

The value of stump split skin grafting following amputation for trauma in adult upper and lower limb amputees

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Abstract

One hundred and twenty adult patients were reviewed in whom split skin grafts were applied to the stump following traumatic amputation of the upper limb (44 amputees) or lower limb (76 amputees). The average follow-up period was seven and a half years after initial amputation. There was delay in prosthetic fitting in all patients. Approximately one third of patients complained of occasional minor ulceration, controlled by removing the prosthesis for a few days or modification of the prosthesis. Further revision surgery, including excision of the grafted skin often combined with proximal bone resection, but not removal of the proximal joint, was necessary in 29% of below-elbow amputees and approximately 50% of below and above-knee amputees. At the above-elbow level, use of skin grafts allowed prosthetic fitting because of preservation of sufficient length of the stump. Despite the fact that revision surgery may often be necessary, split skin grafting has a definite place in the early management of the stump following traumatic limb amputation in the adult. Preservation of stump length with the knee or elbow joint allows easier rehabilitation and lower energy expenditure when using the prosthesis.

Partial foot amputation, when combined with skin grafting usually requires subsequent revision to a more proximal level to obtain a satisfactory result.

Introduction

Preservation of peripheral joints allows enhanced function following amputation. The

below-knee amputee functions more efficiently than the above-knee amputee and the below-elbow amputee functions more satisfactorily than the above-elbow amputee. (Perry and Waters, 1981). Occasionally following trauma, the only way to preserve length is by the use of split skin grafts. The question arises whether the increased length of stump outweighs the disadvantages of a grafted stump. Thomson, Martin and Murray (1980) and Rosenfelder (1970) reported favourable results with grafting in lower limb amputations in children. The results in adults have been controversial. Harris (1981) stated that skin grafts of any type cannot tolerate the presence of a prosthesis. This opinion is shared by Hulnick, Highsmith and Boutin (1949) and Thompson and Alldredge (1944). Burgess (1981), Ascott (1954), Cauty and Bleck (1952), and Dupertuis and Henderson (1946) do not agree. The authors' aim was to further study this problem. Both the early problems in the management and fitting of the skin grafted amputee and the long term problems with prosthetic wear, graft breakdown and revision surgery were assessed.

Materials and methods

One hundred and fifty-five patients with skin grafted stumps were seen at the Amputation Clinic of the Ontario Workers' Compensation Board.

Sufficient information was obtained following postal questionnaire, telephone interview and personal examination on 120 patients. The time the graft was performed, delay in fitting, subsequent prosthetic wear, minor ulceration and wound breakdown were recorded in all patients. All but two patients were men. All patients sustained the injury that led to their amputation in a work related

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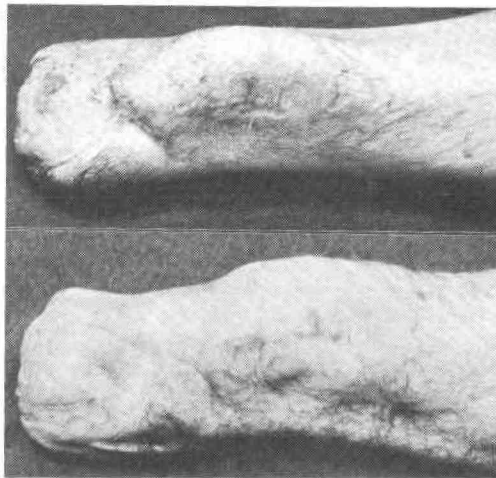


Fig. 1. Maturation of skin graft in below-knee amputation which saved length in a triple amputee (12 month interval between photographs).

accident. Only patients with a minimum follow-up of one year following their most recent operation were included in the study. The longest review was 21 years and the average follow-up was seven and a half years after initial amputation. There were 44 upper limb amputees and 76 lower limb amputees in the study.

Results

There was delay in fitting a prosthesis in all patients. The graft had to be sufficiently stable to withstand the shear stress of the prosthesis. Such maturation of a graft is shown in Figure 1, the time interval between the two photographs being 12 months. Most patients required modifications of the prosthesis including use of a temporary slip socket, incorporation of a thigh or ischial socket to offload the grafted

Table 1. Revisions following skin grafts

Level	Number of patients	Revisions (%)
Below-elbow	34	10 (29%)
Above-elbow	10	1 (10%)
Partial foot	27	20 (74%)
Below-knee	26	13 (50%)
Above-knee	23	12 (52%)
Total	120	56

stump in the lower limb amputee, and occasional fleece lined sockets were used in both upper and lower limb amputees to avoid friction on the skin graft (Bochmann, 1981). The delay in fitting a prosthesis ranged in the upper limb from six to 14 weeks following surgery and 10 to 26 weeks following surgery in the lower limb. The number of revisions required is shown in Table 1. None of the below-elbow and below-knee amputees required revision to a higher amputation level (Table 2).

