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A study of Suction Blisters for Stable Vitiligo

Samia A. Ibrahim[1], Sara Mohamed Ibrahim Mohamed[1], Khaled Gharib[1]*

Dermatology, Venerology & Andrology Department, Faculty of Medicine, Zagazig University, Egypt

Abstract

Vitiligo is an acquired disorder of depigmentation characterized by loss of melanin pigment through the progressive destruction of melanocytes, resulting in amelanotic macules and patches on the skin. It has a significant effect on the quality of life and affects individuals of all ethnicities, skin types, and genders. Traditional therapy for vitiligo primarily involves medical interventions, among them topical and systemic corticosteroids, topical calcineurin inhibitors, narrow-band ultraviolet B phototherapy, excimer laser, and photo chemotherapy with psoralen. Surgical interventions as a method to harvest melanocytes from non-affected skin and introduce them to areas of depigmentation have been developed and refined over the last few decades. These include split thickness skin grafts (STSG), suction blister epidermal grafts (SBEG), and cultured and non-cultured epidermal suspension (NCES) grafts. Although each technique has its unique advantages and disadvantages, NCES grafting in particular has been lauded for its high donor-to-recipient ratio, feasibility in children, reasonable cost, and excellent cosmetic results. However, significant disadvantages remain in traditional NCES grafting, chief among them the considerable operator training required to harvest viable cells and scarring at the donor sites.

Keywords: Non cultured epidermal suspension, suction blister, vitiligo.

Full length article **Corresponding Author*, e-mail: *sara.ibrahim.k1@gmail.com*

1. Introduction

Surgery can often be the treatment of choice for patients with SV and other localized and stabilized forms of vitiligo (non-segmental) after the documented failure of medical interventions [1]. For vitiligo (non-segmental), patients with a stable form of the disease and a negative history of Koebner phenomenon are suitable, but the risk of relapse must be explained thoroughly to the patient [2]**.** The stability of the disease is the prime criterion for raising a patient for surgical treatment. The guidelines recommend surgery for both segmental and non-segmental vitiligo after at least 1 year of stable disease. Another study, indicated that stability of at least 2 years may be required in segmental vitiligo for the disease to remain quiescent thereafter. In non-segmental vitiligo, we could not determine any duration of stability after which the chances of reactivation decrease meaningfully. The disease stability is likely in patients with segmental vitiligo after a period of 2 years of inactivity. However, the risk of reactivation in non-segmental vitiligo does not change significantly with the period of inactive disease [3]. These surgical techniques include replacement of the damaged melanocytes and jointly institute the grafting procedures. The choice of grafting procedure approved usually depends upon the extent, size, and site of the vitiligo lesions, age and expectations of patient and the proficiency of operating surgeon. These grafting techniques include tissue grafting procedures like punch grafting, split thickness or suction blister grafting and cellular grafting procedures like non-cultured or cultured epidermal cell suspension grafting [4]. In order to strengthen clinical results obtained after completion of surgical procedures, whole treatment should be enriched with NB-UVB 311 nm or PUVA phototherapy [5].

2. Classification of surgical methods for the treatment of vitiligo

The surgical approach to vitiligo treatment can be divided into two branches: tissue Grafts: Mini-Punch Graft (MPG), Suction Blister Epidermal Grafting (SBEG), Split-Thickness Skin Grafting (STSG), Epidermal Curettage Technique (ECT), Smash Grafting, Flip-Top Grafting, Hair Follicle Graft and cellular grafting: Cultured Melanocyte Graft, Cultured Epidermal Graft, Non cultured Melanocyte-Keratinocyte Suspension, Non cultured Follicular Root Sheath Suspension. Suction blister epidermal grafting (SBEG) and mini-punch grafting (MPG) are most prevalent in tissue grafting and epidermal cell suspension (ECS) and follicular cell suspension (FCS) in cellular grafting [6].

2.1. Mini-Punch Graft (MPG)

An innovative method, at which a dermabrasion device equipped with dental burrs are used. It was considered as a modification of the previously performed punch grafting in the treatment of hypopigmentation skin disease. It is considered as cost-effective and easy to follow. It is recommended for zones that characterized by irregular shape i.e. (the nipple, lips, or palms) and for acral vitiligo which are considered to respond abortively to medical therapies. The technique involves collecting tissue, frequently from the upper part of the thigh or the gluteal area and is carried out with a punch biopsy tool equipped with a blade [7]. The tool

is placed at the donor site in such a way that the largest achievable number of grafts can be collected from the smallest possible area for most effective mini-punch grafting. Then, the tissue grafts gained in this way are transferred to the previously prepared donor area. Finally, treated site and the region where graft is obtained protected with dressings for four to seven days. Last phase of treatment is phototherapy, which has a beneficial effect on repigmentation process [8]. Mini-punch grafting demonstrates well to excellent repigmentation of treated lesions within six months. Theresponse to MPG and the following therapy is stated due to melanocytes start to horizontally migrate and repopulate depigmented areas [9].The side effects detected at donor site might include textural and pigmentary variations, such as polka dots, color-mismatch hyperpigmentation and cobble stoning, which is most common complication of MPG [10].

