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Epidermal Sheet Grafts for Repigmentation of Vitiligo and Piebaldism, with a Review of Surgical Techniques

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Thin epidermal sheets, obtained by a high-speed air-driven dermatome, were used to repigment white areas in 19 patients with vitiligo and one boy with piebaldism. In the depigmented skin to be treated the epidermis was removed by a rotating diamond fraise under topical and/or local anaesthesia injections. The method was used on most parts of the body, including the eyelids and genitalia. The maximum total area treated on each occasion was 190 cm^2.

Excellent results could be obtained if the vitiligo had been stable and had not increased anywhere during the last 2 years. Lack of immobilization could explain a poor result in some areas. The donor area on the buttocks healed quickly without depigmentation. In the transplanted area milia were observed in the first 6 months. No scarring was seen. The technique has a niche in the treatment of depigmented skin, especially in larger areas.

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In 1947 Haxthausen transplanted Thiersch grafts from normal to vitiliginous skin areas and vice versa on small areas in 3 young women (1). After 9–12 months the normal skin grafted to a depigmented area remained somewhat pigmented only in one of the women. Good repigmentation of vitiligo was obtained 5 years later in a coloured woman by Spencer & Tolmach (2), who used full-thickness grafts. Their findings were consistent with those in a study in which autografts were performed on dark and white spotted guinea pigs (3 for ref.) and were later confirmed by others with use of pigmented Thiersch grafts or minigrafts from punch biopsies (3–9). The most likely reason for the lack of effect in 2 of the 3 above-mentioned patients (1) was that in these patients the disease was probably active (4, 7). Good results on limited areas have also been obtained by using small epidermal sheets from suction blister roofs or by injecting a cell suspension prepared from a shave biopsy into freeze-induced blisters on vitiliginous areas (10–19).

Transplantation of grafts cultured on collagen-coated membranes and transferred to dermabraded vitiliginous areas measuring 10 cm^2 was successful in 3 patients (20). Larger areas of up to 240 cm^2 have been treated effectively with epidermal sheet grafts obtained by culturing epidermal cells for 3 weeks (21, 22). The depigmented recipient site had been denuded by freezing with liquid nitrogen. With other methods cultured melanocytes were applied on dermabraded vitiliginous skin (17, 23, 24). The total area could then be increased to 500 cm^2, which is the absolute limit recommended in a single session (24).

A new technique using thin epidermal sheets obtained with the Zimmer air dermatome showed very promising results on various areas of 5 patients with vitiligo (25). We report here our experience with this dermatome in 19 patients with vitiligo and one patient with piebaldism. The white areas were dermabraded after topical application of EMLA cream.

MATERIAL AND METHODS

Patients

Relevant data for the patients are given in Table I. Patients nos. 1 and 3 were Arabs, patients 2 and 8 were black Africans and patients 16 and 17 were from India. All others were of Caucasian descent. Patient 6 had segmental vitiligo and patient 7 piebaldism. Patient 9 had halo naevi and generalised vitiligo. All others had vitiligo vulgaris.

Procedure

The white areas to be treated were cleaned with alcohol and the borders outlined with a marking pen. The size of the areas was calculated by marking them on a transparent film. The markings were transferred to a paper copy and weighed on an electronic balance to calculate the areas. A topical anaesthetic cream, EMLA®, (Astra, Södertälje, Sweden) was applied under saran-wrap occlusion for 1–5 h. The difference in time depended on the skin thickness, as described elsewhere (26). On the buttocks, from which the epidermal sheets were usually taken, the EMLA was applied for 2 h. One to two hours before surgery, the patients were given 5–10 mg of diazepam and 10 mg of ketobemidone, both orally. Erythromycin capsules, 500 mg × 2, were taken for 7 days after the transplantation.

Transplantation

The EMLA cream on the recipient areas was wiped off with dry gauze and cleaned with sterile saline solution and 70% ethanol. The premarked areas were precooled with ethylchloride spray and then dermabraded with a high-speed dermabrader, normally fitted with a regular diamond fraise. Eyelids were dermabraded manually, with a similar fraise. If pain was felt during the dermabrasion, the areas were sprayed with 0.5% lidocaine in a bicarbonate solution. Denuded areas were covered with gauze moistened with PBS solution, pending transplantation.

