

EVALUATION OF SKIN GRAFT VIABILITY WITH AND WITHOUT SURGICAL REMOVAL OF GRANULATION TISSUE IN SKIN AND SOFT TISSUES DEFECT

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ABSTRACT

Background: Grafts are currently the predominant method of open wounds reconstruction. Various techniques are being practiced in skin grafts but little information is available regarding the best method.

Objective: The aim of this study was to evaluate the results of skin grafts in closure of various defects with or without surgical removal of granulation tissue. **Patients and Methods:** A Comparative Prospective study conducted for the period one year (May 2020 – May 2021) at Tishreen University Hospital in Lattakia-Syria. The study included two groups of patients were compared: group I consisted of 16 patients (53.3%) who underwent skin grafting without granulation tissue surgical removal, whereas group II consisted of 14 patients (46.7%) who underwent skin grafting with surgical removal of granulation tissue. **Results:** A total of 30 patients, 20 males (66.7%) and 10 females (33.3%) with a median age of 44 years were included in the study. Trauma was the most frequent etiology of defects in 15 cases (50%), and extremities were the most affected parts of the body in 18 cases (60%). 56.7% of the patients were smokers, and split-thickness grafts were the most frequent type of applied grafts in 21 cases (70%). There were no significant differences between two groups regarding demographic variables except of age (33.50 ± 19.4 in group I versus 50 ± 17.21 in group II, $p:0.02$). The duration of recovery was significantly shorter in group I (14.06 ± 3.7 versus 16 ± 2.5 in group II, $p:0.04$). The rate of complication in group I was 18.8% which included: seroma (6.25%), partial graft necrosis (6.25%), and complete graft necrosis (6.25%) versus 21.4% in group II which included partial graft necrosis (14.3%), and complete graft necrosis (7.1%) without significant difference, $p:0.8$. Factors that associated with longer duration of recovery in group I were: age older than 18 years ($p:0.04$), smoking ($p:0.001$), and defects located on trunk ($p:0.01$). All patients in group II were older than 18 years and recovery time increased with increasing age ($r:0.48$, $p:0.01$), and presence of smoking was associated with longer time ($p:0.002$). **Conclusion:** The current study demonstrated favorable results in skin grafts viability when closing the skin defects with two techniques, with significantly shorter duration of recovery in patients who underwent grafting without surgical removal of granulation tissue compared with the other group.

KEYWORDS: Grafts, granulation tissue, wound.

INTRODUCTION

Wound healing is a complex and multi-step process which begins immediately after skin damage.^[1] Granulation tissue is an important component in wound healing process, and it represents the third stage of wound healing.^[2] There are many types of cells that contribute in this process which include: fibroblasts, keratinocytes, and endothelial cells which contribute in synthesize collagen and extracellular matrix. In addition to, cytokines, growth factors, and angiogenesis factors are active during this stage. Angiogenesis developed

within granular tissue in order to provide blood and nutrients.^[3]

There are many factors that can interfere with one or more phases of this process and cause impaired wound healing and occurrence of chronic wounds.^[4] There is an increasing economic burden of chronic wounds due to the associated morbidity regarding anatomic defects and poor functional outcomes.^[4]

Skin grafting is defined by transplanting of skin and occasionally other underlying tissue types to another location of the body.^[5]

Grafts are classified to either split-thickness grafts which are composed of epidermis and a variable amount of dermis or full-thickness grafts that include all the layers of the skin.^[6] Healing of a skin graft is a special case of wound healing but the biology of the graft-take remains unclear. Techniques that used in closure of defects by grafts are considered crucial, which conducted either with or without the surgical removal of granulation tissue and there is no standard technique on the best method for closing defects following chronic wounds in order to get the best results with minimal complications.^[7] Several studies have evaluated advantages and disadvantages of each method. Therefore, the aims of our study were:

- 1- To elucidate differences between the two techniques regarding the results of the grafting process.
- 2- To determine the outcomes of the two methods.