2.2. Suction blister grafting (SBEG)

This technique refers tosuction of pigmented epidermis from the dermisby creating blisters and its transfer to achromic areas. SBEG is based on the possibility of collecting the graft by using different suction devices, which, through applying negative pressure, makes it possible to obtain blisters. This technique is considered to be easy and safe and is indorsed for vitiligo lesions around the sensitive area of the mouth and eyelids [11]. The process is introduced by preparing the blisters. Suction blisters are raised from the donor site either the medial aspect of the arm, thigh, abdomen or back via negative pressure from suction plates, cups or inverted syringes with the plunger removed and attached to an automated or manual suction device [12]. Depending on age of the patients and donor site, time of procedure for inducing blister varied between 30 and 180min. Heat was used in one study for reduction of time of separation. Preparation of recipient site, it is cleaned, anesthetized and derma brazed until pinpoint bleeding is visible, signifying that the dermo-epidermal junction has reached. The roofs of blisters at donor site removed and transferred to the prepared recipient site. The bandage should be applied to recipient site for one week, and a judicious use of antibiotic ointment at both sites recommended. After about one to two weeks, grafts will detach, leaving behind transferred melanocytes [13].

This method does not require anesthesia and the patient experiences less pain than shave biopsy method. Similarly, 24 h after the biopsy, donor site dressing is removed and covered with mupirocin ointment, then redressed by Vaseline gauze every 8 h [7]. In addition to being less invasive and less scarring as well as having a lower risk of bleeding, suction blister can prevent further psychological burden related to stigma associated with biopsy in patients caused by more invasive methods. Another benefit of this method was direct accessibility to the epidermal layer. No need for enzymes for dermis and epidermis separation due to separation of the dermis and epidermis layers following the induction of blisters can accelerate the transplantation process and reduce costs [14]. Despite the low cost and lack of special equipment, SBEG is a time-consuming practice for doctors. It is stated that this method is unsuitable for treating larger areas, uneven surfaces or palms. The side effects of this method in the recipient area include hyperpigmentation, per graft halo, infection, color mismatch, reactivation or progression on recipient site and the Koebner phenomenon, along with hyperpigmentation at donor site [16].

2.3. Non cultured Epidermal Cell Suspension (NCES)

This technique refers to the harvesting a skin graft from a donor site, usually acquired from the glutal area, for extracting keratinocytes and melanocytes. Then, it would be relocated to a prepared vitiliginous skin [17]. There are factors that detected to influence the outcome of NCESs and can be categorized into three groups. Initial are the patient's and disease characteristics. The most important factor to determine the success rate of an NCESisstability of the disease. Stable segmental vitiligo (SV) seems to have a better treatment response when compared to NSV.Next is the specified technical details of the NCES procedure, including donor site harvesting, donor-to-recipient ratio, laboratory techniques, and recipient site preparation. Finally, is the postoperative care and postoperative phototherapy [18].

2.4. Follicular Cell Suspension (FCS)

The idea for transplanting hair follicles came from the observation of a perifollicular repigmentation pattern in some vitiligo patients. This method is, overall, the one that requires the greatest effort and has the highest costs. The hair follicle pigmentation relies on a complex interaction between melanotic melanocytes, amelanotic melanocytes, and their precursors in the hair follicle bulge, which is much more difficult to reestablish as compared to the epidermis, which has only differentiated melanotic melanocytes. The melanocyte stem cells in the hair follicle are controlled by keratinocytes and dermal papilla cells as well as extra follicular signals resulting in a much more complex multi-scale regulatory mechanism as compared to epidermis re pigmentation [18]. In the HFCS method, follicular unit extraction is done from the occipital scalp. Few hairs delineated in this area in a square of approximately 10*10 cm and trimmed to 2 mm. Field block anesthesia using 2% lignocaine with adrenaline given encircling delineated donor area. With injection of normal saline, tumescence is achieved in donor area. With the help of 0.7 mm motorized punch, intact hair follicle units extracted in toto. These follicles washed three times in Ringer's lactate solution and incubated with trypsin–EDTA solution at 37°C for 90 minutes.

