

**A COMPARATIVE STUDY OF SPLIT THICKNESS SKIN GRAFT TAKE ON CHRONIC WOUNDS WITH AND WITHOUT SURGICAL REMOVAL OF GRANULATION TISSUE FROM THE RECIPIENT BED**Hasan M<sup>1</sup>, Khundkar SH<sup>2</sup>, Kabir ME<sup>3</sup>, Hossain SMS<sup>4</sup>**Abstract**

**Introduction:** In most of the patients with chronic granulating wounds split skin grafting is the preferred option for coverage of the wounds. Split skin grafts may be applied directly on the granulation tissue or it may be applied after complete removal of granulation tissue. Opinions are divided on this issue.

**Objectives:** To compare the skin take between the split thickness skin grafting on chronic wounds after removal and without removal of granulation tissue in the same patient.

**Methods:** This is a longitudinal type of follow up and comparative study and was carried out in the Department of Plastic Surgery of Dhaka Medical College Hospital, Dhaka between the periods of January 2008 up to December 2009. The study population included the patients with chronic wounds attending the Department of Plastic Surgery of Dhaka Medical College Hospital and in the Plastic Surgery Department of Combined Military Hospital, Dhaka. In this study a total of 57 patients with clinically non infected chronic granulating wounds requiring skin graft were selected. Among which 50 patients were from Dhaka Medical College Hospital and 7 patients were from Combined Military Hospital, Dhaka. In the same patient wounds were divided into Group A and B. In Group A granulation tissue were removed before skin grafting and in Group B the granulation tissues were not removed before skin grafting and skin graft was applied directly on the granulation tissue.

**Results:** In the final skin take assessment it was found that in Group A, 49 (86.0%) patients had a take between 91-100% and 8 (14.0%) patients had a take between 81-90%. None of the patients in this group had a take <80%. In Group B, 30(52.6%) patients had a take between 91-100% and 18(31.6%) patients had a take between 81-90%. There were 9 (15.8%) patients who had a take of <80% and among them 02 patients had a take <70%. Statistically this was significant.

**Conclusion:** Whenever the granulation tissue is removed, the recipient bed has a better chance of skin take as far as infection is concerned. But it must be ensured that haemostasis is achieved before application of the graft.

**Key-words:** Split thickness skin graft, Granulation tissue, Skin take.

**Introduction**

The primary objective of any wound treatment is to achieve a secure primary epithelial coverage of the defect rapidly and completely either by suturing or by application of a graft or a flap<sup>1</sup>. A considerable portion of the patient load in any large Government Hospital are with chronic granulating wounds. Moreover most of the patients in those hospitals have a poor socioeconomic status and as such have a low general health condition. Often they present late with grossly infected wound and a considerable amount of time has to be spent in preparing these patients in respect of improving

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the general health and wound management<sup>1</sup>. Chronic or non-healing wounds are open wounds that fail to epithelialize and close in a reasonable amount of time period, usually defined as 30 days<sup>2</sup>. Medical conditions like Diabetes Mellitus, arterial insufficiency, venous disease, lymphoedema, steroid use, connective tissue disease and radiation injury inhibit wound healing. In general they have a fibrotic margin and a bed of granulation tissue which may include areas of slough<sup>3</sup>. These wounds are either due to trauma, infection, burn, pressure sore, malnutrition, chronic dermatologic disease or to some metabolic condition<sup>2</sup>. However, despite optimal condition for wound healing these wounds frequently does not heal and surgical intervention is required. In most of the patients with chronic granulating wounds split skin grafting is the preferred option for coverage of the wounds. The problem or the question now remains as how to approach while applying skin grafts on these chronic granulating wounds. Some surgeon favoured application of skin grafts after removal of granulation tissue in such wounds<sup>4,5</sup>, because they thought that these wounds are heavily contaminated with bacteria and after removal of granulation tissue graft take improves dramatically and also after healing they produce less scar tissue. While others favoured application of skin graft directly on the granulation tissue<sup>6,7,8,9</sup>. Very little has been written in the literature, comparing the success of skin grafting by these two methods. In 2006, one study was done in India on chronic burn wounds, comparing the results of skin grafting with and without removal of granulation tissue<sup>1</sup>.

