

## A Study of Splitskin Donor Area Healing

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With the ever increasing role of skin grafting in reconstructive surgery we are left with more and more of donor areas to look after. The quick healing of these donor areas is not only desirable but at times governs the staging of plastic procedures, especially in the treatment of extensive burns. A review of literature shows that not much work has been done on the problem of donor site healing, and the factors that govern it. Whatever little knowledge we have is as a by product of researches on the healing of second degree burns, which except for the histological similarity are not totally identical with the donor areas. An effort has been made in this work to study the factors that govern donor area healing, and an assessment has been made of the different methods of their management.

### Material & Methods

The 53 donor areas have been studied in 37 patients, ranging in age from 5 years to 55 years, 27 being males and 10 females. Most of these areas were on the thighs. All the cases where general causes of delayed healing were found or suspected have been excluded. Donor areas in cases of extensive burns have not been included for the same reasons. The role of the following factors has been

studied as to their relations to donor area healing :

#### (i) Depth of the donor area wound.

The depth was calculated by taking a longitudinal strip of the graft removed, and spreading it on a filter paper so as it sticks, and then coiling it. This coil of the graft sticking on the filter paper was then blocked, sectioned, and stained. The thickness of the graft was then measured at 1 mm intervals, using a micrometer eyepiece and disc, from one end to other. Mean depth of the wound was calculated and the areas were divided into, 'Shallow areas', i.e those which were less than 0.3 mm in depth; and 'Deep areas', i.e those which were 0.3-0.76 mm in depth.

#### (ii) Soakage in the postoperative period.

The soakage was taken to be + when it just showed up on the dressing or plaster, and was charted as +, ++, Or +++ according to severity. It was managed in closed technique by either. 'Superbandaging', i.e. by putting more sterile cotton over the soaked bandage as soon as it became apparent and rebandaging; or by 'Redressing', ie by aseptically taking down the dressing upto

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the dressing agent guaze and redressing with fresh sterile cotton and bandage. In cases managed by exposure, if the soakage was trouble some a pressure dressing was applied for a further 12-24 hours, and then discarded. (vide infra).

(iii) Infection in postoperative period.

The patients were divided into three groups :

A - Clean cases

B - Potentially infected cases, i.e. in whom there was a history of previous infection.

C - Obviously infected cases.

Culture and sensitivity was done in all clinically infected areas of Group 'C', while in Group 'B', the type of previous infection was found out from previous records. In cases managed by closed technique the infection was managed by Eusol soakes, while in those managed by exposure it was managed by repeated cleaning and frequent dusting. (vide infra).

(iv) Method of immobilisation and

In cases managed by closed technique, one group was only given a firm bandage while the other group had the part plastered including the joints.

(v) The instrument used for taking the graft.

A record was kept, whether a Humbys Knife, of Grafting razor, or an electric dermatome was used to take the graft.

(vi) Method of management of donor area,

The patients were divided into two groups. One was managed by closed technique while the other was managed by exposure technique.

Closed technique : In this group the donor areas were dressed. Three dressing agents were examined, viz : 2% Scarlet Red, 5% Cibazol vaseline, and plain sterile vaseline. These were chosen to represent the three groups of dressings recommended, ie, Epithelial irritants, antiseptic agents, and bland agents respectively. To provide as near ideal conditions as possible two, or all the three agents were used on the separate, demarcated part of the same donor area so as the other factors like depth of the wound, total thickness of the skin, soakage etc. remain the same.

Exposure technique : We have followed Artz et al (1960), in details with some modifications. Essentially it consists of spreading dry guaze over the donor area in one layer only, and then applying an adsorbant pressure dressing over it in the operation theatre. 24 hours later under sedation, the dressing is taken down leaving the guaze sticking with the coagulated blood in its meshes. Patients is nursed so as the donor area lies on sterile towels for another 12 hours, and thence after all precautions are dispensed with, except that the patient is asked not to interfere with it mechanically and that the basic cleanliness is maintained. Patients are allowed full ambulation. Postoperative soakage and infection when present are managed as mentioned above.

