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VITILIGO SURGERY – EXPANDING THE AESTHETIC HORIZON

Dermatology

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ABSTRACT

BACKGROUND: Autologous negative pressure epidermal harvesting system(ANPEHS) is a newer method where vacuum and heat are used to raise epidermal microdomes. We studied the outcome of ANPEHS, mini punch grafting and split skin grafting in patients with stable vitiligo.
AIM: To compare efficacy of ANPEHS, mini punch grafting and split skin grafting in stable vitiligo.
METHODS: 18 patients with stable vitiligo were randomised into 3 groups A, B, and C. Group-A underwent ANPEHS, group-B mini punch grafting and group-C split skin grafting. Outcome was assessed by VASI score, downtime, colour match, complications and improvement in quality of life.
RESULTS: ANPEHS showed faster and cosmetically better repigmentation. There were no complications like cobblestoning, colour mismatch, scarring and peri-graft halo in group-A
CONCLUSION: ANPEHS is a simple, safe, faster method of autologous epidermal harvesting in stable vitiligo which gives higher aesthetic outcome.

KEYWORDS

Vitiligo Surgery, Epidermal Grafting, Aesthetic Outcome

INTRODUCTION:

Vitiligo is one of the common pigmentary disorders of the skin characterized by depigmented macules and patches over the skin and mucosa, with an enormous amount of social stigma attached to it. Though medical modalities of treatment are commonly preferred, surgical intervention remains the main mode of treatment for stable and focal types of vitiligo. The various surgical methods have been designed with the following aims[1]: a) introduction of artificial pigments into the lesions for permanent camouflage, (e.g. tattooing), b) removal of the depigmented areas forever, (e.g. excision with primary closure, and covering with thin Thiersch's graft), c) repopulation of the depleted melanocytes by various grafts, (e.g. ultra-thin grafts, suction blister and miniature punch grafts, non-cultured epidermal cell suspension or transplantation, and epidermal and melanocyte cultures), d) therapeutically wounding the lesion to stimulate the melanocytes from the periphery and the black hair follicles to proliferate, migrate and re-pigment the lesion, (e.g. therapeutic dermabrasion, laser ablation, cryosurgery (liquid nitrogen spraying), needling, and local application of phenol or trichloroacetic acid).

Various studies on surgical modalities of vitiligo have showed good results, but with complications like cobble-stoning, peri-graft halo, colour mismatch, stuck on appearance and donor site scarring which are inevitable even in aesthetically significant sites. With the newer innovations in obtaining tissue graft like the autologous negative pressure epidermal harvesting system (ANPEHS), a tool that concurrently applies both heat and suction to normal skin to induce epidermal micrografts, [2] surgical outcome can be maximized while minimizing the adverse effects associated with other techniques. We would like to share our experience on a study comparing the efficacy of ANPEHS with the other two commonly practiced techniques – mini punch grafting and split skin grafting.

AIM:

The aim of our study was to compare the efficacy of ANPEHS with mini punch grafting and split skin grafting and to assess the outcome in terms of reduction is Vitiligo Area Severity Index (VASI) score, average duration taken for onset and achievement of near total repigmentation, aesthetic outcome, donor and recipient site complications and improvement in quality of life of the patients in each technique.

MATERIALS AND METHODS:

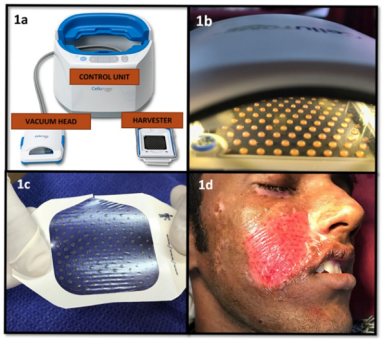
A randomized prospective interventional study was conducted in the Department of Cosmetology, Government Stanley Medical College and Hospital, Chennai, from July 2016 to June 2018, comparing the effectiveness of ANPEHS, mini-punch grafting and split skin grafting in 18 patients with stable and localized vitiligo, after obtaining institutional ethical clearance, and written and informed consent. Patients were of both sex and age group ranged from 10 to 35 years (mean: 20.3). Patients with localized vitiligo resistant to medical management for more than 6 months, stable disease activity of more than one year, willing to get enrolled for the study and follow-up, were included. The site wise distribution of the vitiliginous patches were over the face (7 patients), neck (2 patients), lips (2 patients), trunk (5 patients), and legs (2 patients) patients. Those with active vitiligo and other major systemic illnesses were excluded from the study.