### **Materials and Methods**

This is a longitudinal type of follow up and comparative study and was carried out in the Department of Plastic Surgery of Dhaka Medical College Hospital, Dhaka during the period of January 2008 up to December 2009. The study population included the patients with chronic wounds attending the Department of Plastic Surgery of Dhaka Medical College Hospital and in the Surgery Department of Combined Military Hospital, Dhaka. A total of 57 patients were included in this study, of which 50 patients were from Dhaka Medical College Hospital and 07 patients were from Combined Military Hospital, Dhaka.

The inclusion criteria were chronic granulating wounds at different sites of the body following trauma, infection or burn which failed to epithelialize or close within a period of three weeks. Wounds were at two different sites of the body so that they can be randomly divided into right or left. In case of single large wound it was included by dividing it into two halves. Also the wounds fulfill the standard clinical criteria of suitability of skin grafting. Criteria for exclusion were the wounds due to radiation, pressure sore, venous or arterial ulcer. Also those patients who were on chemotherapeutics, steroids or anticoagulation were not included. Sample size included a total of 57 patients with chronic granulating wounds. The study was done by dividing the wounds into Group A and Group B. Group A included wounds on the right side of the body or wound above and in case of a single wound the right half or the upper half, in which the granulation tissue were removed before the skin grafting. Group B included wounds on the left side of the body or wound below and in case of a single wound the left half or the lower half, in which the granulation tissue were not removed before grafting and skin graft was applied directly on the granulation tissue.

Regular dressings were done before operation to prepare the wound for skin grafting. Once the wound was ready for grafting a wound swab was send for culture and sensitivity. On the day of operation another two swabs from two wounds were send for culture and sensitivity. For Group A wound swabs were taken after removal of granulation tissue and in Group B wound swab was taken from the surface of the wound after washing the wound with normal saline. The skin was harvested by standard procedure and applied to the wounds immediately. The first post operative dressing change was done on the 4th day. Graft take was reassessed again on between 7th and 10th post operative day. Final graft take was assessed on the 16th post operative day. The graft take were categorized into four groups. The best skin take was between 91-100%, the next was between 81-90%. The other groups were between 71-80% and the last group, where skin take was <70%.

## Results

A total of 57 cases were selected for the skin grafting according to the inclusion and exclusion criteria among which 17 (29.8%) patients had wound on two sites and 40 (70.2%) patients had a single wound which was divided into two halves. The age of the patients ranged between 6 to 54 years. The mean age of the study population was 28 years with a standard deviation of  $\pm 12.716$  years. The highest incidence was in the age group of (21-30) years comprising 21 (36.8%) patients (Table- I). Among the 57 patients operated 38 (66.7%) were male and 19 (33.3%) patients were female with ratio of 2:1 (Table- II). Trauma was the major cause of the wound, representing 48 (84.2%) cases. There were 3 (5.3%) burn cases and all of them were from Combined Military Hospital, Dhaka (Table- III). Duration of the wound was counted from the day of injury up to the day of skin grafting. Maximum numbers of patients were grafted between 31-45 days after the date of injury. Mean duration at which the wounds were grafted was 42.38 days with a standard deviation of  $\pm 15.568$  days (Table-IV).

Various micro-organisms were found from the culture of swabs taken before operation. *Pseudomonas* was the most commonly detected single isolate in 34 (59.6%) patients in both groups. Followed by *Escherichia coli* in 13(22.8%) and 12 (21.1%) cases in Group A and Group B respectively (Table- V). Comparative distribution of organisms cultured during operation shows that in Group A, 55 (96.5%) patients had no growth but only 2 (3.5%) patients had a growth of *Pseudomonas*. In Group B, culture showed no growth in 22(38.6%) patients, *Pseudomonas* in 24 (42.1%) patients (Table- VI). While it was compared between the organisms cultured before and during operation in two groups it was found that in Group A, 5 (8.8%) patients had no growth before operation, but swabs taken during operation shows 55 (96.5%) patients had no growth. In Group B, 3 (5.3%) patients had no growth of organism before operation, but wound swabs taken during operation shows 22 (38.6%) patients had no growth (Table-VII). Skin take assessment were done on 16th post operative day which shows that in Group A 49 (86.0%) patients had skin take between 91-100% and 8 (14.0%) patients had a take between 81-90%.