Areas were taken to be completely

healed when the epithellisation was complete, and the trauma of day to day activity, and friction of clothes, did not occasion any bleeding. In cases managed by closed technique the dressings were removed on 6th and subsequent days to make a record of the healed areas, while in cases managed by exposure technique the healing was obvious as the coagulum guaze could be easily lifted off the healed area. The quality of healing was judged according to colour, evenness, and ultimate hairgrowth on follow up, The Standard day of healing was taken to 14 th., as it was found that by this time atleast some part of all the areas, infected or otherwise, was healed.

### Results & Discussion.

The results of the study have been tabulated, and it is proposed to take up the six factors studied one by one and discuss them.

#### Depth of the wound :

Out of 53 donor areas, 29 were 'Shallow areas', while 24 were 'Deep areas'. Table I shows the days of complete healing in the two groups, while Table II compares our results with those of Converse & Robbsmith.

Table I : Relationship of Depth of wound with the day of complete healing.

Day of healing	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	More
Shallow areas	9	4	2	6	5	2	1	0	0	0	0	0	0	0	0	0
Deep areas	0	0	0	0	0	0	0	0	10	2	2	3	3	0	1	3

Table II : Time range of healing of the two types of areas

	Shallow Areas	Deep Areas
Present Series	10-16 Days	14-38 days
Converse & Robbsmith	6-10 Days	14-58 days

Thus we see that out of the shallow areas maximum number (9) healed on the 10th. day, but the average comes to be 12.5 days. In the Deep areas the maximum number (10) healed on 14th. day, which was also the earliest day of complete healing in this group. The average for the Deep areas comes to 18 days. Converse and Robbsmith have reported earliest day of healing in to be the 6th. day in Shallow areas, but in our series none of the areas showed complete healing in 6 days by our criterion. We found the earliest partial area healing time to be 8 days. Epithelial regeneration is said to take 3-4 days, and 4th to 7th day is the time of blister fluid formation which leads to regeneration of lost dermal components (Gillman et al). If the grafts are only epidermal without any dermis, it is possible to have complete healing in 6 days. The average thickness of dermis is 0.048 mm 0.06 mm (Gonzalez-Ulloa), and most of our thin grafts were thicker than that, at least theoretically we expect that the complete healing will take more than 7 days, which in our series did take longer. There is one other factor that can explain the difference

between their results and ours. Majority of the donor areas in Converse series were on Back and Abdomen while in our study 48 of the 53 were on thighs. The skin on the Back and Abdomen is thick and therefore the epithelial remnants in the remaining dermis of the donor areas are richer. In

'Deep Areas', our finding of earliest healing on 14th day, and latest on 38th day compare reasonably with the finding of Converse & Robb-Smith of 14th., and 58th, day respectively. The delay in healing will naturally be not only because of less number of epithelial remnants and more dermal loss, but in such late healing areas some infection is inevitable, which will be partly responsible for this delayed healing.

#### Soakage in the Postoperative period :

Some soakage is inevitable as even in shallow areas the section passes through the vascular dermis. As pars reticularis is more vascular than pars papillaris, more oozing is expected in deeper donor areas. The actual blood loss is not such a problem in most of the cases, instead it is the prevention of infection gaining access to the donor area through the soaked bandage. In the present series the incidence of soakage has been 66%. We did not try out any of the drugs like Adenochrome monocarbarson, which are claimed to minimise oozing, as they have been proved to be ineffective. (Singhal). Table III shows the incidence,

management. we see that 37.5% of the 'superbandaged' cases got infected, while the incidence was 0% in 'Redressed' cases. Colebrook & Hood have demonstrated that the bacteria specially the motile ones like Pseudomonas, can pass through a soaked dressing in few hours, and therefore the time lapse between the discovery of the soakage and superbandaging may be quite sufficient for the infection to reach the donor area, and in any case the superbandaging does not eliminate the bacteria that have already permeated the soaked dressing and therefore they will eventually reach the donor area. On the other hand in 'Redressing', as all the soaked dressings are discarded and therefore the bacteria that might be there. Out of the cases managed by Exposure, we found that only 2 of the 9 areas got infected, and even in these two there was some tempering with the area by the patient faster the pressure dressing was discarded and before the coagulum gauze had dried. Thus we infer that in cases managed by closed technique the soakage should be managed by Redressing and not by super-

Table III : Incidence of soakage & relationship of its management to infection.