The patients were randomized using computer generated random numbers into 3 groups; 6 under each – Group A underwent ANPEHS technique, Group B mini punch grafting and Group C split skin grafting. Baseline investigations, bleeding time, clotting time, serology for Hepatitis B, Hepatitis C, HIV and syphilis were done. Pre procedure photograph of the lesion, VASI score[4], Dermatology Life Quality Index (DLQI) score[5]were taken for all the patients.

Group A patients underwent epidermal harvesting using ANPEHS which is a novel automated tool, that has 3 components (Figure 1a) a harvester, a vacuum head and a control unit. The harvester (a disposable component with a cutting blade), was placed on the donor site (antero-lateral aspect of thigh), and secured with the Velcro strap provided. The vacuum head (a reusable component of the system that delivers negative pressure of -400 mm Hg to -500 mm Hg and heat of 37°C to 41°C from the control unit to the harvester) was then applied to the harvester ensuring a snug fit. Switching on the control unit, negative pressure and heat was rendered and the process of formation of microdomes of epidermis began. The microdome formation can be visualized through the view window (Figure 1b).Within 30 minutes, round well-formed epidermal microdomes were formed and the unit was turned off. The vacuum head was removed and a Tegaderm™ dressing was applied over the epidermal grafts and the blade was activated by lowering the handle. The dressing was then gently removed with the adhered microdomes (Figure 1c). No anesthesia was needed for the epidermal harvesting as the patients experienced very minimal and bearable discomfort during the procedure. The procedure was very well tolerated even by patients in the pediatric age group. The donor site was then dressed with a sterile paraffin gauze. Under local anesthesia, the recipient site was dermabraded using a micromotor with diamond fraise after cleansing and draping. The Tegaderm

dressing with the grafts embedded was spread uniformly over the denuded recipient site after making a few perforations using an 18 G needle for exudation of serum during the postoperative days(Figure 1d).The area was in turn dressed with a sterile paraffin gauze and absorbable sterile pad, secured in place using dynaplast.

Figure 1a - Components of ANPEHS, 1b - Microdomes visualized through the view window, 1c - Epidermal microdomes adhered to tegaderm film, 1d - Grafts applied over the recipient site



The patients in group B underwent mini punch grafting. Skin grafts were harvested from the anaesthetized (local infiltration of 2% lignocaine) donor site (anterolateral aspect of thigh, using 1.5mm sterile disposable punches. The depth of harvesting was kept superficial to involve up to the papillary dermis in order to avoid complications like cobble stoning at recipient site. The grafts obtained were placed in the slots made by removing the vitiliginous skin using 1.5mm punches at the recipient site and the wounds were dressed(Figure 2a). Care was taken to involve the margins of the lesion.

Split skin grafting was done for group C, where, a thin layer of epidermal skin was removed using a sterile shaving blade held in place with a straight artery forceps. The thin graft hence obtained was placed over the dermabraded recipient site after making few slits on it (using a No.11 blade) for exudation of serum.(Figure 2b).

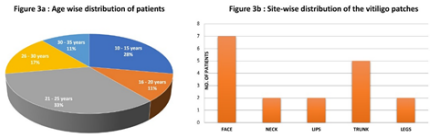
Figure 2a - mini punch grafts in situ, 2b - split skin graft in situ

In all the 3 groups, after the grafting was done, the recipient sites were left immobile and undisturbed for 30 minutes. In both and B and C groups the same dressing method as described in group A, was followed at the donor and recipient sites. The patients were prescribed oral antibiotics and analgesics (oral amoxycillin 30mg/kg/day in three divided doses for 5 days, oral diclofenac 2mg/kg/day in two divided doses for 2 days along with oral ranitidine 6mg/kg/day in two divided doses for 2 days) and were advised to avoid strenuous activities for a week. On the third post-operative day, donor and recipient dressings were gently removed with saline compresses. Patients were followed up weekly once for the first month, once in 2 weeks for the next 3 months, and once a *month* for 12 months. On each follow up, photographs, VASI score, DLQI score, amount and quality of repigmentation, healing of donor and recipient site, and complications at donor and recipient sites were noted and tabulated. Statistical analysis was done using Graph pad calculator. Paired t test and ANOVA test were used to analyze the '*p*' value . A '*p*' value of <0.05 was considered statistically significant.

