

## Direct Pedicle Skin Flap to Weight Bearing Areas of Foot

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### Introduction

**F**EET are the most misused parts of the body as these have to carry the entire body weight with or without proper footwear over rough surfaces which tend to become harder day by day.

Anatomically, the skin of the sole is thick, hard, horny and non-hairy with abundance of subcutaneous tissue divided into small loculi each filled with fluid fat under tension, in order to improve the grip of the sole. Thus, the nature and texture is well adopted to the functional needs of weight-bearing. For these reasons alone, the feet are more prone to trauma, and skin loss is not an infrequent sequel.

Minimal defects over the weight bearing points of the sole are best replaced by rotation flaps from the non-weight bearing areas while large defects necessitate the use of distant flaps. Skin of the calf or thigh is nearer in similarity, texture and thickness and appears ideal for providing adequate skin cover. The aim of this paper is to document the solution to the problems of skin cover to the weight bearing areas of foot by direct pedicle flaps.

### Material and Method

The material for this study is collected from a series of 92 cases coming up for secondary surgical procedures for unstable scars with repeated breakdown, (Fig. 1) exposure of bone with ulceration or osteomyelitis of small bones of the foot. These cases were managed in the Plastic and Maxillofacial Surgery Unit, Medical College and Rajendra Hospital, Patiala.



*Fig. 1—Unstable scar with ulceration over large weight-bearing area of the sole of foot, with extension on medial and lateral sides.*

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The various types of flaps as regards the donor area are shown in table 1. Table 2 shows various types of flaps in relation to recipient areas and the breakdown of cases as regards the age is tabulated in table. 3 (Tables 1, 2, 3).

**Table 1**

Type of flap	
Cross thigh flaps (single)	46
Cross thigh flaps (double)	2
Cross leg flaps	40
Abdominal flaps (Single)	3
Abdominal flaps (Double)	1
Total	92

**Table 2**

Flaps as regards recipient areas.	
Undersurface of the heel with adjoining sole	42
Undersurface of heel and both sides of ankle	24
Undersurface of heel and one side of ankle	18
Circumferential (undersurface, side and front)	5
Fore-foot (First metatarsal area)	3
Total	92

**Table 3**

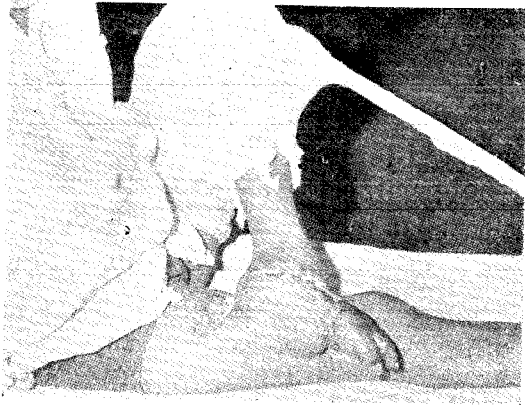
Breakdown of cases as per age.	
Below 10 years	4
11 to 20 years	21
21 to 30 years	38
31 to 40 years	21
41 to 50 years	6
51 to 60 years	2
Total	92

Preoperative planning included a thorough assessment of the relationship between the potential donor site and the recipient area, size and position of the flap, take off point of the pedicle, scope for further extension of the flap in order to achieve added length by delay procedures. Adequate venous and lymphatic drainage of the flap remained constantly at the lowest level and at the same time no point of the flap attachment was dependent. In the case of cross leg flap, the pedicle was normally based towards the long saphenous vein. (Fig. 8). In the case of a cross thigh flap, there was a choice between a medially or laterally based flap depending upon the medial or lateral extension of the defect over the sole of the foot. In a medially based flap, encroachment on to the lateral compartment was avoided as far as possible for the safety of the arterial supply, but in some cases it was done in laterally based flap, Extension of flap permitted a large encroachment on lateral compartment (Fig. 2). In no case a pre-fabricated fixation was used. The fixation at the end of the operation permitted flexibility and avoided any torsion of the pedicle or tension on the flap.

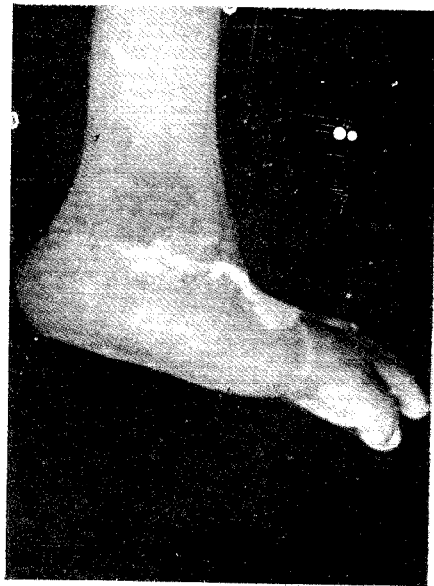
In majority of cases, the flap was to cover different surfaces of foot, therefore only part of the flap was raised and set into partially created recipient area defect (Fig. 2), leaving the remaining flap to be extended (delayed) after 17 to 21 days before the complete setting into the whole defect was obtained at the final procedure.