Method of management	No. of areas	No. of soaked areas	Management of soakage	No. of Infected areas
Closed	34	16	Superbandaging	6
		7	Redressing	0
Exposure	19	9	Pressure dressing for 12 hours	2

and the relationship to infection in different methods of management. In closed type of

bandaging, while in the cases managed by Exposure technique the critical period is the

time gap between the discarding of the pressure dressing and the drying of the coagulum gauze.

### Infection in postoperative period.

Out of the 53 donor areas 9 got infected. 4 of these belonged to Group 'A', 4 to Group 'B' and only 1 to group 'C'. The only explanation of the fact may be that in Group 'C', the consciousness of the already present infection elsewhere prompted more meticulous care. Table IV

managed by exposure. Similarly the time taken to eradicate the infection was much more in cases managed by the closed technique as against those managed by exposure. The reason perhaps is that in exposure technique the detection of infection is almost instantaneous, and its tackling much more efficient. Another finding was that the quality of healing in cases where the healing was delayed was poor. Slow healing consequent upon infection promotes abnormal fibrous tissue laying down, and the epithelium

Table IV : Infected areas, their management & course.

Area No.	Grp.	Prim. inf.	Area inf.	Management	Course	Day of healing	Quality of healing
7 PL	B	Ps. Py.	Ps. Py.	Eusol dress.	4 d	28 d	Dark red Hypertrophic Nonhairy
13 L	A	Nil	Ps. Py.	Eusol dress.	8 d	18 d	No Follow up
13 AL	A	Nil	Ps. Py.	Eusol dress.	9 d	18 d	No Follow up
13 PL	B	Nil	Ps. Py.	Eusol dress.	10 d	21 d	No Follow up
14 L	B	Ps. Py.	Ps. Py.	Eusol dress.	15 d	38 d	Purple & uneven
14 PL	A	Ps. Py.	Ps. Py.	Eusol dress.	15 d	37 d	Purple & uneven
19 L	A	Nil	Staph.	Eusol dress.	1 d	15 d	Pink & even
25 L	B	Ps. Py.	Ps. Py.	Exposure	4 d	18 d	Pink & even
32 PL	C	Ps. Py.	Ps. Py.	Exposure	1 d	15 d	Pink & even

summarises the relevant details of postoperative infection. A perusal of the table shows that the healing was delayed in all the infected cases as expected, and that the delay was proportional to the time taken in its eradication. The typing of the donor area infection, was in all the cases of Groups 'B' & 'C' was the same as the Primary infection, which shows that the postoperative infection is essentially a self-infection rather than a cross infection. It also comes out that the cases managed by close technique took longer to heal than those

formed is of poorer quality.

### Methods of immobilisation and protection.

Out of the 53 donor areas, 25 areas were Bandaged, 9 areas were Plastered, and in 19 no immobilisation was done at all. The results are summarised in Table V. Trauma during the healing phase whether frictional or shearing is expected to interfere with the healing of the donor areas.

Table V : Average day of healing with different methods of immobilisation

Method of immobilisation	No. of cases	Average day of healing
Plastering	8	13 days
Bandaging	19	12 days
No immobilisation	15	16 days

N. B. Infected case have been excluded.

Baily & Duck (1960) have compared the three methods and have concluded that both the plastering and the bandaging are useless as none of the two checks the rotational strain. Our results show that both bandaging and plastering give almost the same results, while the cases managed without any immobilisation show a comparatively delayed healing. But this group also includes two cases where the coagulum guaze was mechanically interefered with, and if we exclude these two cases, the average day of healing in this group comes to 14.5 day, as compared to 12 days and 13 days in cases managed by Bandaging, and Plastering respectively. Thus we find that absence of immobilisation does delay healing, though the delay is not appreciable.

