



## Early Excision and Grafting versus Delayed Skin Grafting in Burns Covering Less than 15% of Total Body Surface Area; A Non-Randomized Clinical Trial

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### ► ABSTRACT

**Objective:** To compare outcome of patients with burns covering less than 15% of total body surface area (TBSA) undergoing early excision and grafting or delayed skin grafting.

**Method:** This was a non-randomized clinical trial including 54 patients with less than 15% TBSA burn referring to Ghotboddin Hospital of Shiraz. They were assigned to two study groups, each group including 27 patients: the early excision and grafting group (EEG group) and the delayed grafting group (DG group). Patients were followed postoperatively for 6 months. Hospital stay, graft success rate, itching score and scar formation during 6 months of follow-up were recorded and compared between two study groups.

**Results:** During the study 1 patient was lost to follow-up in early excision and grafting group. Baseline characteristics were comparable between two study groups. The graft success rate was significantly higher in those patients who underwent early excision and grafting when compared to delayed grafting group (96.88% vs. 92.88%;  $p=0.033$ ). However the length of hospital stay, itching and scar scores were comparable between two study groups after 6 months of follow-up.

**Conclusion:** In patients with burns covering less than 15% TBSA, early excision and grafting is associated with higher graft success rates compared to the delayed excision and grafting. However length of hospital stay, itching and scar formation is comparable between the two techniques.

**Clinical Trial Registry:** This trial is registered with the Iranian Clinical Trial Registry (IRCT2013092313880N2).

**Keywords:** Deep burns; Early excision and grafting; Delayed grafting; Itching score; Scar formation.

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### Introduction

Burns are amongst the most devastating injuries that leave not only physical deformity but also

psychosocial harm, especially in places like the face and hand [1-3]. Scar formation and itching are two of the most important complications which are difficult to manage in patients with deep burns. Scar formation

is the definite phenomena following deep burns in which the healing usually takes 3 weeks or more. The Scars that follow deep burns can be minimized by appropriate surgical management during the first 2 weeks of injury [4].

In the surgical approach to deep burn wounds (deep second and third degree burns), two distinguished techniques are applied. In the first and oldest technique a more conservative approach is implemented by routine wound care until the shedding of the scar and the formation of granulation tissue, after which skin grafting of the burned and unhealed area can be applied. This technique consumes more time for the granulation tissue that is appropriate for the skin grafting, to form. In this chronic process patients will be more susceptible to scar formation. In the second technique, scar tissue is excised during the first days post burn (preferably in the first 2 weeks) and auto grafted simultaneously when the patient becomes stable [early excision and grafting (EEG)] [5].

Yet the optimal time for the EEG is not a consensus. In today's practice, wounds that are unlikely to achieve spontaneous closure in about 3 weeks are excised and grafted. The estimation by the surgeon on whether or not a partial thickness burn will heal in less than 3 weeks, is approximately 70% accurate in equivocal cases, whereas this estimation by the surgeon, is usually considered as the indication for EEG [6]. Theoretically both techniques have some benefits, yet very little data was found to document the superiority of one technique over the other in a population with small size burns, so our objective was to compare the newly rekindled approach with the more conservative approach in order to better clarify their benefits and disadvantages in patients with less than 15% of total body surface area (TBSA) burns.

## Materials and Methods

### Patients

This was anon-randomized clinical trial being performed during a 1-year period from September 2012 to September 2013 in Ghotbod hospital, level I burn center in southern

Iran affiliated with Shiraz University of Medical Sciences. The study protocol was approved by both the institutional review board (IRB) and the medical ethics committee of Shiraz University of Medical Sciences and all the participants gave their informed written consents before inclusion in the study. This clinical trial is registered with the Iranian Clinical Trials Registry (IRCT2013092313880N2). Our terms for inclusion in the study were second and third degree burns covering less than 15% of TBSA with an age limitation of 6 months-65 years, and our exclusion criteria was having associated diseases like diabetes and cardiac diseases, scars from previous burn injuries and having connective tissue disorders. From these patients, 54 met the inclusion criteria.

