JPRAS Open 13 (2017) 41–45

Contents lists available at ScienceDirect

JPRAS Open

journal homepage: http://www.journals.elsevier.com/jpras-open

Case Report

Plantar reconstruction using a step-ladder advancement flap

G. Furubayashi*, M. Sawaizumi, T. Maeda, K. Tanakura

The Cancer Institute Hospital of Japanese Foundation For Cancer Research Plastic and Reconstructive Surgery, 3-8-31, Ariake, Koto, Tokyo 135-8550, Japan

ARTICLE INFO

Article history:
Received 12 January 2017
Accepted 17 May 2017
Available online 25 May 2017

Keywords:
Step-ladder advancement plantar flap
Medial plantar flap
Loss of plantar site
V-Y advancement flap

ABSTRACT

A medial plantar flap is superior as a sensory flap with regard to tissue wear, prevention of ulcer recurrence, and other such factors. However, a wound at a plantar weight-bearing site is likely to lead to abnormal hyperkeratosis that can cause pain and fissures. In addition, the development of a scar contracture in infant patients can cause failure of normal foot development. To overcome these issues, we developed a method in which an island flap from a non-weight-bearing site is used as a step-ladder advancement plantar flap for moderate-sized tissue loss at a plantar weight-bearing site, followed by primary closure of the flap donor site with suturing to prevent scar contracture and abnormal hyperkeratosis. This technique showed good functional and cosmetic outcomes, as the step-ladder-like suture lines were unlikely to cause scar contracture and abnormal hyperkeratosis owing to the staggered scar, leading to pain prevention.

Introduction

The plantar weight-bearing site is difficult to treat in many cases when loss of skin and soft tissue occurs. A medial plantar flap from a plantar non-weight-bearing site has been used for moderate-sized tissue loss at the plantar weight-bearing site.[1] This flap is superior as a sensory flap with regard to

* Corresponding author. Fax: +81 3 3520 0141.
E-mail address: genfurubayashi87@gmail.com (G. Furubayashi).

http://dx.doi.org/10.1016/j.jpra.2017.05.002

tissue wear, prevention of ulcer recurrence, and other such factors. However, a wound at a plantar weight-bearing site is likely to lead to abnormal hyperkeratosis that can cause pain and fissures. In addition, development of a scar contracture in infant patients can cause failure of normal foot development. To overcome these problems, we developed a method in which an island flap from a non-weight-bearing site is used as a step-ladder advancement plantar flap for moderate-sized tissue loss at a plantar weight-bearing site, followed by primary closure of the flap donor site with suturing.[2] Here, we report the use of this technique in three cases.

Operative technique

In the step-ladder advancement plantar flap technique, a septal flap that can be prepared on the foot is designed in a form resembling various types of step-ladders and is transferred to the site of tissue loss using V–Y advancement. In principle, the flap is designed at a non-weight-bearing site adjacent to the site of tissue loss. Orientation of the skin island is determined by referring to the position of the pedicle vessel, margin of the surrounding skin, and orientation of the furrows. In the case of the foot, a flap is prepared in a non-weight-bearing site. However, in the case of large tissue loss, skin on the tuberosity of the navicular bone is included.

A basic form of the flap in V–Y advancement is estimated and used as the basis for the step-ladder design. Usually, 4–6 stairs, in which the last stair is a triangle with a sharp angle, are designed. It is preferable to design the flap by dividing each step-ladder into two or three step-ladders (Figure 1). After elevation of an island flap, the flap is transferred to the site of tissue loss by extension in order to repair the loss using the first stair. Next, the wound is closed in such a way that the loss from shifting the first stair is covered by the second stair. The donor site is closed primarily according to V–Y advancement.

Case report

Case 1

A 7-year-old female child developed a 1 × 1.3 cm synovial sarcoma in the right calcaneal region. As a result of extensive resection, the site of skin loss was 3 × 3.3 cm, exposing the calcaneus. We used a step-ladder advancement plantar flap from a medial plantar non-weight-bearing site. After the surgery, the flap showed complete engraftment in approximately two weeks, and she began walking with weight bearing, using a splint. One year postoperatively, she had no trouble in running and could return to daily playing activities, and the scar matured. Presently, seven years postoperatively, she has no limitations in her daily living and exercise activities. The growth of the affected foot is equivalent to that of the unaffected foot (Figure 2).

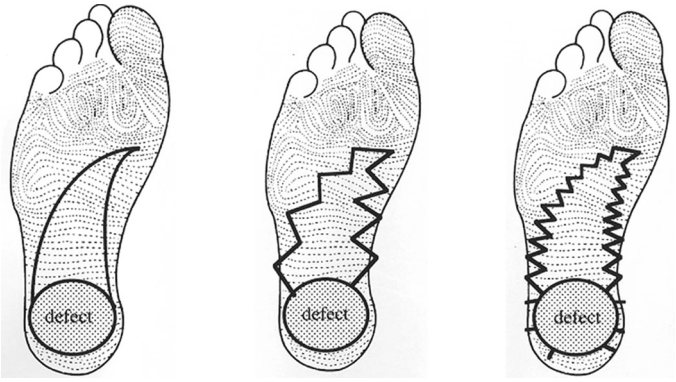

Figure 1. Design of a step-ladder advancement plantar flap.