Treatment of Ulcer by Hair, Follicular Unit Transplantation and Split Thickness Skin Grafting

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ABSTRACT

In this study, we included patients having ulcers of diabetic, pressure, traumatic and venous etiologies with area ranging between 20cmsq to 40cmsq. In the present study, in group A, majority of cases had BMI in the range of 31-40 (n=7, 35%) followed by 25-30 (n=5, 25%), followed by underweight cases (n=2, 10%). These variables had no effect on the outcome of the study. Majority of the cases in both the groups had wound area of 31-40 cm2 We compared the study cases according to types of ulcers involved and in both the groups, traumatic ulcers were the commonest ulcers involved followed by diabetic and surgical wound. The recipient sites were observed for infection at Post-operative Day 2, 4 and then on OPD follow up at 1,2,4,8 weeks. No statistically significant relationship was found in Age, Sex and BMI in both the groups.

Keywords: Follicular, transplamtation, split-thickness, ulcer, grafting

INTRODUCTION

The process of cutaneous wound healing is incredibly complex, dependent on an intricate interplay between several highly regulated factors working in concert to restore injured skin towards repaired barrier function. This sequence of events plays out normally in most superficial wounds; however, it can go awry at numerous steps along the pathway, especially with underlying disease states such as diabetes [1-2]. The biochemical, cellular, and environmental regulation of wound repair involves a complex interaction between serum enzyme cascades, locally acting growth factors, circulating platelets and monocytes, tissue macrophages, fibroblasts, endothelial cells, epidermal cells, and the local cellular microenvironment [3].

Achieving skin cover is a big task to prevent skin infection and to reduce morbidity. The goal of large ulcer treatment is to obtain wound epithelialization as expeditiously as possible. Split Thickness Skin grafting is one of the routinely done traditional method for the management of large and small healing ulcers. Recent researchers have found that the use of hair follicles (Hair follicular unit transplantation) might be a feasible approach to developing topical wound applications for more rapid wound healing [4]. Clinicians have reported that hair bearing areas (eg Scalp) tend to heal faster than non-hair bearing areas (soles, palms) [5].

Epithelial follicular stem cells migrate to the epidermis to aid with the rapid re-epithelialization of wounded skin [6]. In this pilot study we are comparing HFUT with the traditional STSG for healing ulcers, of size ranging between 10cm2 to 40cm2. With promising results, the study in this hospital will be a motivation to implement HFUT method in healing ulcers and in large size ulcers [7].

RESEARCH OBJECTIVES

To compare clinical outcomes of patients with Healing Ulcer following Hair Follicular Unit Transplantation and Split-Thickness Skin Grafting. To study the outcome in the groups of Hair Follicular Unit Transplantation, Versus Split Thickness Skin Grafting in terms of:

Healing Duration (Epithelialization), Recipient site Contracture, Recipient site Infection, Donor site complications, Post-Operative Pain

LITERATURE REVIEW

Han and Ceilleyv [8] found that out of all the patients 2 patients did not respond to the treatment, wherein, one was having varicose vein that needed surgical management and the other was having pyoderma gangrenosum in the background of venous stasis. There were no adverse events following the procedure. Donor site healed well in all cases.

Suthar et al., [9] conducted a pilot study in which autologous grafts of follicular units were transplanted into experimental area of ulcer bed and found that there was a significant enhancement of wound healing compared to the control area. Budamakuntla et al., [10] in their study observed that the improvement in the volume was significantly more compared to the improvement in area (P = 0.02). Three (13.33%) patients showed more than 75% reduction in the area of ulcer and five showed 50%–75% reduction in the area of the ulcer.

Sorg et al [11] conducted a comparative study between STSG and HFU transplant for chronic wound ulcers. In their study observed that the mean age of patients was 57.1, BMI was 28.11 and mean area of wound in square cm was 7.33. Age, sex and BMI were found to have no statistically significant relationships with the survey scores.

MATERIALS AND METHOD
Study Criteria
Type of study
It is an Analytical, Prospective, Comparative study
Source of data: Patients with healing ulcers admitted in KIMS Karad in Department of Surgery.

Study duration
24 Months (November 2016 to November 2018)
Sample size : 40 cases (20 cases of each HFUT and STSG group)

Inclusion Criteria
1. Patients having healing ulcers of diabetic, pressure, traumatic and venous etiologies with area ranging between 10cm2 to 40cm2.