Twenty of 27 partial foot amputations associated with skin grafts had to be revised (Table 3) and 14 were revised to the Syme (12) and below-knee (2) level. Although the partial foot amputation was preserved in 13 patients, skin grafts used in plantar or terminal aspects of the partial foot amputation resulted in unsatisfactory stumps because of skin graft intolerance and pain (Table 3 and Fig. 2).

Table 2. Revisions to preserve proximal joint

Amputation level	Revisions	Revisions at same level to preserve proximal joint
Below-elbow	10	10
Below-knee	13	13
Partial foot	20	6

Table 3. Outcome of 27 partial foot amputees with skin grafts

Revision to level more proximal	12	Syme
Local revision	2	Below-knee
No further revision	6	(1 satisfactory)
	7	(1 satisfactory)



Fig. 2. Unsatisfactory skin grafting to plantar and terminal aspects of partial foot amputation.



Fig. 3. Successful revision following modification of a skin grafted stump allowing preservation of the knee joint (4 month interval between photographs).

Figure 3 illustrates successful revision of a skin grafted below-knee stump. Initial skin grafting followed by successful revision of the stump allowed preservation of the knee joint in below-knee amputees.

One third (40/120) of patients with split skin grafts complained of occasional minor ulceration at the junction of the graft with normal skin. This breakdown was often easily controlled by leaving the prosthesis off for a few days or making minor prosthetic adjustments. This minor problem did not detract from the use of a prosthesis and was considered by most users to be preferable to having a shorter stump. In the upper limb, eight above-elbow amputees were fitted with a prosthesis who would otherwise have had insufficient stump length for prosthetic fitting (See Fig. 4).

The results in Table 1 initially suggest that those who decry skin grafting and amputees are correct. There is a high rate of revision following skin grafting. Table 2 helps to clarify the situation. It shows that despite revision being necessary in a high proportion of below-elbow amputees and an even higher proportion of below-knee amputees, the subsequent revision still enables preservation of the proximal joint in all patients. However, only a small number of partial foot amputations were saved and these resulted in poor stumps due to skin graft intolerance and pain (Tables 2 and 3).

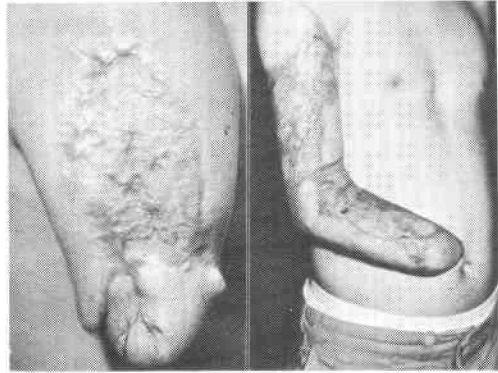


Fig. 4. Use of skin graft to preserve length in above-elbow amputation (left) and below-elbow amputation (right).

Often the skin graft could be totally removed by excision and primary suture following stump shrinkage and this two stage amputation left the patient with a satisfactory stump for prosthetic fitting (Fig. 5). The resulting stump was covered by normal skin with intact sensation. This situation is to be preferred to that which would arise if amputation had been done primarily at a higher level when either the elbow joint or knee joint would have been sacrificed.

Preservation of stump length with the knee or elbow joint allows better function with less energy expenditure to the patient. Similar

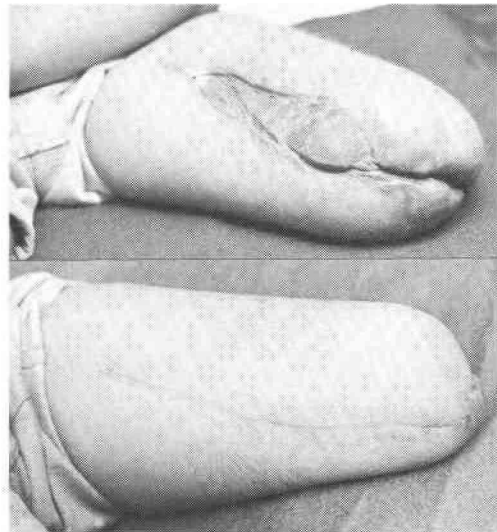


Fig. 5. Excision of skin graft area to preserve length and improve prosthetic fitting in above-knee amputation (4 month interval between photographs).

success has not been achieved with partial foot amputations and skin grafts should not be applied to plantar or terminal aspects of partial foot stumps.

In the adult traumatic amputee, split skin grafting has a definite place, and many patients benefit from this approach despite the fact that revision surgery may become necessary at a later date to provide skin with normal sensation, allowing the surgeon the ability to preserve the proximal joint above the amputation.

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