No patients had a take <80%. On the other hand in Group B, 30 (52.6%) patients had a take between 91-100% and 18 (31.6%) patients had a skin take between 81-90%. Also 9 (15.8%) patients had a take <80% (Table- VIII).

**Table-I:** Distribution of the study population by age (n=57)

Age Range	Number of patients	Percent
0-10 yrs	7	12.3
11-20 yrs	7	12.3
21-30 yrs	21	36.8
31-40 yrs	14	24.6
41-50 yrs	5	8.7
51-60 yrs	3	5.3
<b>Total</b>	<b>57</b>	<b>100.0</b>
Mean $\pm$ SD	28 $\pm$ 12.716	

**Table-II:** Distribution of study population by sex (n=57)

Sex	Number of patients	Percent
Male	38	66.7
Female	19	33.3
<b>Total</b>	<b>57</b>	<b>100.0</b>
M : F = 2 : 1		

**Table-III:** Mechanism of the wound (n=57)

Mechanism	Number of Patients	Percent
Trauma	50	87.7
Infection	4	7.0
Burn	3	5.3
<b>Total</b>	<b>57</b>	<b>100.0</b>

**Table-IV:** Duration of wound (n=57)

Duration	Number of patients	Percent
21-30 days	7	12.3
31-45 days	31	54.4
46-60 days	16	28.0
61+ days	3	5.3
<b>Total</b>	<b>57</b>	<b>100.0</b>
Mean $\pm$ SD	42.38 $\pm$ 15.568	

**Table-V:** Comparison of organisms cultured before operation (n=57)

Name of Organism	Group A	Group B	Total
No growth	5 (8.8)	3 (5.3)	8 (7.0)
<i>Proteus</i>	2 (3.5)	4 (7.0)	6 (5.3)
<i>Pseudomonas</i>	34 (59.6)	34 (59.6)	68 (59.6)
<i>Staph aureus</i>	2 (3.5)	2 (3.5)	4 (3.5)
<i>E. coli</i>	13 (22.8)	12 (21.1)	25 (21.9)
<i>Citrobactor</i>	1 (1.7)	2 (3.5)	3 (2.7)
<b>Total</b>	<b>57 (100.0)</b>	<b>57 (100.0)</b>	<b>114 (100.0)</b>
Figures in parentheses indicate percentage X <sup>2</sup> =1.54; df=5; p= 0.908 (Not significant)			

**Table-VI:** Comparison of organisms cultured during operation (n=57)

Name of Organism	Group A	Group B
No growth	55 (96.5)	22 (38.6)
<i>Proteus</i>	0 (0)	1 (1.8)
<i>Pseudomonas</i>	2 (3.5)	24 (42.1)
<i>Staph aureus</i>	0 (0)	2 (3.5)
<i>E. coli</i>	0 (0)	8 (14.0)
<i>Citrobactor</i>	0 (0)	0 (0)
<b>Total</b>	<b>57 (100.0)</b>	<b>57 (100.0)</b>
Figures in parentheses indicate percentage $\chi^2 = 43.758$ ; $df=4$ ; $p= 0.000$ (Significant)		

**Table-VII:** Comparison organisms cultured before and during operation in two groups (n=57)

Groups	Pre operative bacteriological profile		Per operative bacteriological profile	
	No growth of organism	Growth of organism	No growth of organism	Growth of organism
Group A (Granulations removed)	5 (8.8%)	52 (91.2%)	55 (96.5%)	2 (3.5%)
Group B (Granulations not removed)	3 (5.3%)	54 (94.7%)	22 (38.6%)	35 (61.4%)
	Figures in parentheses indicate percentage $\chi^2 = 0.13$ ; $df=1$ ; $p= 0.714$ (Not significant)		Figures in parentheses indicate percentage $\chi^2 = 43.58$ ; $df=1$ ; $p= 0.000$ (Significant)	