Exclusion criteria

1. Infected ulcer 2. Patients with proven deranged coagulation profile. 3. Malignant Ulcers 4. Not willing to sign the informed written consent Methodology: 20 Patients were selected randomly in each Group A and B Study subjects were divided into two groups: Group A was managed using Method for Hair Follicular Transplantation (HFUT) technique, and in Group B method of Split-Thickness Skin Grafting (STSG) was used.

Group A (Hair Follicular Transplantation technique)
Pre-operative preparations of patient

The patient with a healing ulcer of size 10cm 2 to 40cm 2 fitting the inclusion criteria was selected. Pre-operative workup with CBC count, Random Blood Sugar, Renal Function Tests, Serum Electrolytes (Na + K), Urine Examination, Chest Xray and ECG were done. Pre-operative antibiotics according to wound culture and sensitivity report were started. Once the ulcer was in a healing stage Hair Follicular Unit Transplantation was done. Anesthesia Infiltration of 2% Xylocaine is used for both the Donor and Recipient area [12].

Operative Parts

Donor Area and Recipient Area Recipient Area Healing Ulcer.

Donor Area: Scalp hair follicles of Occipital region (Safe Zone). This zone is traditionally considered to be resistant to Dihydrotestosterone (DHT) and the quality of Hair follicles in this area is superior than the rest of the scalp. The average hair density on scalp is 70-80 Hair Follicular Units per cm^2. About 5-8 hair follicular grafts per cm 2 are harvested. So there is no resultant hair deficiency in the donor area.
Following was the sequence for harvesting hair follicles from the donor area:

- The donor area was trimmed down to 1mm length.
- Area to be harvested is infiltrated with Local anesthetic solution (Xylocaine 2%).
- Individual hair follicles was punched out using motorized punch (Image-1) of size 1mm around the hair follicle.
- Harvested hair follicle was preserved in a Normal Saline for the time before they were implanted in the ulcer area.
- Hair follicles were implanted in the ulcer area by stick and place method using a 19G/20G needle a slit of depth 4mm-5mm is made, in which one hair follicular unit is implanted using forceps. Hair was implanted at a density of 5 units per cm2
- The donor area wound was closed with a compression bandage and local antibiotic ointment.
- After transplantation the ulcer area was closed with Vaseline gauze and dressing was done over it.
- First dressing was done after 48 hr and observations like Graft acceptance, Infection, Pain, Uprooting of Hair follicular grafts, start of epithelialization process are noted.

- Donor area is healed within 48 hrs and no further dressing is required.
- Patient can resume his normal routine and is asked to follow up for alternate day dressing.

Group B (Split-Thickness Skin Grafting)

Split thickness graft will be harvested from convenient donor area and grafted on the ulcer. Required investigations like Complete blood count, biochemical analysis of blood, serology, Wound Culture and Sensitivity are performed. Anesthesia, General Anesthesia or Spinal Anesthesia as required for the procedure. Operative Parts, Donor Area and Recipient Area Donor Area-Grafts were taken from thigh preferably. Recipient Area-Healing Ulcer.
Harvested graft is meshed with the help of blade and the graft is washed with normal saline and spread over on a wooden block.
The recipient site is prepared for grafting and the graft is then placed on the ulcer surface with the dermis (lighter side) down.
A Tie over Bolster dressing is done over the graft which is opened after 48 hrs. In the donor area, Hemostasis is achieved followed by a Vaseline Gauze dressing. Dressing is opened after 48 hrs and observations like Graft acceptance, Infection, Pain, start of epithelialization process are made. Later alternate day regular dressing is done for both the sites and observations are noted. Once the patient is discharged, follow up is done in the OPD for alternate day dressing.

Evaluation

The following parameters are assessed on a Physician Global Assessment Scale, and
the observations are scored as below
1-Healing Duration (Full Epithelialization completed in)
2- Recipient site Infection
3- Recipient site Contracture
4-Donor Site Complications
5-Post Operative Pain

Data Analysis

The collected data was entered using Microsoft Excel software and analyzed using SPSS Statistical package Version 21. Qualitative parameters were analyzed using Mann Whitney U Test while Quantitative parameters were analyzed using Z-test.

RESULTS

The present study was conducted among 40 cases of patients having healing ulcers in Department of General Surgery, KIMS, Karad.

Two groups

Group A: Hair Follicular Unit Transplantation
Group B: Split Thickness Skin Grafting.