PATIENTS AND METHODS

This is a Comparative Prospective study of a group of patients with a variety of clinical situations that required skin grafts attending department of plastic surgery at Tishreen University Hospital in Lattakia-Syria during one-year period (May 2020- May 2021). The inclusion criteria were: patients of both sexes and all ages with defects resulting from traumatic wounds, wounds after oncologic resection, and burns. The exclusion criteria were: presence of chronic diseases that disrupt healing such as diabetes mellitus and chronic drug use. The following workup included: history and physical examination were performed. Characteristics of the defects were recorded: etiology, size, and location were recorded. Patients assigned to group I who undergone grafting without surgical removal of granulation tissue, and group II who undergone grafting with surgical removal of granulation tissue. Grafts which applied were either full-thickness or split-thickness skin grafts. Patients were followed up at regular intervals in the post-operative period by taking photographs and comparison with photographs before surgery. Graft failure was defined as complete or partial failure to establish and maintain a successful vascular supply at recipient site which associates with many risk factors such as infection, inflammation, and physical displacement resulting from hemorrhage and mechanical shear.

Ethical consideration: All patients were provided a complete and clear informed consent after discussion about the study.

Statistical Analysis

Statistical analysis was performed by using IBM SPSS version 20. Basic Descriptive statistics included means, standard deviations (SD), median, Frequency and percentages. To examine the relationships and comparisons between the two group, chi-square test was used. Independent t student test was used to compare 2

independent groups. Pearson's correlation coefficient was used to measure the association between quantitative variables. All the tests were considered significant at a 5% type I error rate ($p < 0.05$), $\beta: 20\%$, and power of the study: 80%.

RESULTS

The baseline characteristics of the participants were as shown in (Table 1). Males represented 66.7 % of the study population and females 33.3 % with male: female ratio was 2:1. Ages range from 1 year to 76 years (median 44 years) and smoking was present in 17 cases (56.7%). The defects came in different sizes which range from 4 to 25 cm² with mean size 12.43±6.2. With regard to the affected areas, the extremities were the most commonly affected which observed in 18 cases (60%), followed by trunk in 7 cases (23.3%) and head with neck in 5 cases (16.7%). The defects had occurred as a result of trauma in 15 cases (50%), burns in 10 cases (33.3%), and tumors in 5 cases (16.7%). Reconstruction of the defects was performed either by full-thickness grafts in 9 cases (30%) or by split thickness grafts in 21 cases (70%).

Table 1: Demographic characteristics of the study population.

Variable	Result
Sex	
Male	20(66.7 %)
Female	10(33.3%)
Age(years)	44 (Range 1-76)
Smoking	
Present	17(56.7%)
Absent	13(43.3%)
Location of the defect	
Extremities	18(60%)
Trunk	7(23.3%)
Head and neck	5(16.7%)
Size of defect (cm2)	12.43±6.2(Range 4-25)
Etiology of defect	
Trauma	15(50%)
Burn	10(33.3%)
Skin Cancer	5(16.7%)

Skin grafting was achieved either without surgical removal of granulation tissue in 16 cases (53.3%) or with surgical removal of granulation tissue in 14 cases (46.7%). The demographic characteristics were compared between the two groups as shown in table 2. In the group I, males represented 62.5% of the patients and females 37.5%, whereas males represented 71.4% and females 28.6% in group II without significant differences, $p: 0.6$. There was a significant difference between two groups regarding age, in which patients were younger in group I (33.50 ± 19.4 versus 50 ± 17.21 , $p: 0.02$). 56.3% of the patients in group I were smokers versus 57.1% in group II, $p: 0.9$. The mean size of the defect in group I was 12.43 ± 5.8 versus 12.42 ± 6.9 in group II without significant difference, $p: 0.9$. The

distribution of the defects in group I according to the location was as follow; extremities (68.8%), trunk (18.8%), and head with neck (12.5%) versus 50%, 28.6%, and 21.4% in group II respectively, p: 0.5. Defects were classified according to the cause of injury as follow in group I; trauma (43.8%), cancer (12.5%),

and burn (43.85%), versus 57.1%, 21.4%, and 21.4% in group II respectively without significant difference between groups, p: 0.4. Split thickness grafts were the most applied grafts in two groups; 75% in group I versus 64.3% in group II without significant difference, p:0.5.