**Table-VIII:** Comparison of graft take on 16th post graft day (n=57)

Skin graft take percentage	Group A	Group B
91-100%	49 (86.0)	30 (52.6)
81-90%	8 (14.0)	18 (31.6)
71-80%	0 (0)	7 (12.3)
<70%	0 (0)	2 (3.5)
<b>Total</b>	<b>57 (100.0)</b>	<b>57 (100.0)</b>
Figures in parentheses indicate percentage $\chi^2 = 17.42$ ; $df=3$ ; $p= 0.0006$ (Significant)		

## Discussion

Skin grafting is an important surgical procedure practiced in many discipline of surgery and in every corner of the world. Few of the important cause of skin graft failure are an interface between the graft and the bed like haematoma, infection of the recipient bed and improper immobilization. If these factors can be avoided then it can be expected to have a successful skin graft take. However there is still some controversy regarding application of skin graft on the chronic granulating wounds. Someone favoured grafting after removal of granulation tissue and others favoured applying the graft directly on the granulation tissue. Carl Thiersch, a prominent German described removing granulation tissue from the wound before applying his graft, which dramatically improved graft take<sup>10</sup>. Ackman proposed that, exuberant granulation tissue were an abortive attempt at wound healing and that has been unsatisfied by skin covering at the appropriate time<sup>5</sup>. Granulation tissue is the result of prolonged wound treatment and was not a serious contraindication to skin grafting, provided they are removed. Brown and McDowell (1942) proposed that, if the granulations were new, flat, not oedematous, and otherwise bright red and healthy, the graft may be placed right on them<sup>4</sup>. But it was preferred that the granulation should be carefully shaved down to a smooth, yellow base with a large sharp knife and then the grafts were to be applied. The granulations were never scraped away. If cutting them to a large area caused too much of blood loss, it was omitted. Others favoured application of graft directly on the granulation tissue<sup>6,7,8,9</sup>. McGregor and McGregor (2000) suggested grafting should be done in healthy granulation tissue with good marginal healing without delay<sup>8</sup>. They also suggested that good marginal healing was presumptive evidence that granulation would accept a skin graft; for it can be assumed that infection virulent enough to destroy a graft would be inimical to marginal epithelial growth. Regarding the bacterial flora common organisms colonise a raw surface according to site and circumstance but with exception of *Str. Pyogenes* and *Pseudomonas aeruginosa*, such organisms were of little consequence as a general rule. According to them clinical appearance was a better guide than bacterial flora in assessing suitability for grafting.

A study was carried out comparing skin grafting with and without surgical removal of granulation tissue in chronic burn wounds in India. In this study the mean age of the patients were 28.0 years with a standard deviation of  $\pm 12.716$  years. Males were two times than female with a ratio of 2:1. Trauma was the leading cause of wounds. Maximum patients were grafted between the duration of 31-45 days representing 31 (54.4%) patients. Comparison of bacteriological profile before and during operation in two groups showed that washing the wound with normal saline or removal of granulation tissue reduces bacterial load significantly, but removal of granulation tissue reduces it more because in more number of cases in Group A there was no growth of organism. Skin graft take was assessed finally on the 16th post operative day. It shows in this study that skin take was better by applying the graft after complete removal of granulation tissue, than by applying the skin graft directly on the granulation tissue. A study was carried out in India by Dhat et al in 2007 where they compared the skin graft take in burn wounds after removal and without removal of granulation tissue. In their study they did not find much of a difference, whether skin was grafted on the granulation tissue or after their complete removal<sup>1</sup>. In our study skin graft take was better after removal of granulation tissue because it removes a large number of micro organisms and gives a clean bed for putting the graft. There were few postoperative complications where the skin graft was applied directly on the granulation tissue. Besides the less percentage of skin take, there were excessive exudates during the first dressing. Also in a few patients the underlying granulation tissue were seen protruding through the mesh holes of the skin, cosmetically which was not well accepted.

### Conclusion

It is known that granulation tissue is heavily colonized with micro organism. So whenever the granulation tissue is removed, it actually removes the micro organism from the wound. Then when the skin graft is placed on that wound it has a better chance of take as far as infection is concerned. But it must be ensured that proper haemostasis is achieved before application of the graft. In this study, bacteriological status of the

recipient bed after removal of granulation tissue showed no growth in most cases. So it can be concluded that skin graft take is better when skin is applied after complete removal of granulation tissue than when the skin graft is applied without removing the granulation tissue from the recipient bed.

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