Demographic Features

In Group A75% of the cases were males and 25% were females while in Group B60% were males and 20% were females (Figure 1).
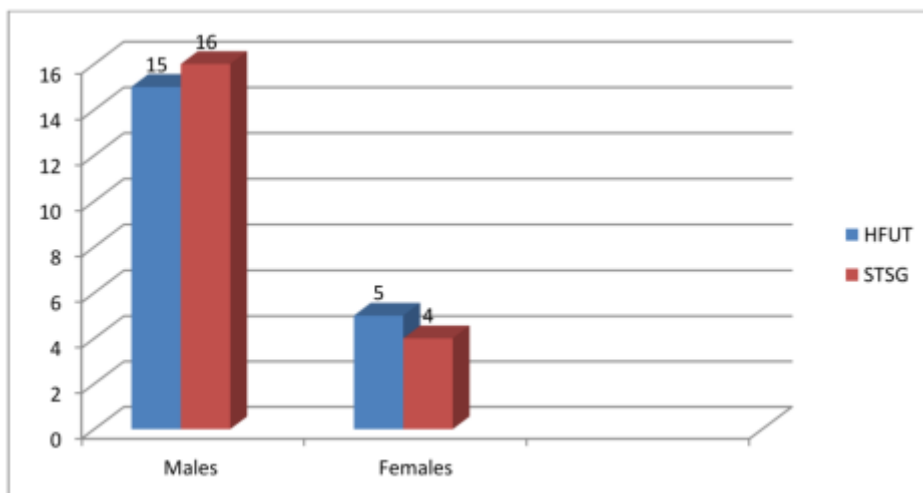
Figure 1: Gender-wise distribution of patients

In Group A 35% and 30% in Group B belonged to age group of 30-40 years, followed by age group 40-50 years (in 25% each group) (see Figure 2).
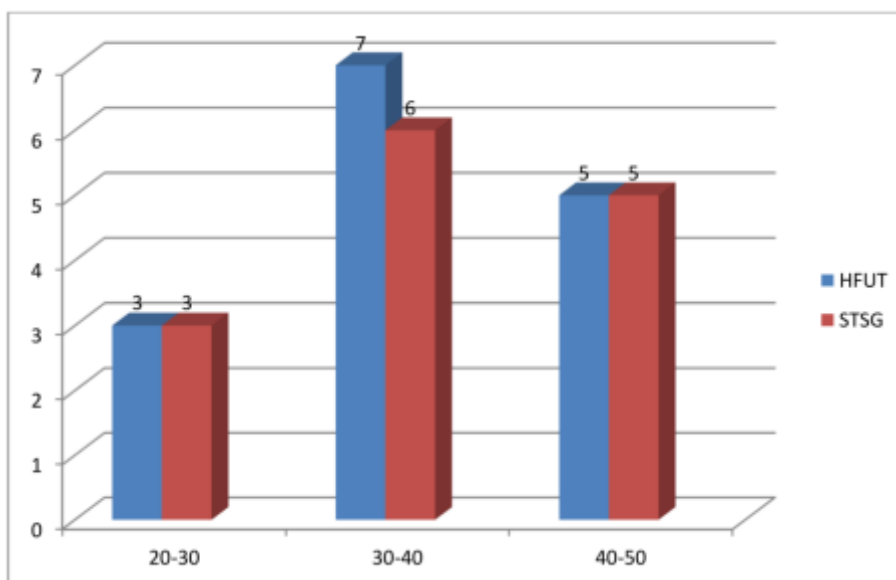

Figure 2: Age distribution of study patients

Body mass index distribution

In Group A, majority of cases had BMI in the range of 31-40 (n=7, 35%) followed by 25-30 (n=5, 25%), followed by underweight cases (n=2, 10%). Similarly in Group B, majority of cases had BMI in the range of 25-30 (n=6, 30%) followed by 31-40 and underweight individuals (n=5, 25% in each). The distribution is shown in following table and graph (Table 1, Figure 3).