RESULTS:

Out of the 18 patients enrolled for the study, 10 were males and 8 females. The age wise distribution is depicted in the pie chart (Figure 3a). The distribution of the vitiligo patches were over the face7/18 (39%), neck 2/18 (11%,) lips 2/18 (11%), trunk 5/18 (28%), and legs 2/18 (11%) as shown in (Figure 3b).

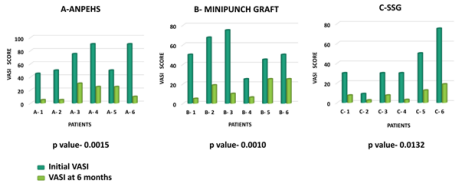
Figure 3a - Pie chart showing patients' age wise distribution, 3b - Bar diagram showing distribution of vitiligo patches



The results were assessed in the terms of a) outcome (using VASI score and photographs), b) downtime (donor & recipient site healing, average duration for onset of repigmentation and time taken for near total pigmentation), c) complications, d) improvement in quality of life (using DLQI), and e) new onset of disease activity.

The outcome was assessed in the following ways : (i) Comparing the VASI score - initial and at the end of 6 months. It was found that there was a significant reduction in VASI score with a statistically significant '*p*' value (<0.05) in all the three groups calculated using paired t test. The '*p*' values for group A, B and C were 0.0015, B 0.0010, 0.0132 respectively (Figure 4).

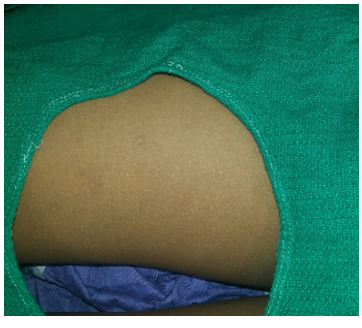
Figure 4 - Comparison of initial VASI score and score at the end of 6 months in all the 3 groups



(ii) Comparing the percentage reduction in VASI score at the end of 6 months, among the three groups, using ANOVA test showed a '*p*' value of 0.313 proving that there was no difference in the outcome among the 3 groups, statistically. (iii) The amount of repigmentation based on the percentage reduction in VASI score at 6 months was classified as mild (0-25%), moderate (26-50%), good (51-75%), excellent/near total (76-100%). Percentage reduction in VASI score was calculated as : ((initial VASI - VASI at the end of 6 months) / initial VASI) X 100. It was seen that in group A, 50 % of patients showed near total repigmentation and 33.3% good amount of repigmentation compared to group B (33.3% near total and 50% good repigmentation) and C (16.7% near total and 83.3% good repigmentation. Hence the number of patients attaining near total repigmentation was the highest in group A.

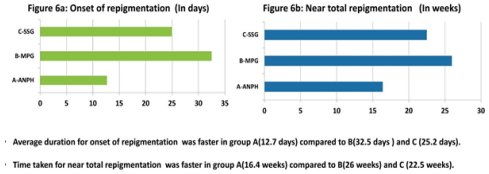
Assessing the downtime, the donor site wound healed completely within 3 days with no scarring in group A and dressing was required only for a day (Figure 5) as compared to group B and C where the wounds healed with scarring and hyperpigmentation in 2 to 3 weeks and the wound required dressing for 1 -2 weeks. Immediate recipient site reactions like erythema, tenderness and exudation were seen in all the patients.

Figure 5 - Healing of donor site without scarring in group A



None of our patients had any signs of infection. The average duration for onset of repigmentation was faster in group A (12.7 days) compared to B (32.5 days) and C (25.2 days) (Figure 6a). The time taken for near total repigmentation was faster in group A (16.4 weeks) compared to B (26 weeks) and C (22.5 weeks)(Figure 6b).

Figure 6a -Graph showing average duration for onset of repigmentation, 6b - Graph showing time taken for near total repigmentation



Excellent colour match with uniform repigmentation was seen in group A (Figure 7a, 7b, 7c, 7d) and C (Figure 8a, 8b). In Group B patients, though there was a remarkable improvement, the pigment match with the surrounding skin was variable with few areas of hyperpigmentation (Figure 9a, 9b).