### Group Allocation

The patients were assigned to two study groups; the early excision and grafting group (EEG group) and the delayed grafting group (DG group) based on their own choice and consent. Those who had been referred to our center less than 14-day post-injury were considered for EEG group. Overall 127 patients met the criteria for inclusion in EEG group. Those who did not have consent for EEG and those who were referred to the hospital more than 14 days post-injury were considered as DG group which included 27 patients.

### Intervention and follow-up

In EEG group, patients were operated after being stabilized during the first 14 days after injury. In the operating room with sterile conditions and under generalized anesthesia the dead tissue (Scar) was excised until reaching an appropriate bed for grafting. The debrided area was then covered with a partial-thickness meshed or non-meshed (sheet) skin taken from the patient's healthy skin of the thighs at the same stage. The dressing was then removed on the 5<sup>th</sup> postoperative day unless signs of infection (such as abnormal discharge, high grade fever, changes in general condition and etc.) were observed, in which the dressings were changed sooner. Patients were visited weekly in the first month and then every month for the next 5 months. In DG group, patients had their dressings changed 1-2 times a day with topical antibiotics including silver sulfadiazine and mafenide acetate. Nutrition was emphasized and intravenous antibiotics were started for patients in whom signs of infection or positive cultures were seen (as mentioned for EEG group). The decision for operation was made after the formation of granulation tissue as a good bed for grafting. For DG group, in the same operating conditions as EEG group, excess granulation tissue was first removed until reaching a suitable bed for grafting and then the operation followed in a similar a manner as EEG group.

In the post-operative visits, progression of graft intake, infections, contracture and deformities were monitored and managed. The variables that were measured and compared amongst the two groups included: degree of scar formation, graft intake and the hospitalization time. A successful graft intake was considered as one that has a pink color and is attached to the basis of the grafted area firmly.

For assessing the itch score the 5-D itch scale was used. According to this scale, each patient is given a score from 1 to 5 for each of the five following parameters: duration, degree, direction, disability and distribution. The overall score of each patient can range from 5 (no pruritus) to 25 (severe pruritus) [7]. Scar evaluation was done using the Vancouver scale. This index scores the scars based on four parameters which include: vascularity, pigmentation, pliability and height of scar tissue. Each patient receives a score ranging from 0 to 13, 0 indicating complete recovery

and 13 indicating severe scarring [8].

### Statistical Analysis

The statistical analysis was done using the SPSS software version 11.0 (SPSS Inc., Chicago, IL, USA). The Mann-Whitney U test was used to compare the parametric data and the Chi-square test was used to compare the qualitative data among the two groups. The results are demonstrated as mean $\pm$ SD and proportions as appropriate. A two-tailed  $p$ -value of less than 0.05 was considered statistically significant.

### Result

From the initial 54 patients included in the study, 1 was lost to follow-up from EEG group. Thus the final number of patients included in the study was 53 patients (26 in EEG group and 27 in DG group). The flow diagram of the patients is demonstrated in Figure 1.

The baseline characteristics of the patients are summarized in Table 1. There was no significant difference between two study groups regarding the demographic information as well as baseline clinical characteristics. The baseline characteristics of the

wounds were comparable between two study groups.

We found that the graft success rate was significantly higher in EEG group when compared to DG group (96.8 $\pm$ 5.6 vs. 92.8 $\pm$ 7.5;  $p=0.033$ ). The duration of the hospital stay was comparable between two study groups. In the same way, the itch score was comparable between two study groups after 6-month of follow-up. Scare assessment using the Vancouver scale in the two groups along the 6 months of follow-up, showed that in EEG group, 20 patients (76.9%) had complete recovery, while in group 2, 18 patients (66.7%) had complete recovery. Overall the two groups did not have any significant difference ( $p=0.393$ ). Table 2 compares the study outcome between two groups.