Table 1: Body Mass index of cases

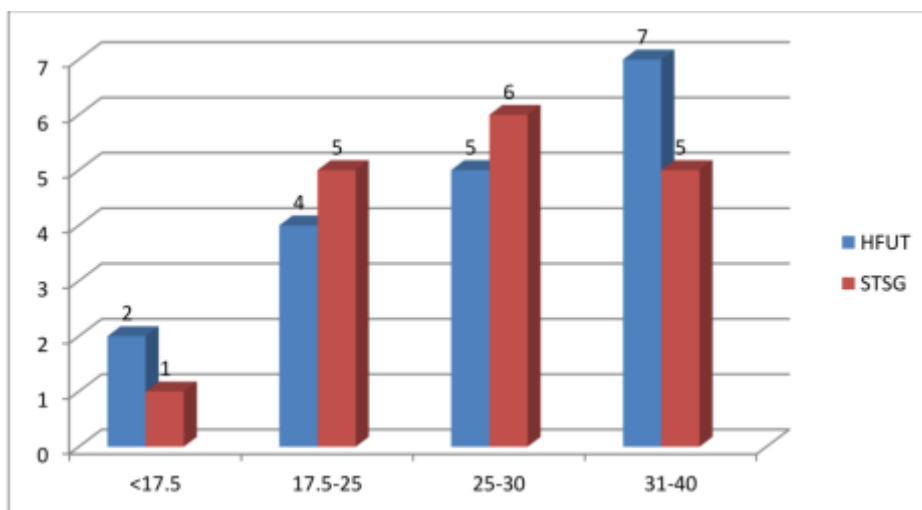| BMI	Group A		Group B	
	Number	Percentage	Number	Percentage
<17.5	2	10%	1	5%
17.5-25	4	20%	5	25%
25-30	5	25%	6	30%
31-40	7	35%	5	25%
>40	2	10%	3	15%
Total	20	100%	20	100%

Figure 3: Body Mass index of cases

Distribution of wound area among the patients Majority of the cases in both the groups had wound area of 31-40 cm 2 (Group A: n=14, 70%, Group B: n=15, 75%) (see Table 2, Figure 4).

Table 2: Distribution according to wound area (cm2)

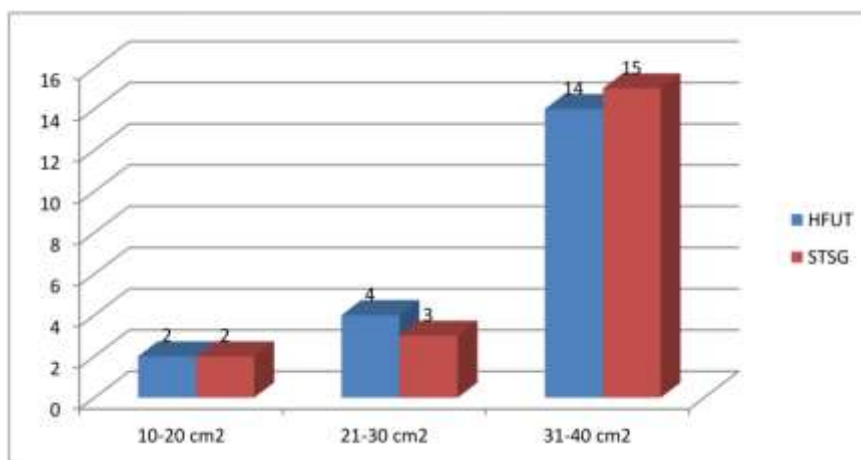| Wound area	Group A		Group B	
	Number	Percentage	Number	Percentage
10-20cm2	2	10%	2	10%
21-30cm2	4	20%	3	15%
31-40cm2	14	70%	15	75%
Total	20	100%	20	100%

Figure 4: Distribution according to wound area(cm^2)

Distribution of cases according to Types of ulcers It was observed that in both the groups, traumatic ulcers were the commonest ulcers (50% Vs 60% in either groups) involved followed by diabetic and surgical wound (Table 3).

Table 3: Types of ulcers

Type		Group A	Group B	
	Number	Percentage	Number	Percentage
Traumatic	10	50%	12	60%
Varicose	2	10%	3	15%
Diabetic	4	20%	3	15%
Surgical Wounds	4	20%	2	10%
Total	20	100%	20	100%

Healing duration

The average Healing time in Group A (HFUT) was 5 weeks and that in Group B (STSG) was 4 weeks. P value was 0.286 and not statistically significant. The scores were based on the Physician Global Assessment scale as shown in Figure 5.
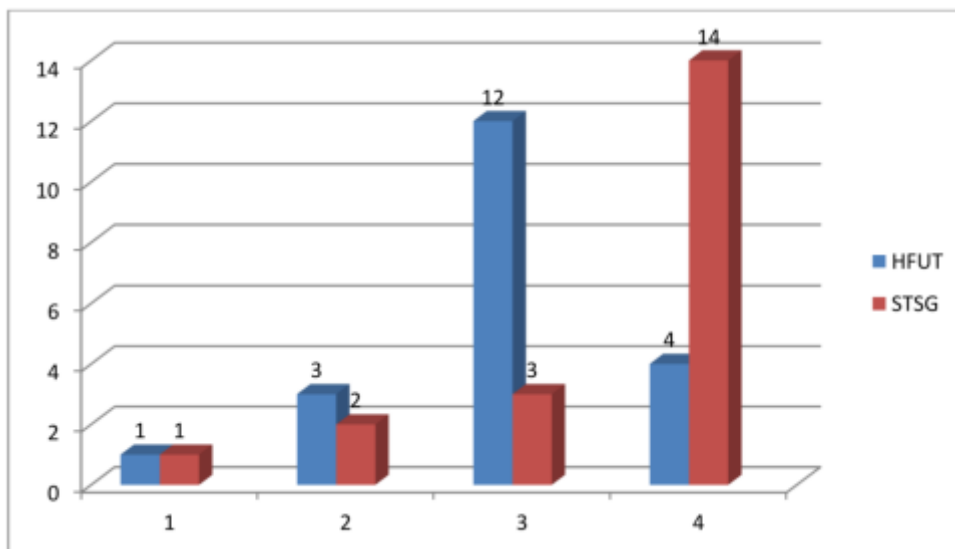