#### Instruments used for taking the grafts.

It has been suspected that the electric dermatome may damage the remaining epithelial remnants in the donor area wound because of the effects of its vibrations and heat generated, on the analogy of the bone drill which has been shown to leave dead and damaged osseous tissue in the host bone. (Watson Jones). In the persent study there are only three areas where an electric dermatome was used, and all these areas healed in standard time. We did see a host of other donor areas not included in the study where an electric dermatome was used and found that a majority of them showed hypertrophic healing. We do not propose to draw any inferences as the number of the cases in the study is too small, and propose to study it further.

#### Method of the management of the donor area.

Closed Technique : 34 areas were managed by this technique. Out of them Scarlet red was used on 19 areas, Cibazol vaseline guaze on 22 areas, and simple sterilised vaseline guaze on 16 areas. Table VI sums up our observations. We find that there is hardly any difference in average

Table VI : Relationship of dressing agents to the healing of donor areas.

Dressing Agents	No. of areas	No. of inf. areas	Earliest day of healing	Latest day of healing	Average day of healing
Scarlet Red	19	3	10	38	11.9
Cibazol vaseline	22	4	10	37	11.6
Plain Vaseline	16	2	10	21	11.5

day of healing, or the percentage of the areas getting infected. Cannon & Brdford made a comparative study of Boric acid ointment, 5% Scarlet red, and 5% Cibazol vaseline ointment and came to the same conclusions, ie. all are equally good. Jeffords & Hagerty made a comparative study of simple vāseline and Nitrofurazine (Furacin) dressing and concluded that the later were better as they gave 90.2% epithelisation as against 80.3% with vaseline guaze dressings in the same time period. But they had not considered other factors like depth of the wounds studied, nor gave the incidence of infection, though have mentioned that two of their areas got infected with Ps. Pyocyaneus and did not show any epithelisation at all. In our series 7 of the 9 infected areas has Ps. Py. We have not used any specific agents Ps. Pyocyaneus as we think that the prophylactic use of these agents on all donor areas may not only be costly but unnecessary as the overall incidence of infection is very low provided the postoperative soakage is managed properly. Thus we infer that the dressing agent itself is not important, and that the dressing mainly serves the purpose of protecting the donor area wound during the process of healing.

*Exposure Technique :* : 19 areas were managed by this technique. Out of these 10 were shallow areas, and 9 were deep areas. Out of the former healing was delayed in 3 areas. Latest day of healing being 16th. day, but the average day of healing was 14th. Out of the deep areas there was delayed healing in 6 of the 9 cases, with average day of healing being 19th This includes three infected cases. Subjectively there was only minimal discomfort in first few days

after which the patients were almost trouble free. Detection of infection was immediate, and therefore its tackling was quick with the course of infection being 1 day, 4 days, & one day (Table IV), and the Quality of healing being as good as in uninfected areas as all the three areas gave pink and even scars on follow up. As early as 1943, Cannon at al had made a comparative study of exposure method using application of 10% Tannic acid, 5% Tannic acid, 5% Silver nitrate. 2 % Gentian Violet, and Triple dye, as against Boric vaseline dressings and had found that all the agents used with exposure gave inferior results to those managed by dressings. We can see that all the agents they used were too concentrated. Artz et al in 1955 studied 2000 areas. using a single layer of guaze as scaffolding for the coagulum and found the results were much better with exposure technique except where areas crossed the flexion creases. In 1960 Artz and Gaston modified the technique further by using pressure dressing for first 24 hours. This reduced blood loss and what is more important allowed for a thinner coagulum. They got consistantly good results with this modification of exposure technique. Recently Osterhout et al have tried spraying the donor aras with n-Butyle and n-Heptyle 2-cyanocrylate, and managing them by exposure. They have found it quite satisfactory.

Our findings are that there is not much difference in healing of donor areas whether they are managed by exposure or closure as long as the postoperative soakage in the later is managed by Redressing, and not by Superbandaging.

**Summary**

53 donor areas have been studied, and the role of depth of the wound, postoperative soakage, infection, immobilisation, instru-

ment used for cutting the graft, and the closed, and exposure methods of management has been assessed, the results have been discussed and compared with available literature.

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