The hair follicles are placed in a new test-tube of trypsin–EDTA every 30 minutes and reaction in previous tube terminated by adding trypsin inhibitor (Sigma-Aldrich). Cell suspensions of all three tubes are then put in a single tube and filtered through a 70 μm cell strainer (Becton Dickinson, Sunnyvale, CA, U.S.A.). Cell suspension is then centrifuged for 10 minutes at 2,500 rpm to obtain a cell pellet [18]. The recipient area thoroughly cleansed and anesthetized, followed by dermabrasion with a motorized dermabrader until pinpoint bleeding is observed. Dermabrasion must be performed in at least two directions. The denuded area is covered with a saline-moistened gauze piece to achieve hemostasis. Previously prepared follicular suspension is pronounced into a 20-gauge needle. It is evenly poured onto denuded surface and then recipient area is covered with a collagen dressing, followed by a sterile gauze piece with another dressing. Following procedure, patient is allowed to return home, and, on eighth day, they should present for dressing removal. In some cases, antibiotics may be prescribed for a week, although this varies by hospital guidelines. After complete re-epithelialization, approximately two weeks. Most common side effects include infection of recipient site and color mismatch in form of hyperpigmentation [19].

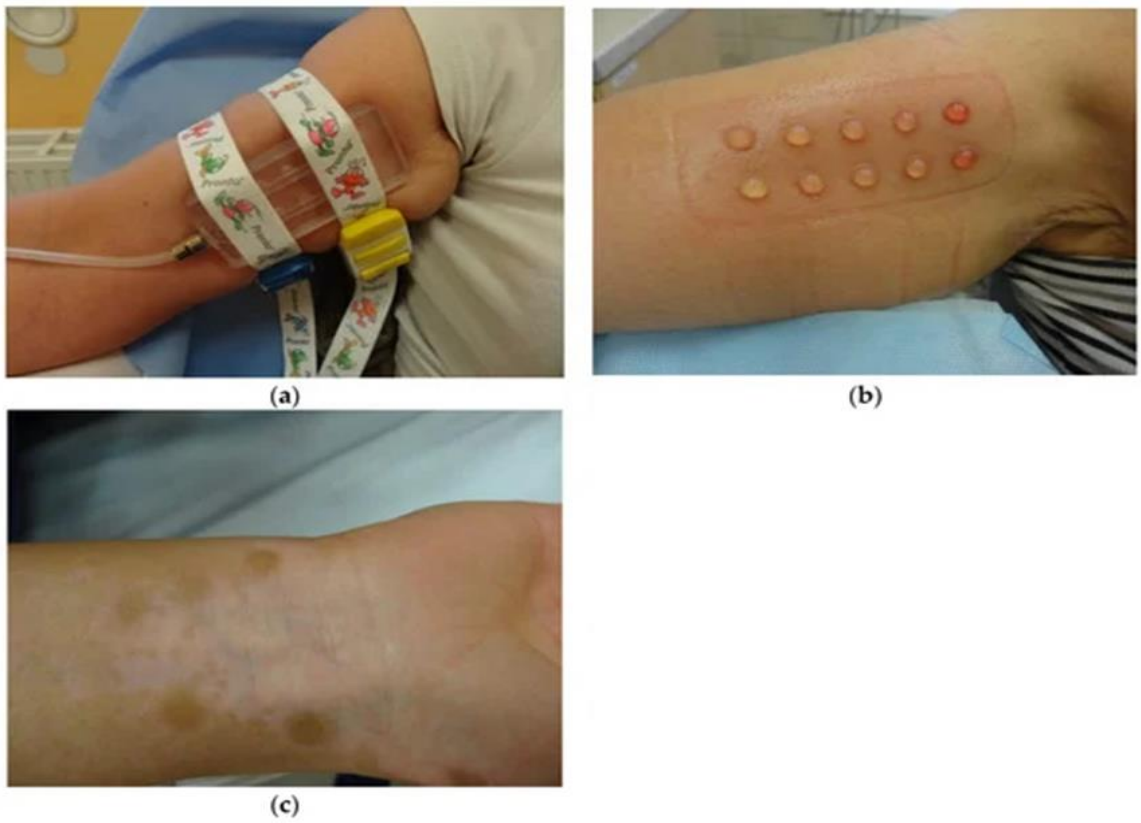

Figure 1. (a) Induction of blisters on the forearm by the use of the suction blister-forming dish; (b) completed blister formation; (c) visible process of re pigmentation occurring peripherally from the recipient site [6].