The donor area was then cleaned in the same way as the recipient area and the margin was injected with 1% lidocaine, mixed 1:1 with sodium bicarbonate solution, to ensure that no pain would be felt. A Zimmer air dermatome (Zimmer Inc. Warsaw, Ind, USA) was fitted with a 3″ shield and set at 0.08 at the level control for obtaining 0.1 mm thin epidermal grafts. After removal, the thin epidermal sheet was moistened with a few drops of S-MEM medium (Gibco, Gaithersburg, MD), to ensure that the sheet did not become dry before being applied. The slightly bleeding donor area was covered with Tegaderm® (3M, St. Paul, Minn.), glued with Mastisol® (Federal laboratories, Inc, Ferndale, Michigan) and covered with an adhesive bandage.

A piece of the epidermal sheet was applied to the dermabraded recipient area. The sheets were secured with silicone netting (Mepitel®, Mölnlycke AB, Mölnlycke, Sweden) and then covered with saline-moistened gauze and bandaged. The patient rested in a hospital bed for at least 4 h after the procedure had been completed. The bandages were removed after 1 week. In the following weeks the patients were encouraged to expose themselves moderately to the sun in slowly increasing doses.

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Table I. *Data for the treated patients*

Patient no. 6 had segmental vitiligo and patient no. 7 piebaldism. Numbers marked a, b and c indicate that the patient was operated on 2–3 times.

Pat. no	Sex	Age	Years with leukoderma	Years stable	Sites treated	Treated area cm^2	% repigmented
1a	M	61	4	2	Forehead	80	100
1b	M	62	5	3	Chest, arms	90	100
2	M	12	10	0	Eyelids, face, legs	75	0
3	M	25	5	1	Neck, scrotum	30	10
4	F	38	29	0.5	Hands	80	0
5	F	18	7	0.5	Neck, legs, feet	50	70
6	M	22	2	2	Face	20	100
7a	M	8	7	7	Arm	80	100
7b	M	8	7	7	Arm	80	100
8	M	52	22		Neck	100	70
9	M	19	11	4	Eyelid, chest, arm	110	100
10	F	59	3	0.5	Hands	190	20
11a	M	46	45	1	Hands, arm	70	hand 50, arm 100
11b	M	46	45	1	Hands, arm	140	hand 50, arm 100
12	F	41		1	Hands, finger	140	50
13a	M	42	5	2	Eyelid, perioral	18	0
13b	M	42	5	2	Chin, neck, arm	70	100
14	F	34	20	19	Eyelid	10	100
15	F	17	3	1	Hands	100	100
16	F	19	6	1	Eyelid, face, leg	70	100
17	M	52	42	1	Face, hands, feet	160	95
18	F	40	8	2	Face, hands, arm	120	100
19	M	45	10	2	Arms, hip, leg, feet	90	95
20a	F	49	3	1	Face	140	95
20b	F	49	3	1	Hand, finger, chin	160	100
20c	F	49	3	1	Neck	140	100

RESULTS

The recipient areas were again inspected and photographed after 4–8 months. The results are shown in Table I and are exemplified in Figs. 1 and 2. Excellent results with 100% repigmentation were observed in patients who had had stable, non-active lesions for at least 2 years. In those with less repigmentation or none at all, it was evident at the follow-up inspection that the vitiligo was increasing. Small epithelial miliaria-like cysts were seen in the recipient areas in the first 6 months, especially in the face and on the neck (Fig. 2b). The patients were instructed to open the milia with a fine needle and press out the contents. The transplanted areas appeared pink in the first month. No scarring was seen in any of the patients.

DISCUSSION

There are three prerequisites for an excellent result with this epidermal sheet grafting, namely that the vitiligo must be stable, that the transplanted areas have to be immobilized, and that the donor epidermis has to be of appropriate and even thickness.

