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ORIGINAL RESEARCH

Role of Single Dose Intradermal Triamcinolone Infiltration in Preventing Hypertrophic and Keloid Scarring at Skin Grafting Donor Site

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ABSTRACT

Background: "Hypertrophic scars" are excessive scars with thick fibrous tissue that does not extend beyond the margins of the initial wound or incision. They're usually broader than they need to be for regular wound healing. Following excision, intraoperative and postoperative intralesional steroid treatment has been proven to minimise recurrence to less than 50%.

Materials and Methods: This is a prospective and single centre study conducted in the Department of General Surgery, Maheshwara Medical College & Hospital from 1st September 2020 to 4th September 2021. Males and females in the age group between 18 and 60 years were included in this study. The split thickness skin graft was harvested from a normal thigh where no skin graft had been harvested earlier. Indications for skin grafting were both elective and emergency.

Results: In our study, male was predominant 72.5% and remaining was 27.5%. Among the study group, 67.5% were post burn contracture raw areas, 30% posttraumatic raw areas and 3% post infective raw areas. Among 40 donor site steroid injection sites 9 are hyperpigmented (dark), 9 are hypo pigmented and 20 are similar in colour with surrounding skin compared to 20 (hyper), 13 (hypo), 7 (iso) respectively at donor site control areas. Mean value of normal skin thickness is 1.70, test site skin thickness is 2.30 and at control site skin thickness is 2.70. In our study57.5% cases have mild pain at test site, 42.5% cases have no pain at test site and 45% have moderate pain at control site in the post-operative period.

Conclusion: Reduced scar diameters, height, scar texture, colour match, and symptomatic relief were found in our investigation, with little dose-related drug-induced adverse effects. With regard to pigmentation and thickness, employing post operational intra lesional triamcinolone acetate injection after harvesting skin grafting resulted in a superior cosmetic and symptomatic outcome in skin grafting donor locations.

Keywords: Keloid scarring, Scar hypertrophy, Intradermal triamcinolone.

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INTRODUCTION

Scar hypertrophy seems to be inevitable when any wound heals; it varies in degree depending on factors like skin pigmentation, individual tendency, specific body locations and degree of local trauma, they are of aesthetic concern to the patient and the surgeon and also can cause troublesome symptoms of tenderness and itching.[1]

Keloids are pathological scars presenting as nodular firm lesions that extend beyond the area of injury. They do not spontaneously regress, often continuing to grow over time. The prevalence is high in the dark phototypes with an estimated incidence of 5–16% in the Hispanic and African-American populations. The most frequently affected body areas are chest, shoulders, earlobes and upper back.[2] Symptoms often include itching and pain. Unlike hypertrophic scars, keloids do not improve over time and commonly recur following surgical excision.[3] Large lesions may lead to cosmetic disfigurement and functional impairment, thus affecting the quality of life.[4]

The abnormal wound-healing process underlying keloid formation results from the lack of control mechanisms regulating cell proliferation and tissue repair. Histologically, keloids are characterized by haphazardly arranged hyalinized collagen bundles and a tongue-like advancing edge in the papillary dermis.[5] Despite many clinical, histological and in vitro findings, the pathogenic mechanisms underlying keloid formation have not been fully elucidated.[6] Excessive matrix accumulation and cell proliferation are distinctive histological features of keloids, resulting from the increased proliferation and lower apoptotic rate of fibroblasts.[7] The change in the normal balance between extracellular matrix (ECM) deposition and degradation seen during wound healing, especially along the remodeling phase, may play a role in keloid formation. Increased local levels of PAI-1 and low levels of urokinase have been reported in keloid fibroblasts, likely leading to reduced collagen degradation.[8]

Excision of the lesion followed by injection of triamcinolone is one the most successful combination regimen in the management of keloids. Cure rates exceeding 80% have been consistently reported using this regimen.[9] Intralesional steroids act by suppressing the inflammatory response, diminishing collagen synthesis, decreasing mucinous ground substance production and inhibiting collagenase inhibitors that prevent the degradation of collagen. The adverse effects of steroids include atrophy of the skin, hypopigmentation, telangiectasia and cushingoid effects from systemic absorption.[10]

Several strategies were suggested for keloid therapy, but, to date, no universally effective treatment was found.[10] Current therapeutic approaches fall into three broad categories: alteration of the inflammatory response; modification of collagen metabolism; surgical and physical manipulation of the keloid scar.[11] Therapeutic approaches include surgical excision, intralesional injection of steroids, verapamil, 5-fluorouracil (5-FU), cryotherapy, laser therapy (fractionated CO2 laser, Nd:YAG laser, pulsed-dye laser), silicone sheet dressings, irradiation, retinoids, tacrolimus, imiquimod and combination therapy.[12]

Since keloids are notoriously characterized by a high recurrence rate after surgical excision, nonsurgical approaches are recommended for primary treatment.[13] The most common approach is intralesional corticosteroid injection alone or in combination with other treatment modalities. Triamcinolone acetonide (TAC) is the most commonly used intralesional corticosteroid.