Figure 7a, 7b, 7c, 7d - Excellent colour match with uniform repigmentation seen in group A

Figure 8a,8b - Excellent colour match with uniform repigmentation seen in group C

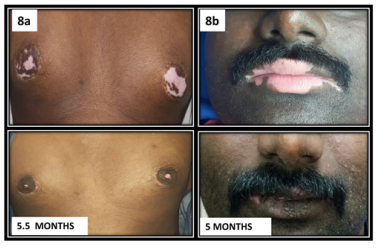
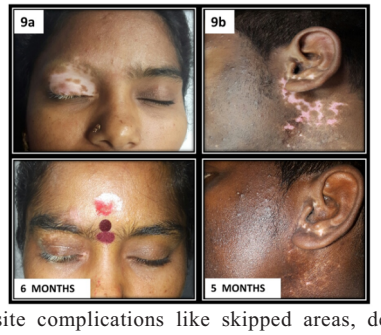
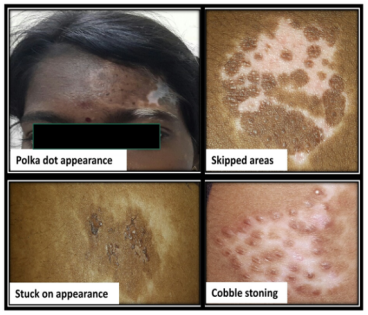


Figure 9a, 9b - Repigmentation seen in group B



Recipient site complications like skipped areas, depigmented junctional lines were seen in group A and C. None of the patients in group A showed cobble stoning, peri-graft halo, stuck on appearance of the graft polka dot appearance, whereas cobble stoning (2 patients), skipped areas (2 patients), peri-graft halo (1 patient) and polka dot appearance (2 patients) were seen in group B (Figure 10).

Figure 10 - Recipient site complications seen in group B and C



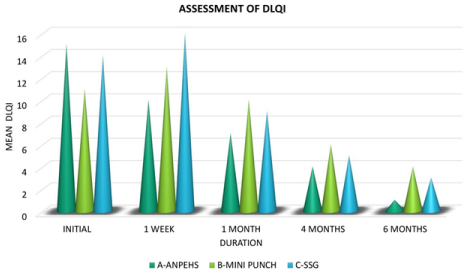
Group C patients showed complications like stuck-on appearance (Figure 10).of the graft (3 patients), depigmented junctional lines (3 patients) and skipped areas(2 patients). (Figure 11)

Figure 11 - Donor and recipient site complications

GROUP	RECIPIENT SITE											DONOR SITE
	ERYTHEMA	TENDERNESS	EXUDATE	INFECTION	COBBLE STONING	STUCK ON TYPE APPEARANCE	COLOUR MISMATCH/ POLKA DOT	PERI GRAFT HALO	SKIP AREAS	DEPIGMENTED JUNCTIONAL LINES	REACTIVATION OF VITILIGO	
A	++	+	+	-	-	-	-	-	+	+	-	NO SCARRING
B	+	+	-	-	+	-	++	++	++	-	-	SCARRING/ HYPER-PIGMENTATION
C	++	+	+	-	-	+	+	-	+	+	-	SCARRING/ HYPER-PIGMENTATION

There was a drop in DLQI in the initial 1 week in all the patients in group A, as the donor and recipient site healing was uneventful and faster and the patients were able to resume their daily routine from the third post-operative day. Whereas there was an increase in DLQI in the other 2 groups, (B and C) in the first week as most of the patients had pain and exudation over both donor and recipient sites necessitating rest from the routine activities.(Figure 12). At the end of 6 months all the patients showed a significant drop in DLQI with a 'p' value less than 0.05 in all the 3 groups, calculated using paired t test.

Figure 12 - Assessment of DLQI



One patient under group-C had reactivation of disease activity, at fourth month of follow-up showing extension of depigmentation beyond the graft site and he was treated with tapering doses of oral steroids(starting with 0.5mg/kg/day) for 3 months and phototherapy, after ruling out foci of any infection. Follow up of the patients at the end of one year was consistent with the results at the end of 6 months while 2 patients in group B developed Koebnerisation in the form of extension of depigmentation at the donor site. They were treated with tapering doses of oral prednisolone as mentioned above.