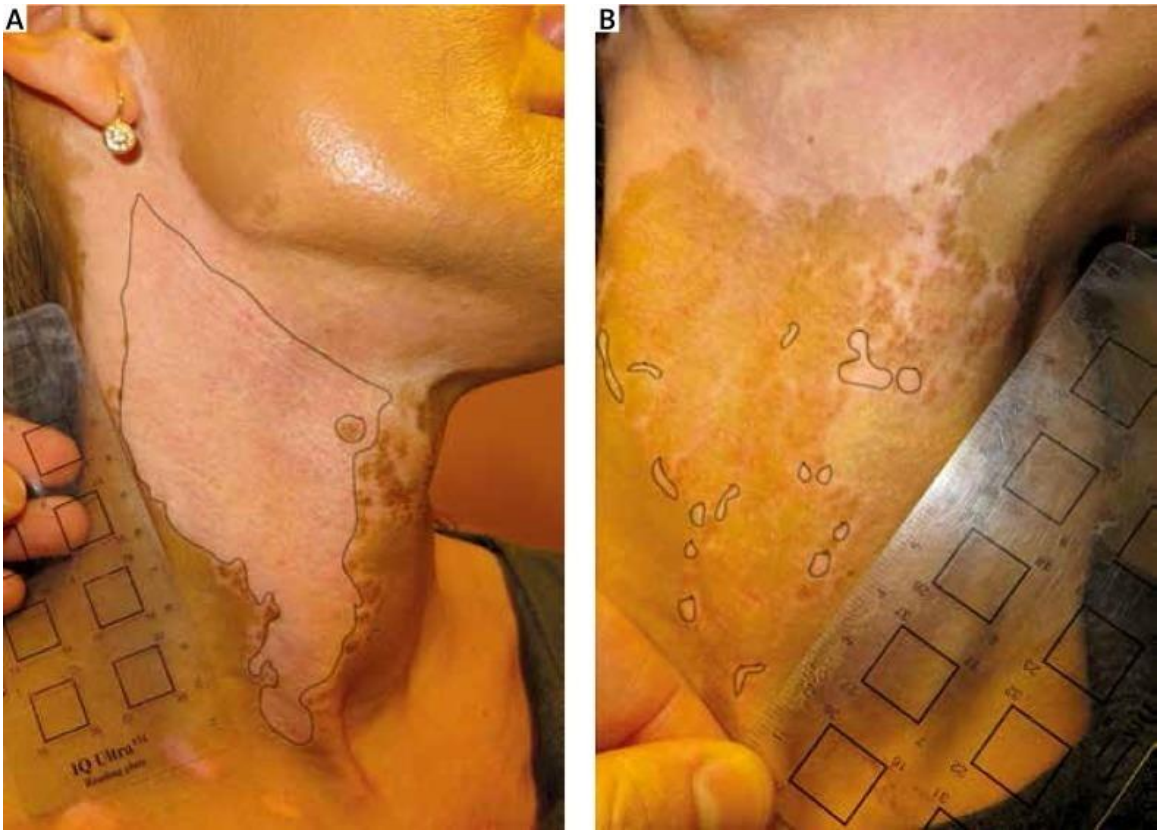

Figure 2. A – Patient 4, area 2 (neck) – before SBEG, B – patient 4, area 2 (neck) – 6 months after SBEG (after transferring 40 suction blisters) [15].

References

[1] A.M. Gamal, R.A. El-Barbary, N.H. Moftah. (2021). Updates in surgical treatment of vitiligo. Journal of Recent Advances in Medicine. 2(1): 118-127.

[2] J. Seneschal, R. Speeckaert, A. Taïeb, A. Wolkerstorfer, T. Passeron, A.G. Pandya, H.W. Lim, K. Ezzedine, Y. Zhou, F. Xiang. (2023). Worldwide expert recommendations for the diagnosis and management of vitiligo: Position statement from the international Vitiligo Task Force—Part 2: Specific treatment recommendations. Journal of the European Academy of Dermatology and Venereology. 37(11): 2185-2195.

[3] N. Taneja, V. Sreenivas, K. Sahni, V. Gupta, M. Ramam. (2022). Disease stability in segmental and non-segmental vitiligo. Indian dermatology online journal. 13(1): 60-63.

