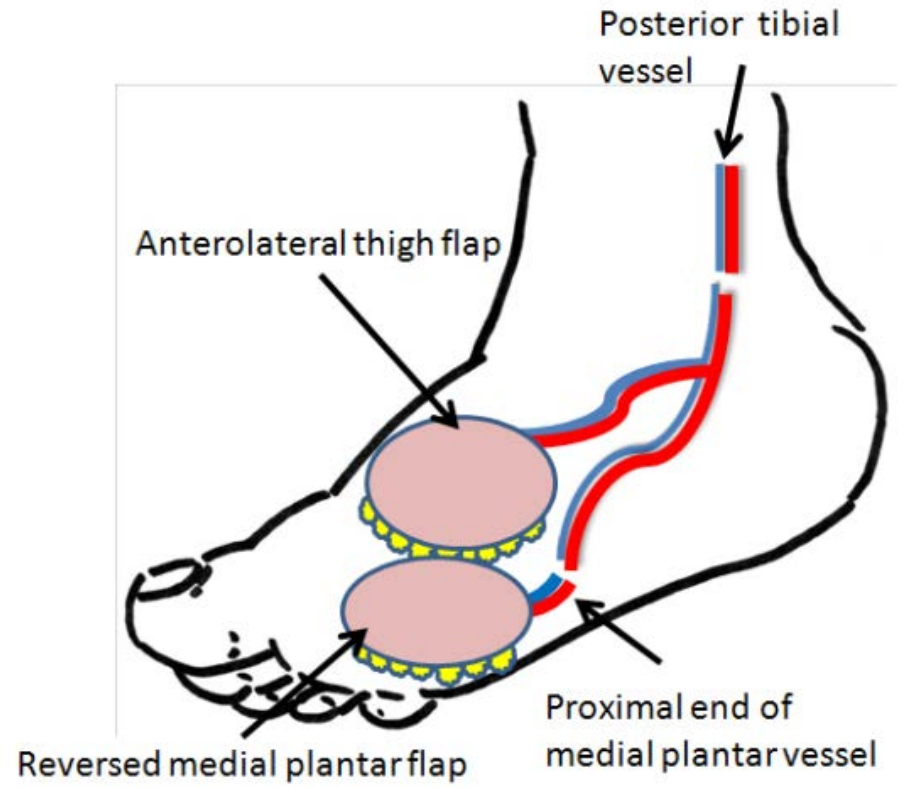


Figure 6



Figure 7