Regarding stability some of our patients believed that their vitiligo was not increasing. Later it became evident that the patients with no repigmentation after transplantation had been

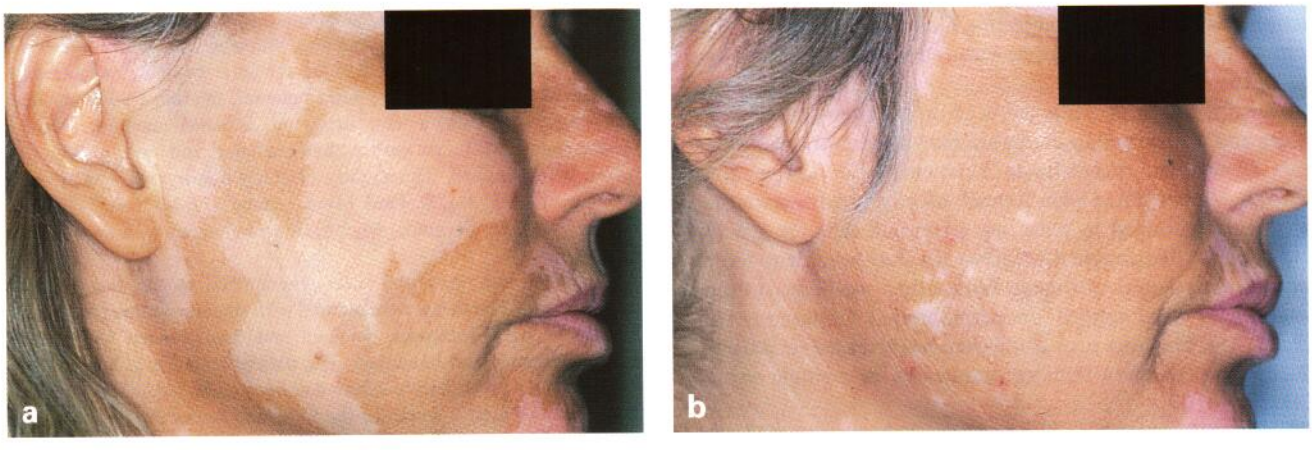

Fig. 1. Patient no. 20 (*a*) before transplantation and (*b*) 8 months later.