[4] B. Oberoi, S. Baveja, V. Pathania, S. Neema. (2023). Comparative study of the efficacy and safety of two grafting procedures (an automated epidermal harvesting system and non-cultured epidermal cell suspension) in the treatment of stable vitiligo. Indian Journal of Dermatology, Venereology and Leprology. 89(4): 536-542.

[5] R. Czajkowski, W. Placek, I. Flisiak, D. Krasowska, J. Maj, M. Marchlewicz, A. Reich, H. Wolska, L. Rudnicka. (2019). Vitiligo. Diagnostic and therapeutic recommendations of the Polish Dermatological Society. Dermatology Review/Przegląd Dermatologiczny. 106(1): 1-15.

[6] A. Frączek, M. Kasprowicz-Furmańczyk, W. Placek, A. Owczarczyk-Saczonek. (2022). Surgical treatment of vitiligo. International journal of environmental research and public health. 19(8): 4812.

[7] J.L. Griffith, M. Al-Jamal, I.H. Hamzavi. (2018). Classification of Surgical Therapies in Vitiligo. Vitiligo: Medical and Surgical Management. 193-207.

[8] S.A.M. Salem, T.A. Fezeaa, N. El Khazragy, M.Y. Soltan. (2021). Effect of platelet-rich plasma on the outcome of mini-punch grafting procedure in localized stable vitiligo: clinical evaluation and relation to lesional basic fibroblast growth factor. Dermatologic Therapy. 34(2): e14738.

[9] A. Samy, A. El-Sabbagh, A. Mohamed, M.M. Abdel-Halim. (2022). Usefulness of Micro-Punch Skin Grafting for Treatment of Resistant Vitiligo. The Egyptian Journal of Plastic and Reconstructive Surgery. 46(1): 9-14.

[10] A. Dalla, D. Parsad, K. Vinay, V. Thakur, M. Sendhil Kumaran. (2020). A prospective study to assess the efficacy of various surgical modalities in treatment of stable vitiligo patches over resistant sites. International journal of dermatology. 59(7): 837-842.

[11] P. Ashwini, D. Sushmitha, S. Veeranna. (2020). Vitiligo with special emphasis on vitiligo surgery. Archives of Medicine and Health Sciences. 8(1): 140-146.

[12] T. Kawakami. (2022). Surgical procedures and innovative approaches for vitiligo regenerative treatment and melanocytorrhagy. The Journal of Dermatology. 49(4): 391-401.

[13] M. Khalili, R. Amiri, S. Mohammadi, B. Iranmanesh, M. Aflatoonian. (2022). Efficacy and safety of traditional and surgical treatment modalities in segmental vitiligo: A review article. Journal of cosmetic dermatology. 21(6): 2360-2373.

[14] M.A. Nilforoushzadeh, A. Ataei, S. Zare. (2023). Two methods with less donor site complications of epidermal cellular grafting in cell therapy of vitiligo. Iranian Journal of Public Health. 52(9): 2021-2024.

[15] T. Iwanowski, P. Szlązak, A. Rustowska, M. Sokołowska-Wojdyło. (2018). Efficacy of suction blister epidermal grafting with concomitant phototherapy in vitiligo treatment. Advances in Dermatology and Allergology/Postępy Dermatologii i Alergologii. 35(6): 592-598.

[16] H.J. Ju, J.M. Bae, R.W. Lee, S.H. Kim, D. Parsad, A. Pourang, I. Hamzavi, J. Shourick, K. Ezzedine. (2021). Surgical interventions for patients with vitiligo: a systematic review and meta-analysis. JAMA dermatology. 157(3): 307-316.

[17] V. Vachiramon, K. Triyangkulsri, D. Saengwimol, K. Chanprapaph. (2019). Outcome of repeated use of donor site for noncultured epidermal cellular grafting in stable vitiligo: a retrospective study. BioMed research international. 2019(1): 7623607.

[18] D. Bassiouny, S. Esmat. (2018). Autologous non-cultured melanocyte–keratinocyte transplantation in the treatment of vitiligo: patient selection and perspectives. Clinical, Cosmetic and Investigational Dermatology. 11: 521-540.

[19] D. Gunaabalaji, R. Pangti, A. Challa, S. Chauhan, K. Sahni, S.K. Arava, G. Sethuraman, S. Vishnubhatla, V.K. Sharma, S. Gupta. (2020). Comparison of efficacy of noncultured hair follicle cell suspension and noncultured epidermal cell suspension in repigmentation of leukotrichia and skin patch in vitiligo: a randomized trial. International journal of dermatology. 59(11): 1393-1400.