#### Fixation

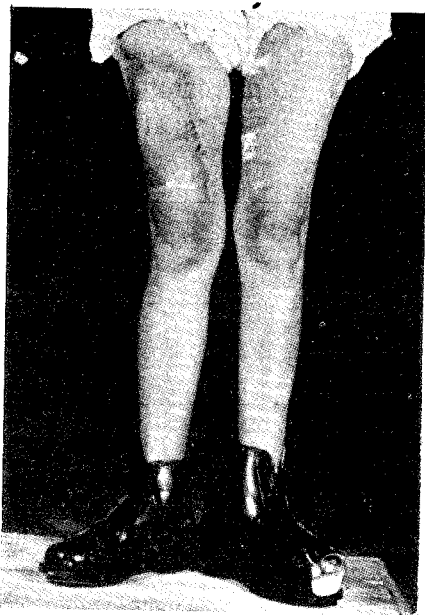
It is usually effectively done by POP immobilisation with various wooden struts



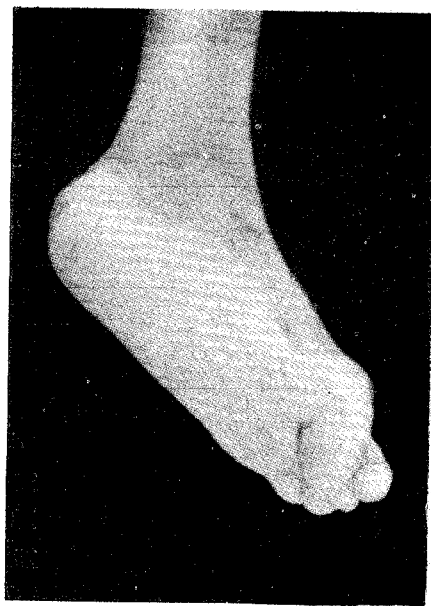
*Fig. 2—Cross thigh flap based laterally. Lateral extension of the flap was done after 21 days.*



*Fig. 3—Final result, after 8 months. The patient is doing full weight bearing.*



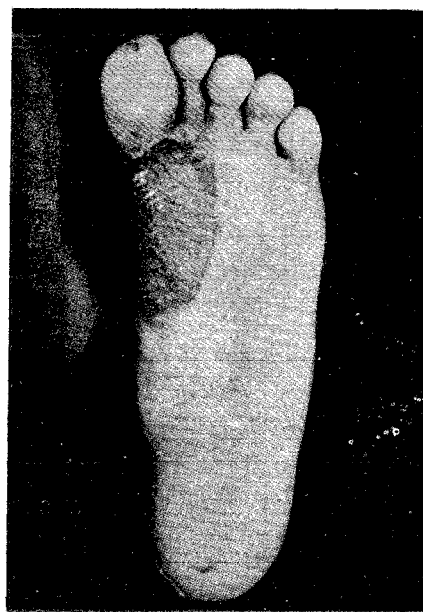
*Fig. 4—Patient in Fig. 3 on her feet, with soft padded sole shoes. Note the donor defect on the right thigh.*



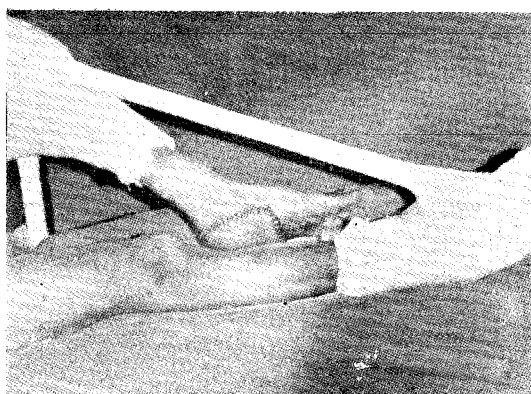
*Fig. 5—Post injury contracture of great toe.*



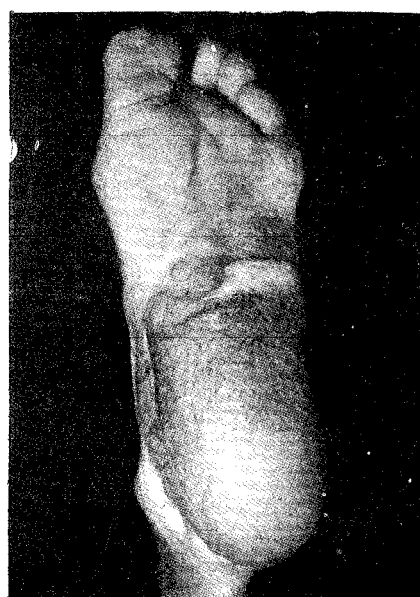
*Fig. 6—Cross leg flap over the head of first metatarsal, after excision of unstable scar.*



*Fig. 7—Final result*



*Fig. 8—Cross leg flap to the medial and under surface of posterior half of foot.*



*Fig. 9—Final result after extension and separation.*

at suitable points (Fig. 2, 6 & 8). Postoperatively the position was maintained.