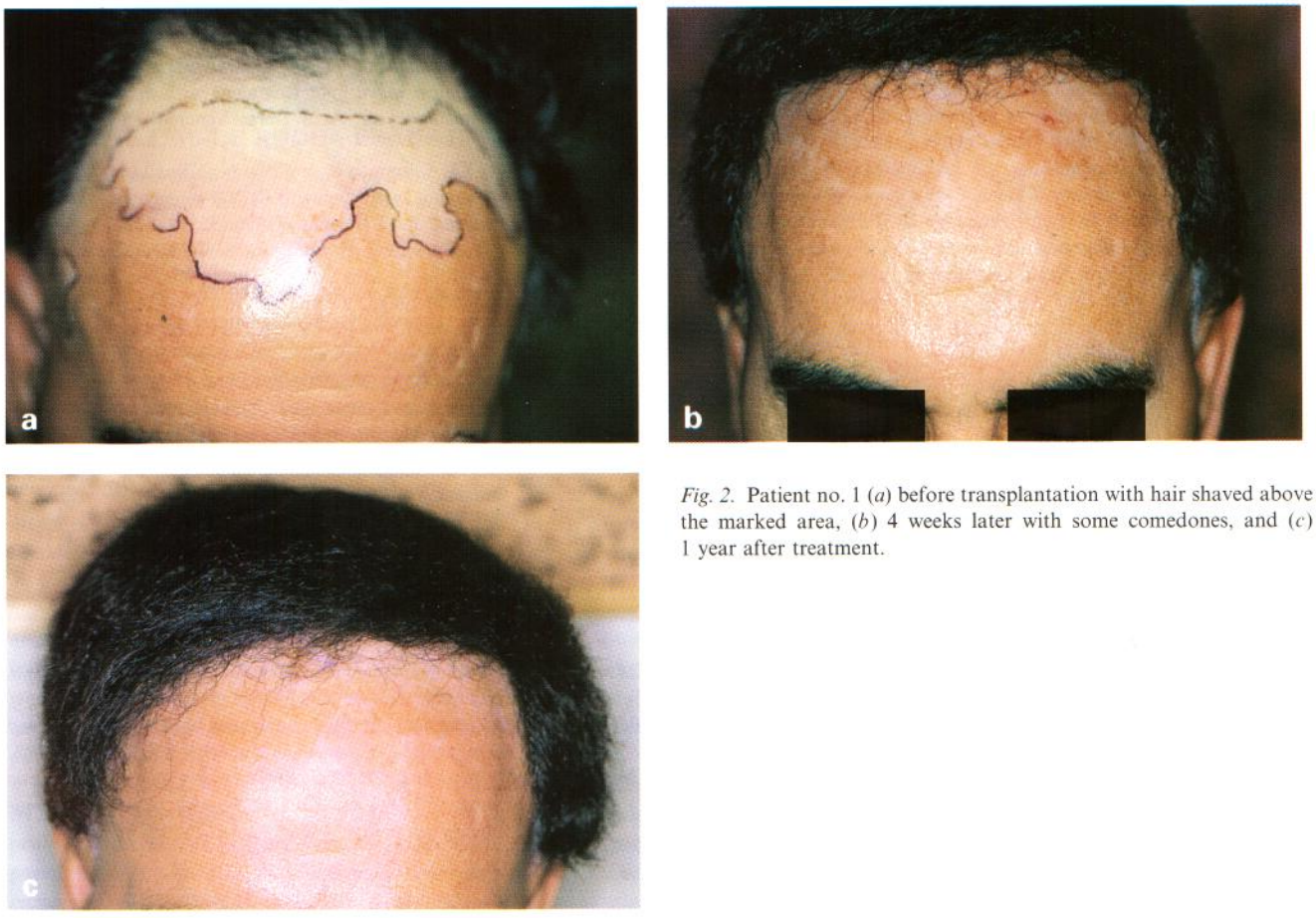

Fig. 2. Patient no. 1 (*a*) before transplantation with hair shaved above the marked area, (*b*) 4 weeks later with some comedones, and (*c*) 1 year after treatment.

desperate and therefore pushed for a trial. At follow-up the aggravation of their disease could be easily established (patients 2, 4 and 10).

In one patient (no. 11) the take of the transplanted skin on the hands was only 50%; on the arms it was 100% on two occasions. Movement of the hands and fingers might explain the partial failure in this case. Kahn & Cohen (25) immobilized the hand for 8 days and obtained excellent or good results in 3 patients, indicating the importance of immobilization of this area.

When taking the donor epidermis, it is easy to get an uneven thickness, especially on the curved buttock area, if the skin is not stretched well during the procedure. Too thin sheets, however, do not have enough melanocytes to produce pigmentation and skin that is too thick cannot be used on areas with thin skin as the eyelids.

We chose to use the buttock as a donor site, since there is a risk for the Koebner phenomenon, especially when taking deeper split-skin grafts (13). No such reaction was noted, however, in any of our patients, which might indicate that the superficial sheets taken with the Zimmer dermatome do not induce the Koebner reaction so often. When repeated operations were performed, we used the upper leg, which is technically easier.

The transplants healed well and pigmentation without reddening was observed within 3 months, which is somewhat earlier than after application of cultured cells (24). The main side-effect was the milia-like keratinous cysts that were seen especially on the forehead and on the hairy part of the back of the neck (patient 8). These may have been caused by occlusion of the sweat ducts. Residual fragments of epidermis are another possibility, suggested by Kahn & Cohen (25).

The procedure was carried out under topical anaesthesia with EMLA cream, which makes it safe and less expensive compared with the use of a fully equipped operating theatre if general anaesthesia is used. It is important, however, to apply the EMLA cream in the right way (26).

We agree with Kahn & Cohen (25) that – if performed in patients with stable vitiligo – the method can give excellent results on large areas, if the recipient areas can be immobilized. If the precautions mentioned above are taken, our results might be improved. When many small areas have to be covered, the method is very time-consuming. The method seems to have a niche in our present treatment of patients with vitiligo.

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