DISCUSSION:

Vitiligo is an acquired depigmenting disorder of great cosmetic importance affecting 1 – 4% percent of the world's population and one that has a major impact on the psychosocial life of the patients.There are many cases of vitiligo that either fail to or only partially respond to the medical line of treatment indicating that melanocyte reservoir [6] is no more available for repigmentation in these areas. Surgical treatments are among the most effective interventions for localised and stable vitiligo, and such patients respond well to methods like autologous skin grafting procedures like epidermal cell culture grafting, pure melanocyte culture grafting, epidermal grafting by suction blister technique, thin Thiersch's split skin grafting, or thin split skin miniature punch grafting and tattooing. Stability of vitiligo is manifested as the absence of new lesions, the absence of spread of existing vitiligo lesions, and absence of Koebner's phenomenon. Though the duration of stability is a debatable issue, the Indian Association of Dermatologists, Venereologists, and Leprologists (IADVL) task force has defined stability as 'a patient with no new lesions, no progression of existing lesions and absence of Koebner's phenomenon during the past one year'[3]. The advantages of epidermal grafting over traditional split-thickness skin grafting include little or no patient discomfort during harvesting, obviating the need for anesthesia; minimal outpatient setting rather than an operating room; a superficial donor site wound that heals within two to four weeks with minimal scarring; and a simplified procedure that requires a minimal surgical expertise. Epidermal micrografts can be obtained using the novel automated, minimally invasive tool which is now available commercially. This tool is already being used successfully in the

treatment of non-healing ulcers[7]. It generates a negative pressure of -400 mm Hg to -500 mm Hg and heat of 37°C to 41°C to raise the epidermal microdomes, which are formed at the derma-epidermal junction and contain proliferative cells that secrete wound healing growth factors (e.g. vascular endothelial growth factor, transforming growth factor alpha, platelet-derived growth factor, hepatocyte growth factor, and granulocyte colony-stimulating factor)[7].Hence the healing of the donor site wound is rapid and the repopulation of melanocytes at the recipient site is achieved faster compared to the other methods.

An interesting aspect of ANPEHS is that it acts as a combination of three techniques : (1) suction blister grafting – negative pressure and heat are used to raise epidermal microdomes, (2) similar to split skin grafting –a split is formed by suction exactly at the derma-epidermal junction, (3) like punch grafting –multiple circular micrografts resembling punch grafting technique are obtained from the harvester plates. The adverse effects associated with these common modalities mentioned above, can be minimized with ANPEHS as a) less time is required compared with the conventional suction blister grafting, b) better colour match, uniform pigmentation and cosmetically acceptable donor site healing without a scar as compared with split skin and punch grafting. There is also no risk of transmissible diseases as the harvester unit is disposable and the method is autologous. The entire procedure can be completed within 15 to 60 minutes, and there is no need for donor site anesthesia due to the absence of pain sensory organs in the epidermis, which results in minimal patient discomfort. The patients can return to their daily routine immediately, though they are asked to avoid strenuous activities for a week as the first 72 hours are most crucial for graft uptake due to fibrin bonding, and then begin the onset of vascular anastomosis and fibrovascular growth [8].

In our study, we observed a near total repigmentation in 16.4 weeks, which was way faster compared to the other studies with epidermal grafting where near total repigmentation took three to six months to appear [9]. The common complications associated with other skin grafting procedures like cobble stoning, hyperpigmentation, peri graft halo, sinking pits, formation of milia and scarring, and beaded margins were not observed with the ANPEHS method in our study. There are very minimal studies for the role of ANPEH in vitiligo and to the best of our knowledge ours is the first one comparing the effectiveness of ANPEHS with other two commonly used modality of surgical management of vitiligo. The drawbacks of this tool are – fixed size of the harvester plate and the cost of the treatment. Improvisations made in the tool like availability of variable sizes of harvester plate, would enable us to choose the appropriate size for the patch to be treated. Though expensive compared to the other methods, the excellent aesthetic outcome and the ease of performing and better patient compliance, makes it one of the best modalities to treat vitiligo over face and other sites of cosmetic concern, and hence the cost-effectiveness is justified. The pitfall of this study being smaller sample size, larger controlled studies are required to statistically prove its effectiveness.

CONCLUSION:

ANPEH technique is an ideal, simple, safe, faster method of autologous epidermal harvesting in stable vitiligo. It can be used to treat sites of aesthetic significance like the face, with a promising outcome. Larger controlled studies are required to statistically prove its significance in this field.

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