MATERIALS & METHODS

This is a prospective and single centre study conducted in the Department of General Surgery, Maheshwara Medical College & Hospital from 1st September 2020 to 4th September 2021.

Inclusion criteria

- Males and females in the age group between 18 and 60 years were included in this study.
- The split thickness skin graft was harvested from a normal thigh where no skin graft had been harvested earlier.
- Indications for skin grafting were both elective and emergency.

- Patient willing to give informed written consent.

Exclusion criteria

- Children below 18 years and adults above 60 years.
- Patients contraindicated for steroid use like diabetics, hypertensive, epileptics, benign intracranial hypertension, peptic ulcer, chronic nephritis, tuberculosis etc.
- Patients not willing to give the written consent.

Patients who needed therapeutic split skin grafting for various elective and emergency plastic surgery procedures are considered in the study. 4 months is the study period.
30 patients who need more than 20X10 cm area of split skin grafting to resurface the defects are being included in the study;
10X10 cm skin graft donor site (half of the original area) is marked as the test site and 10X10 cm skin graft donor site is marked as the control site.
Thigh is the donor site in all cases and Humbys knife used for harvesting uniform thickness skin graft in all cases.
The strength of triamcinolone acetonide used for this study is 40 mg / ml. 1 ml is diluted to 10 ml with addition of 9ml of normal saline and with a maximum of 1-2 ml per dose i.e. maximum of 80 mg per dose. 0.01–0.02 mL is injected per square cm of marked test area of skin graft donor site.
Local care of the healed donor site at the end of 3 to 4 weeks is followed by application of lubricant in the form of coconut oil rubbed into the thigh. No compression garments are prescribed.

Technique and procedure

General or Regional anesthesia, uniform thickness skin graft measuring more than 20 × 10 cm is harvested from thigh with hand driven dermatome.
After the harvest of the uniform thickness skin graft (using a hand held dermatome), oozing was controlled by the application of normal saline soaked sponge with pressure; after 5 minutes the wound was separated into the test and control areas.
The prepared steroid solution was then injected intra-dermally along the marked test site, leaving control site using a 20-gauge cannula mounted on a 10-ml syringe-10 ml for the entire 100 square cm area; dressing was done using Vaseline gauze followed by gauze and gamgee pads and regular roller bandages. Elasticated bandages were avoided.
The skin graft donor sites were examined Patients are followed at 1st month, 2nd and 4th month, for a detailed examination of the scar at the skin graft donor site. The following parameters were assessed.

1. In the 1st month:

- at 14, 21 days and
- weekly after that till complete donor site healing (in those patients where healing had not been complete)

2. The following scar characteristics measured at subsequent monthly visits:

The consistency of the scar is classified as either hard, soft or consistency similar to the surrounding skin. Scar suppleness compared with normal adjacent thigh skin.
Other features like skin atrophy, erythema, ulceration, skin necrosis at steroid injection site is also recorded.
Healing time is the time taken for complete epitheliastion of the skin grafting donor site.

RESULTS

In our study, male was predominant 72.5% and remaining was 27.5% in [Table 1].

Table 1: Distribution of Gender

Gender	Frequency	Percentage
Male	29	72.5
Female	11	27.5
Total	40	100

Table 2: Distribution of Age group

Age Group	Frequency	Percentage
18 to 20 years	13	32.5
21 to 40 years	20	50.0
41 to 60 years	07	17.5

In [Table 2], in our study most of the patients were belong to 21-40 years of age (50%) and least 41-60 years (17.5%).

Table 3: Therapeutic indication for skin grafting

Parameters	Frequency	Percentage
Post burn contracture raw areas	27	67.5
Posttraumatic raw areas	11	27.5
Post infective raw areas	02	5

In [Table 3], among the study group, 67.5% were post burn contracture raw areas, 30% posttraumatic raw areas and 3% post infective raw areas.

Table 4: Pigmentation: in comparison to the adjacent normal skin

Parameter	Test area	Control area
Iso pigmentation	20	07
Hyper pigmentation	11	20
Hypo pigmentation	09	13

In [Table 4], among 40 donor site steroid injection sites 9 are hyperpigmented (dark), 9 are hypo pigmented and 20 are similar in colour with surrounding skin compared to 20 (hyper), 13 (hypo), 7 (iso) respectively at donor site control areas.

Table 5: Comparison of scar thickness at test and control site (in mm)

	1.0 to 1.5	1.5 to 2.0	2.1 to 2.5	2.5 to 3.0	3.1 to 3.5
Test	0	23	11	6	0
Control	0	0	21	13	6
Normal skin	9	31	0	0	0

In [Table 5], mean value of normal skin thickness is 1.70, test site skin thickness is 2.30 and at control site skin thickness is 2.70

Table 6: Pain (Visual analogue scale--mild-1-3, moderate 4-7, severe 8-10)

	None	Mild	Moderate	Severe
Test site	17	23	0	0

Control site	0	22	18	0

In [Table 6], 57.5% cases have mild pain at test site, 42.5% cases have no pain at test site and 45% have moderate pain at control site in the post-operative period.