### Delay Procedure

Primary delay advocated generally for a cross leg flap was not done in any case. Post-operative delay (extension of the flap) wherever needed was done 17 to 21 days after the first operation, in order to gain additional length (Thind et al, 1977).

### Final Separation

This was usually carried out one week after the extension and the flap was set into its final position with adequate thinning or shaving of the granulations formed after delay. As the blood supply was enough, it healed well inspite of some infection in cases where extension of the flap was done.

The hospital stay of the patients varied from 30 to 90 days with an average of 38 days. The patient was discharged from the hospital with a POP cast and a walking caliper to keep the weight off the flap. Weight bearing was permitted after 3-4 months with a soft rubber-shoe or foam-rubber under the pressure-bearing areas (Fig. 4) Follow up varied from 6 months to 12 years and the results have been generally good as judged by subjective feelings and objective functional assessment (Fig. 3, 7 & 9). Minor ulceration or blister formation was seen in eight cases which healed spontaneously following proper care. The aspect of return of sensations is still being studied.

### Discussion

The necessity to provide full thickness skin cover to the weight-bearing part of the

foot is without reason the only solution to the problems of skin loss following gross-scarring or bone exposure. The need for a subcutaneous padding between the skin and the deeper structures requires no emphasis. In due course of time a flap will consolidate, adding to the suppleness of the foot. A split skin graft on the other hand, can not be compared to a flap under similar circumstances. It lacks cushioning effect and is incapable of withstanding the stress and strain of weight-bearing. Additionally, the bed may not be suitable for its parasitic existence. Infrequently it becomes hyperaesthetic and this is a definite disqualification at such a site and it would repeatedly ulcerate and finally breakdown due to friction of shoes and rough surface. A split thickness skin graft can at best serve as temporary dressing only.

Having decided in favour of a full thickness cover, let us discuss the merits and demerits of various methods. It may be a direct pedicle flap—cross leg, cross thigh or even an abdominal flap (in case of children only) or a distant closed flap, tubed pedicle, marsupial or jump flap. The distant closed flaps are multi-staged procedures i. e. 4 to 6 procedures with at least 3 weeks interval between each stage. Thus, each of these methods takes minimum of 3 to 4 months. There is a potential risk of failure of each stage, fixation is longer and the final transfer from the carrier to the recipient site is no less uncomfortable.

On the other hand, keeping in view these factors of speed, safety and simplicity, a cross-leg flap from the posteromedial aspect

of the calf may be used as a universal donor site in majority of the cases. Where the defect is more extensive, located over the lateral part of the sole or required multi-surface coverage as is the more usual requirement, a cross thigh flap based medially, laterally or a retrograde flap including genicular anastomosis may be a better choice. In the case of children, when a big flap is required a single or double pedicle thigh or abdominal flap is good.

Skin transfer by direct flap is fairly simple and has certainly been less complicated in the hands of the authors than other methods discussed above.

In planning a direct flap, due consideration should be given to the scope for extension of the flap to gain added length by a delay procedure (Thind et al, 1977). The fixation should be reasonably comfortable avoiding torsion, tension or shearing strain at the suture line. Generous planning with flexibility permits small changes of position and initial oedema to occur without causing embarrassment to the circulation of the flap. Gravity should work to the advantage of the flap and aid venous drainage both at the time of giving the flap and after separation of flap, and this is a vital point which requires constant attention.

There has been no major loss in this series

but only minor losses were seen in 6 cases. These were due to low grade infection at the suture line or improper position of limb after separation of the flap.

The average stay in the hospital in these cases has been 38 days which is considerably less than that of a tubed pedicle used over an intermediate carrier.

Considering all the factors i. e. speed, simplicity and safety, we recommend a direct pedicle flap to the weight-bearing area of foot. A follow up of 6 months to 12 years bears this out.

### Summary

Ninety two cases of skin loss on the weight-bearing areas of the foot where direct pedicle flap has been provided are presented. Advantages of direct pedicle flap over skin graft and other flaps in such situations are described.

Some requirements in planning and execution of these direct flaps to foot are detailed with special emphasis on extension of the flap where it is needed.

The various donor sites used for covering these defects are mentioned with the factors necessitating their use.

The follow-up for a period varying from 6 months to 12 years has been done.

### REFERENCE

- Thind, R. S., Singh, P. D. : Extension of skin flap-an experimental and clinical  
and Kaur, H. study. Ind. J. Plast. Surg., 10 : 1, 1977.