Figure 5: Healing duration among the cases

Recipient site Contracture

Recipient site contracture is assessed on follow up in OPD on week 4, 8 and 12. Patient were scored according to the grade of contracture and scores were given. In Group A there was no contracture in all the cases and the overall score was 20. While in Group B 15 Patients had Mild grade (Score 3) of contracture, 3 had Moderate grade (Score 2) and 2 patients had Severe grade (Score1) of contracture. The Mean score of Group A was 4, while that of Group B was 2.7. With a P value of 0.0001, there is a significant difference between the two groups.

Post-operative Pain

Patients response on a pain assessment scale was taken ranging from 1-10 on a Visual Pain Analogue Scale (see Figure 6). We observed that the mean rank score was relatively greater in Group A (3.9), as compared to group B (3.05). It shows that post-operative pain is significantly lesser after HFUT as compared to STSG. With a P value of 0.0001 there is a significant difference between post-operative pain in both the groups (Table 4).
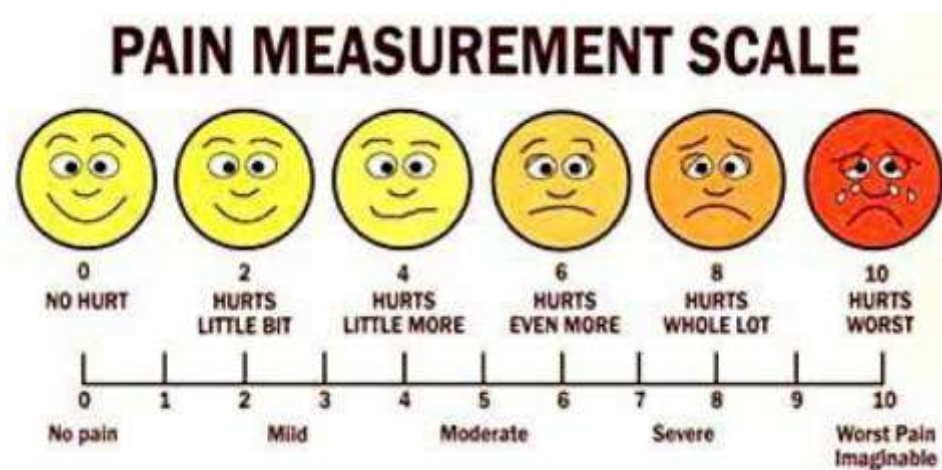

Figure 6: Pain assessment scale

Table 4: Post-operative pain (morbidity)

Outcome Indicators	Score	Group A		Group B	
		Number	Percentage	Number	Percentage
Post operative Pain	1	0	0%	3	15%
	2	0	0%	3	15%
	3	5	25%	14	70%
	4	15	75%	0	20%
Mean Score		3.75		2.55	
Level of significance		0.0001 (P Value < 0.05, Significant Difference)			

CONCLUSION

We compared the study cases according to types of ulcers involved. Traumatic ulcers were the commonest ulcers involved followed by diabetic and surgical wound. Healing ulcer of any etiology is the prerequisite for both the methods. We assessed healing duration among both the groups. The average Healing time in Group A (HFUT) was observed to be 5 weeks and that in Group B (STSG) was 4 weeks. In our study the contraction at Recipient site was studied in a Physician global assessment Scale.In Group B Responses ranged from Mild Contracture in 75% cases, Moderate contracture in 15% cases and Sever contracture in 10% cases. Where as in Group A the wound maintained normal elasticity and did not show contracture. Moreover, the HFUT group donor sites healed without any complications. While in STSG group four patients had donor site complications like Itching, Infection, Hypo pigmentation, hypertrophic scar and Pain.

CONFLICT OF INTEREST

None

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