Table 7: Distribution of Itching

	None	**Mild**	**Moderate**	**Severe**
Test site	16	24	0	0
Control site	0	09	02	29

In [Table 7], 72.5% have at control site, severe itching and half of them with sleep disturbances.

Table 8: Scar classification

	Test site	**Control site**
Hypertrophic	19	33
Normal	21	07

In [Table 8], Hypertrophic scar occurred in 47.5% cases at kenacort injection site & in 82.5% of cases at test site have scars comparable with adjacent normal skin.

Table 9: Donor site healing

Test site -- less than 21 days 31 More than 21 days 09
Control site -- all healed within 21 days

In [Table 9], in 77.5% cases test site healed before 21 days and 22.5% cases healed by 4 weeks.

Table 8: Scar texture

	Frequency	**Percentage**
Similar	31	77.5
Rough/Altered	09	22.5

In [Table 10], Better scar texture in terms of elasticity and pliability noticed in steroid injected skin graft donor sites and comparable to adjacent skin in 31 cases.

DISCUSSION

Intra-lesional steroid injection has been described as well accepted and recommended treatment modality for the therapy of hypertrophic scarring; it has been variously used with or without the addition of compression bandages. There are few studies on the prophylactic use of steroid injection to control scar formation.[14] Evidence based accepted doses of triamcinolone 40mg/ml for a thick keloid scar, 10mg/ml for hypertrophic scar with total dose should not normally exceed 1-2 ml per dose, and intra muscular dose is 60-100mg /dose.

This study was done to find whether the prophylactic administration of local steroid has any benefit in reducing the incidence of hypertrophic scarring and the symptoms that it induces. The skin graft donor site was divided into two parts designated as the test and control site. To avoid the possibilities of diffusion across the border between the test and donor sites, the readings were taken at least 5 cm away from the Centre.

In this study group, same region (thigh) chosen both as test and control site and uniform skin thickness graft harvested at both sites. Since both test and control sites are same region avoiding several biases of inter individual & region variations. No form of pressure garment or compression therapy had been used; once the area had healed routine care had been advised specifically instructing against massage to avoid obfuscation of any therapeutic effect noticed.

Pigmentation of the test and control areas were compared to the surrounding normal skin and the incidence of hyperpigmentation were 9 in the test site and 15 in the control site; hypopigmentation was noticed in 7 of the test sites and 10 of the control sites. It implies better Scar color & matched with adjacent normal thigh. One of the side effects of the use of local steroids is skin hypopigmentation and atrophy; in fact it is this noticeable use effect that is put to use in the treatment of hypertrophic scars and keloids.

Measurements of scar thickness were taken at the test and control site and normal site for reference.18 of 30 test sites had skin thickness less than 2.0 mm (all 30 normal skin thickness was less than this value) whereas 16 of the control sites had thickness more than 2.0mm and none were less than 2.0mm.

The mean scar thickness values were 2.20 for the test site and 2.60 for the control site and 1.69 for the normal skin. When we classified the scars as normal (mean values nearer to 1.69) and hypertrophic (mean values closer to 2.60) there were 16 hypertrophic scars in the test group and 14 in the control group and 26 normal scars in the test group as against 4 in the control group. None of the patients has scar atrophy. Hence more of the hypertrophic scars formed in the control than the test group.

18 of the 30 patients had mild pain at the test site where as 14 of the 30 patients had moderate pain at the control site. 18 of the 30 patients had mild itching at the test site where as 22 of the 30 patients had severe itching with sleep disturbances at the control site. Mild pain and less severe pruritus noticed at steroid injection site compared to control site. No systemic side effects like hypertension, diabetes, Cushing's reported in the study group and it implies single dose triamcinolone shown may have little post-operative or no long term systemic absorption effects. Better scar texture in terms of elasticity and pliability noticed in steroid injected skin graft donor sites.

Uniform results with respect to color, thickness at test sites not achieved, may be due to lack of uniformity in the amount of drug injected per each square centimeter with syringe and intravenous cannula. 6 of the 30 patients had delayed wound healing beyond 21 days at the test site whereas all the control areas had healed before 21 days. Healing was complete in these 6 patients after a further period of 1 week. This delay may be due to associated nutritional deficiency and low hemoglobin level. There was no incidence of necrosis or ulceration. It implies no significant impact on healing time with single dose steroid intradermal infiltration.

Insufficient evidence of clinical benefits and cost effectiveness, poor patient compliance of pressure garment therapy and as prophylactic measure to prevent hypertrophic scarring, demands search of additional prophylactic regimen to prevent hypertrophic scar incidence.

CONCLUSION

Results of the study showed reduced scar dimensions, height, better scar texture, color match, and better symptomatic improvement with minimal dose related drug induced side effects. There seemed to be a better aesthetic and symptomatic outcome in skin grafting donor sites by using per operative intra lesional triamcinolone acetate injection after harvesting skin grafting, with respect to pigmentation and thickness. In addition, there is some improvement in pain and itching on the scar with the use of the drug. This therapeutic effect can be obtained with a minimal incidence of delayed wound healing.

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