Table 2: Demographic characteristics of the study population by comparison of the two group.

Variable	Group 1 16(53.3%)	Group2 14(46.7%)	P value
Sex			
Male	10(62.5%)	10(71.4%)	0.6
Female	6(37.5%)	4(28.6%)	
Age(year)	33.50±19.4	50±17.21	0.02
Smoking	9(56.3%)	8(57.1%)	0.9
Size of defect (cm²)	12.43±5.8	12.42±6.9	0.9
Location of the defect			
Extremities	11(68.8%)	7(50%)	0.5
Trunk	3(18.8%)	4(28.6%)	
Head and neck	2(12.5%)	3(21.4%)	
Etiology of defect			
Trauma	7(43.8%)	8(57.1%)	0.4
Skin Cancer	2(12.5%)	3(21.4%)	
Burn	7(43.85)	3(21.4%)	
Type of grafts			
Split thickness grafts	12(75%)	9(64.3%)	0.5
Full-thickness grafts	4(25%)	5(35.7%)	

In group I, the duration until recovery ranged from 10 to 20 day with a mean time 14.06±3.7 whereas recovery time ranged from 12 to 20 day with a mean duration 16±2.5 in group II, p:0.04. There were no significant differences between two groups regarding complications, which developed in 3 cases (18.8%) in group I versus 3 cases (21.4%) in group II, p:0.8. In

group I, complication included seroma, partial and complete graft necrosis on average 6.25% of each, whereas in group II complications included partial (14.3%) and complete necrosis (7.1%) without any case of seroma: 0.8. Graft failure was occurred on average one case in each group.

Table 3: Outcome of skin grafting by comparison of the two group.

Variable	Group 1 16(53.3%)	Group2 14(46.7%)	P value
Time to recovery(day)	14.06±3.7(10-20)	16±2.5(12-20)	0.04
Complications	3(18.8%)	3(21.4%)	0.8
Seroma	1(6.25%)	0(0%)	
Partial graft necrosis	1(6.25%)	2(14.3%)	
Complete graft necrosis	1(6.25%)	1(7.1%)	

In group I, the mean duration of healing was 14±3.7 in males and 14.16±4.2 in females, p:0.9 versus 15.44±2.6 in males and 17.25±2.2 in females in group II, p:0.2. Time of healing was shorter in patients younger than 18 years in group I (11±1.1 versus 15.18±3.7, p:0.04) whereas all patients in group II were older than 18 years and mean time of healing was 16±2.5. The mean duration of healing was significantly longer in smokers in two groups; 18.10±1.1 versus 13.85±3.9, p:0.001 in group I and 18.4±1.6 versus 14.50±1.7, p:0.002 in group II. On average, the time of healing was longer in full-thickness grafts compared to split thickness grafts without significant difference; 15.25±4.1 versus 13.63±3.7, p:0.4 in group I and 17±3.4 versus 15.55±2.1,

p:0.3 in group II. In group I, the longer duration of healing was in defects located on trunk (18±2), followed by extremities (13.20±3.6) and head with neck (12.50±3.5), with presence of significant difference, p:0.01, whereas in group II, the longer duration of healing was in defects located on head and neck (16.66±4.1), followed by extremities (16.5±2.07) and trunk (14.75±2.2), without significant difference, p:0.5. In group I, longer duration of healing was in defects resulting from cancer (15.50±0.7), followed by burn (13.85±3.9) and trauma (13.83±4.4), p:0.8, whereas in group II the longer duration of healing was in trauma (16.71±1.9) and cancer (16.66±4.1), p:0.2.

Table 4: Comparison of recovery time between the two group according to the study variables.