### Discussion

Early excision and grafting has become the standard treatment for deep burn injuries [9] with the rationale that it decreases bacteremia and inflammatory mediators (by early removal of the burned skin and simultaneous wound coverage), thus decreasing the chances of sepsis and multi-organ failure and death as indicated by some studies [10,11]. The procedure

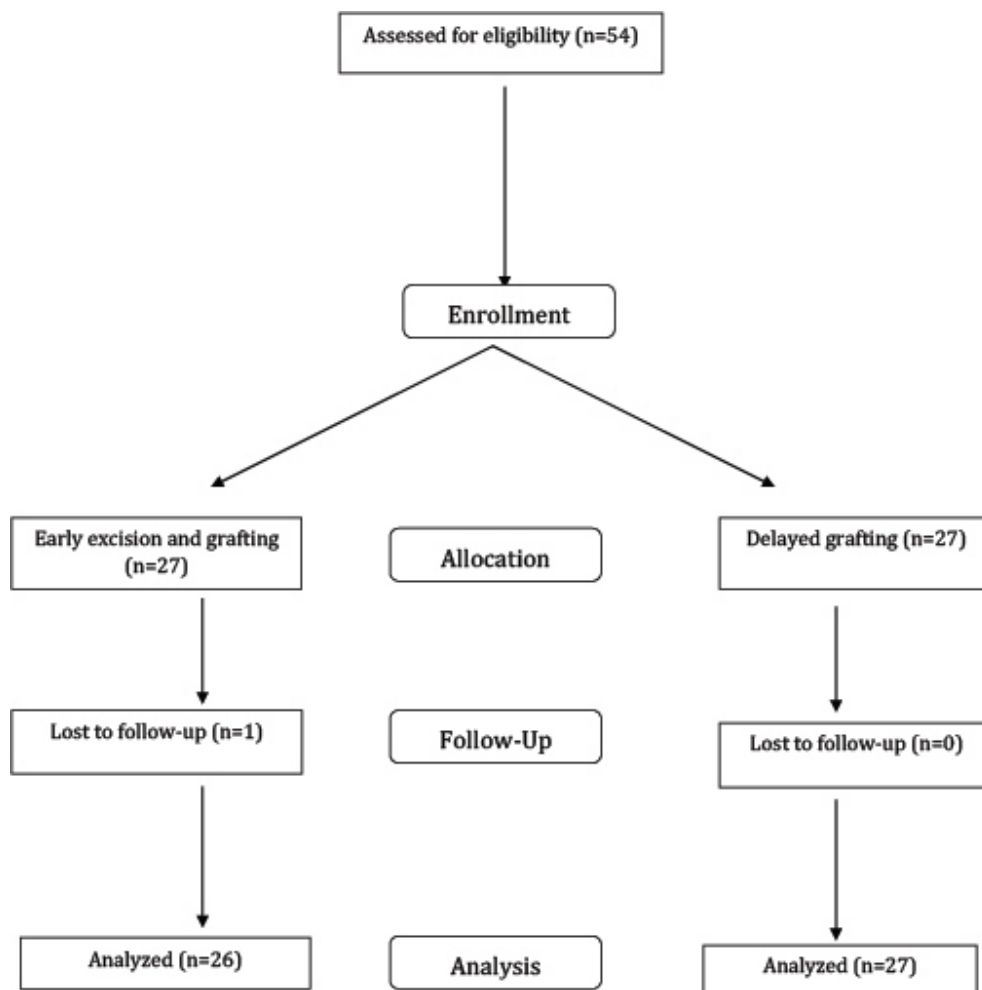


Fig. 1. CONSORT flow diagram of the study.

**Table 1.** Baseline characteristics of 53 patients with burns who underwent early excision and grafting or delayed grafting.

	EEG group (N=26)	DG group (n=27)	p value
Age (years)	21.9±16.5	20.1±14.4	0.789
<b>Sex</b>			
Men (%)	16 (61.5%)	16 (59.3%)	0.865
Women (%)	10 (38.5%)	11 (40.7%)	
<b>Burn type</b>			
Type II (%)	17 (65.3%)	15 (55.5%)	0.086
Type III (%)	6 (34.7%)	12 (44.5%)	
Hospital stay (days)	7.92±4.4	9.38±8.7	0.654
Burn surface (TBSA)	7.92±6.1	6.59±4.8	0.668
Surgery surface size (TBSA)	6.3±4.19	5.29±4.1	0.395

**Table 2.** The 6-month surgical outcome of 53 patients with burns who underwent early excision and grafting or delayed grafting.