Variable	Group 1 16(53.3%)	Group2 14(46.7%)
Sex		
Male	14±3.7	15.44±2.6
Female	14.16±4.2	17.25±2.2
P value	0.9	0.2
Age group		
<18	11±1.1	----
>18	15.18±3.7	16±2.5
P value	0.04	-----
Smoking		
Present	18.10±1.1	18.4±1.6
Absent	13.85±3.9	14.50±1.7
P value	0.001	0.002
Type of graft		
Split thickness grafts	13.63±3.7	15.55±2.1
Full-thickness grafts	15.25±4.1	17±3.4
P value	0.4	0.3
Location of the defect		
Extremities	13.20±3.6	16.5±2.07
Trunk	18±2	14.75±2.2
Head and neck	12.50±3.5	16.66±4.1
P value	0.01	0.5
Etiology of defect		
Trauma	13.83±4.4	16.71±1.9
Cancer	15.50±0.7	16.66±4.1
Burns	13.85±3.9	13.66±0.5
P value	0.8	0.2

We studied the relationship between age and duration of recovery in the two groups. we found that with increasing age, there was a significant increasing in

recovery time (r: 0.0.67, p: 0.006) in group I and (r:0.48, p:0.01) in group II, figure.^[1,2]

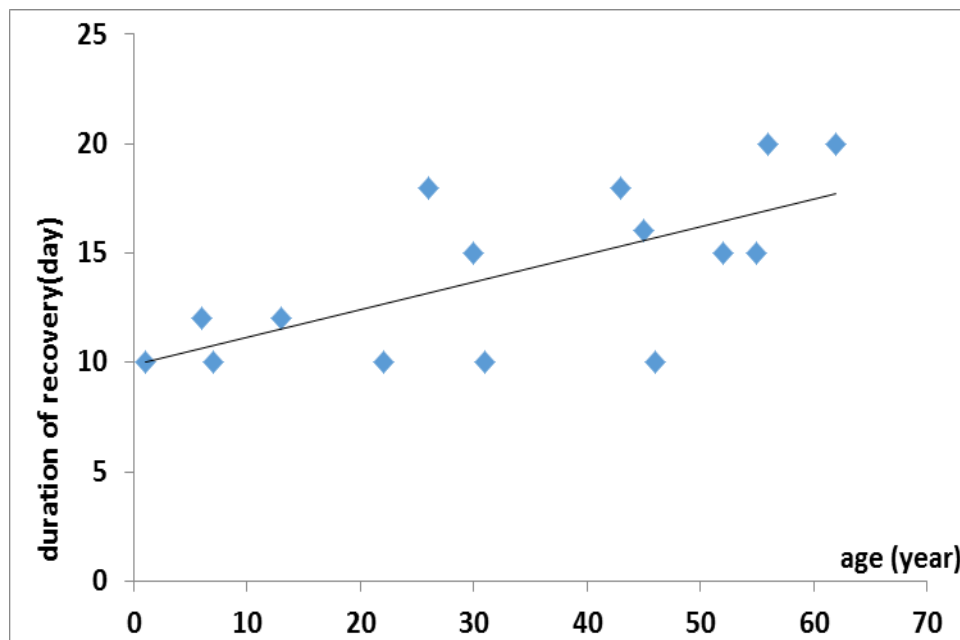


Figure (1): Association between age and duration of recovery in group I.