	EEG group (N=26)	DG group (n=27)	p value
Hospital stay (days)	7.92±4.4	9.38±8.7	0.654
Graft success rate (percentage)	96.8±5.6	92.8±7.5	0.033
Itch score	8.61±10.4	8.9±10.4	0.977
Scar score	0.38±0.89	0.55±0.93	0.393

requires experience and training especially for estimating the depth of the burn. An underestimation of the burn depth with unwanted delayed spontaneous healing can lead to more scarring, on the other hand an overestimation and EEG can lead to excess removal of healthy tissue and iatrogenic injury. Estimation of the wound is quite difficult as indicated by Goodwin *et al.* where in their study 46% of the initial wound depth estimations were erroneous [12].

The pioneer of the concept of EEG was cope *et al.*, [13], meanwhile the interest in EEG was rekindled by the introduction of the tangential excision by Janzekovic in 1970 [1,14]. Many benefits are associated with this approach including: reduction of patient hospital stay due to early closure of the wound, bacterial colonization of the wound, virtually eliminating the pain that's associated with the burned portion by early grafting, promoting quicker healing of the wound and decreased hospital costs [14-17]. On the other hand the approach does have some disadvantages including: the excessive removal of healthy tissue during escharectomy due to erroneous estimation of burn depth, especially if performed on the third to fifth day, also the longer operation time due to the concomitant escharectomy and skin grafting [12].

In the traditional approach patients do have prolonged hospital stays and are more prone to problems like joint contractures and hypertrophic scars due to the prolonged process of wound healing, increased hospital costs, more painful dressing changes and increased psychological stress [11]. Yet some authors have shown no circumstantial differences in mortality [14], cosmetic and functional outcomes in the EEG compared to the more conservative approaches, but as surgeons have become more experienced in the approach of EEG better functional and appearance outcomes have been resulted [15,18-22].

In our study the patients were evaluated based on

burn size, operated surface size, hospital stay, graft success, itching score and scar formation during a 6 month period. The patients all had less than 15% total body surface area burns. They were otherwise healthy, so mortality was not considered as a factor. The results of our study was in coherence with the study by Saaq *et al.*, [23]. In their study, 120 patients who underwent EEG and DG, were evaluated in a two year period. In result they also documented better graft take, as one of the ultimate goals in treating any patient with burn injuries [19,24], in the EEG group.

In a Meta-analysis by Yee Siang Ong *et al.*, [11] in 2005, they studied 6 randomized controlled trials regarding the comparison of EEG and DG. They concluded that hospital stay is significantly reduced in the group that had early excision and grafting. Hospital stay have been shown to decrease in other studies using the EEG approach [14], our study did not show a better outcome in hospital stay. This is probably due to the fact that unlike other studies, our patients all suffered minor sized burns (less than 15% of total body size), as a result they did not have prolonged hospital stays to contribute to a meaningful difference among the two groups.

Although, in our study, the scare score did show better results in group 1 in comparison to group 2 (0.38±0.89 vs. 0.55±0.93), but it was statistically insignificant. This was the same with the itch score in which better results were documented in group 1 but these differences were statistically insignificant. This finding could be due to the fairly small population size that was selected for the study.

Our results were also supported by other studies that documented better results after EEG [10,14,25-29], although these studies were all in patients with large sized burns thus making them differ in some of their results.

This study has some limitations including the small population size and the non-randomized nature of



the study; moreover some confounding elements have not been taken into consideration like burns depth and the cause of the initial injury and also the preoperative condition of the patients who received the DG, which could have affected the results.

Studies with larger sample populations should be designed in patients with different burn sizes, in order to better clarify the advantage or disadvantage of the EEG approach in these groups.

In conclusion, early excision and grafting has

become a standard operation that is performed dealing with most deep dermal burns, our study supports the superiority of the approach in graft success rates when dealing with patients who suffer less than 15% TBSA burns. Although better outcome was also documented in hospital stay, itch score and the scar score, these results were not statistically significant.

**Conflict of interest:** None declared.

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