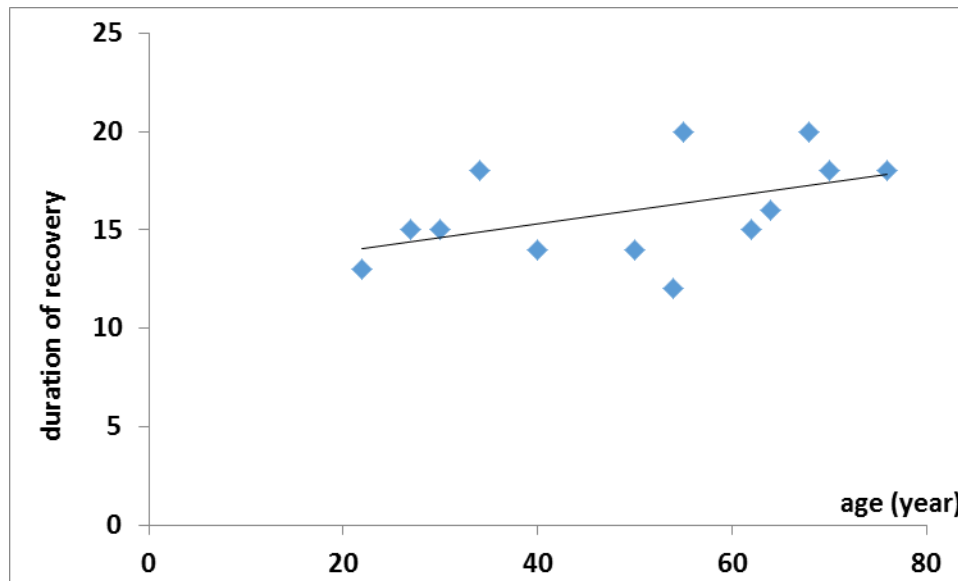


Figure (2): Association between age and duration of recovery in group II.

DISCUSSION

This descriptive comparative study of open wounds in 30 patients assessed reconstruction of defects, as well as complications occurring after skin grafting with or without surgical removal of granulation tissue. This study showed the main findings: First, patients were of a wide range of ages and approximately two-third of patients were males. Extremities were the most affected part of the body, and trauma represented the most frequent etiology of defects. Split thickness grafts represented the most common type of applied grafts, approximately in three-quarter of patients. Second, there were no significant differences between two groups regarding the demographic and characteristics of defects except of age, in which patients in group I were younger. Third, duration of recovery was shorter significantly in group I, without significant difference between two groups regarding rate of complications, and grafts failure was occurred on average one case in each group. Finally, longer duration of recovery was associated significantly with older age and presence of smoking in two groups. In addition to, effect of defect location on recovery time was observed only in group I. These findings may be explained as follow: surgical removal of granulation tissue increases loss of blood and protein and lead to more oozing of tissue fluids, resulting in prolonged recovery time. Aging in healthy older adults causes a temporal delay in wound healing which is associated with an altered inflammatory response with alteration in chemokine production and reduced macrophage phagocytic capacity⁸. Nicotine stimulates sympathetic nervous activity resulting in release of epinephrine, which causes peripheral vasoconstriction and decreased tissue blood perfusion, and carbon monoxide in cigarette smoke also causes tissue hypoxia. In addition to, smoking increases complications post-operative such as infection, leakage, and grafts necrosis which delay duration of recovery.^[9] These findings are comparable with results of previous studies.

Dhar et al (2007) demonstrated in a study conducted in patients with chronic burns wounds who underwent skin grafting after surgical removal of granulation tissue or without surgical removal of granulation tissue that graft uptake was similar in two groups, but higher rate of blood loss, longer operative time, and more cost of surgery were found in patients who underwent grafting with surgical removal of granulation tissue.^[10]

Krishna et al (2017) showed in a study conducted in 30 patients with healthy granulating post-burn wounds who underwent grafting either with scraping or without scraping, that there was significantly decreased blood loss and increased duration of complete wound healing in patients who didn't undergone granulation tissue removal.^[11]

Sharma et al (2021) conducted a study in Nepal during one year on patients with skin defects resulting from various etiologies who underwent skin grafting by split thickness grafts with or without granulation tissue surgical removal. Graft uptake was similar in two groups, but loss of blood and protein was higher in patients who underwent grafting with surgical removal of granulation tissue with longer duration of surgery and high costs.^[12]

Shaikh et al (2021) demonstrated in a study conducted in patients with defects resulting from various causes who underwent grafting either with or without granulation tissue surgical removal, that no significant differences were found between two groups regarding graft uptake, but blood loss was higher and complete recovery was faster when granulation tissue was removed.^[13]

In summary, graft uptake and complications that occurred after two methods were similar, but with shorter duration of recovery in patients who underwent grafting

without surgical removal of granulation tissue compared with the other technique.

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