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EPIDERMIS AS A GRAFT

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In the study of the morphogenetic properties of the transplanted epidermis, in some cases after excision of a skin graft by means of a dermatome it is placed in medium containing trypsin, where after a short time the cutaneous epithelium is separated mechanically from the dermis [2, 3]; in other cases, to obtain an epidermal graft, small pieces of skin are cultured in vitro until the formation of epithelial growths [7] or until the formation of a single sheet of epithelial cells [5, 6]. The third method is associated with division of pieces of skin into cells with the aid of trypsin, followed by culture either of the whole cell suspension [1] or of the subsequently isolated population of keratinocytes [10], until a single epithelial sheet is obtained. A relatively simple method of separation of the epidermis from the dermis, eliminating the need to culture cells of the cutaneous epithelium in vitro and (or) to treat them with trypsin, also is known [9]. This method is based on exposure of an area of skin to a partial vacuum. Under these circumstances all the layers of the epidermis become separated together with the cells of the stratum germinativum, whereas the basement membrane remains attached to the dermis [4]. The viability of the separated epidermis has been proved by the study of its morphological and histochemical properties [8].

The aim of this investigation was to study the possibility of using epidermis, separated from the dermis by exposure of an area of skin to a partial vacuum, as grafting material.

EXPERIMENTAL METHOD

Autografting of the epidermis was carried out on noninbred female laboratory rats weighing 200-240 g. As a first step, under ether anesthesia a bed was prepared to receive the graft, for which purpose the rat's hair was shaved in the region of the upper third of the spine and the skin was treated with alcohol. A circular incision 2 cm in diameter was made in the interscapular region down to the subcutaneous fatty areolar tissue. By means of two rows of U-shaped sutures, the base of a chamber shaped like a hollow truncated cylinder was sutured to the outer edge of the incision. The circular skin flap remaining inside the base was then removed. As a result, a fullthickness skin defect was formed on the surface. A gauze pad, soaked in nitrofurazone solution, was placed on it. A lid was fitted above the base of the chamber and fixed by means of a strong rubber band. After 24 h, the donor area was prepared under ether anesthesia. The hair was pulled out on the animal's right side and the fur accurately shaved. The skin was washed with soap and water and dried. The chamber was placed on the prepared area, with a hole 2 cm in diameter, covered with stretched Kapron gauze with a mesh of 0.5 × 0.5 cm, and was placed in contact with the skin. Air was withdrawn from the chamber for 45 min, gradually reducing the pressure during the first 15 min to -0.6 kg/cm^2, and thereafter maintaining it at that level for the remainder of the time. During exposure to the negative pressure, the skin of

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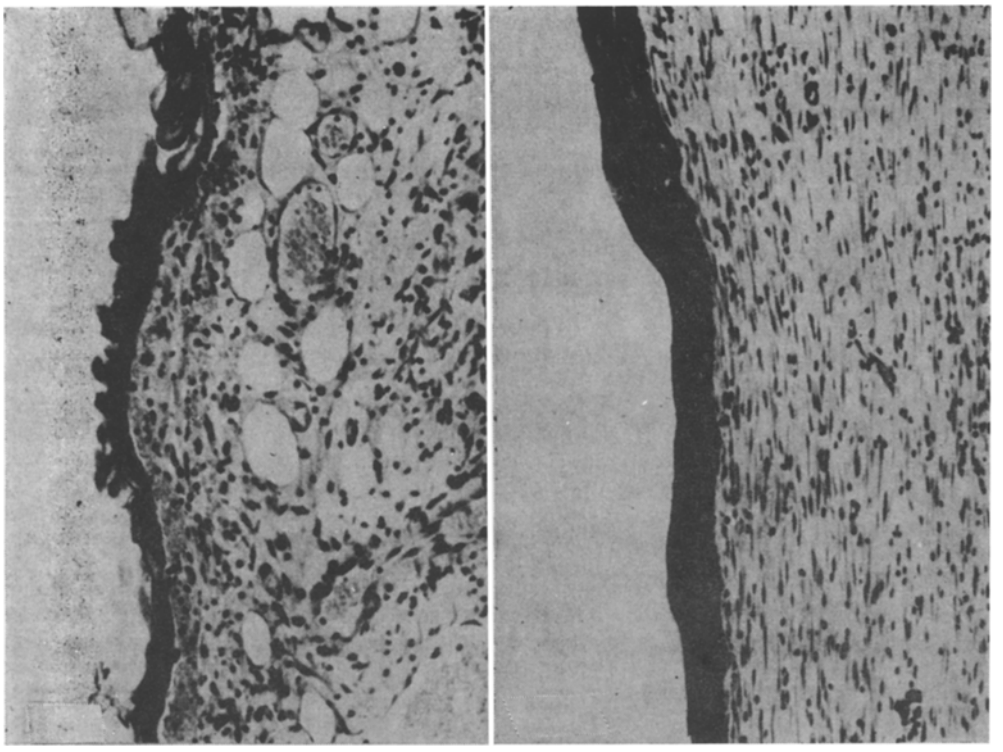

Fig. 1 Fig. 2

Fig. 1. Epidermal graft on surface of full-thickness in skin defect 24 h after transplantation. Here and in Figs. 2 and 3: hematoxylin and eoisin; objective 9, ocular 10.

Fig. 2. Hyperplasia of transplanted epidermis and formation of stratum granulosum 7 days after transplantation.

the donor area developed blisters, because the space between the separated epidermis and dermis was filled with tissue fluid. When the stated time had elapsed the negative pressure inside the chamber was released and the chamber removed. The tops of the blisters which formed were cut off at the base and the areas of epidermis thus obtained were transferred to the prepared bed. For the first 2 days after transplantation the wound surface was irrigated with a solution of antibiotics. It was then covered with a gauze pad soaked in nitrofurazone solution. After 24 h it was removed and a new pad soaked in chlorhexidine solution was applied to the wound surface. This changing of pads with alternation of the solutions of antiseptics wetting them continued for 15 days. The surface of the recipient bed with areas of transplanted epidermis then remained exposed. The animals were killed under ether anesthesia 1, 7, and 28 days after transplantation. Strips of granulation tissue were excised from those parts of the wound surface where transplanted epidermis was present. They were fixed in Zenker-formol, dehydrated, and embedded in paraffin wax. Sections were cut to a thickness of 7 μμ perpendicularly to the wound surface. The sections were stained with hematoxylin and eosin.

EXPERIMENTAL RESULTS

Viable epidermis, present on the surface of the recipient bed, 24 h after transplantation had all its cellular layers characteristic of normal epidermis, with the natural arrangement (Fig. 1), except that its stratum corneum formed multiple folds, and the stratum germinativum consisted mainly of cells spreading over the surface of the granulation tissue. Clear signs of development of an epidermis appeared 7 days after transplantation (Fig. 2). The number of its layers increased. Cells in the stratum basale were more compactly arranged than 6 days previously. Mitoses were often seen in it. Keratohyalin granules in the stratum granulosum were larger than in cells of the normal epidermis. Along the edges of the grafts, they could be seen to be overgrowing the exposed parts of the wound surface. The epidermis 28 days after transplantation remained more stratified than normally, but a well developed stratum corneum was now visible in it (Fig. 3).

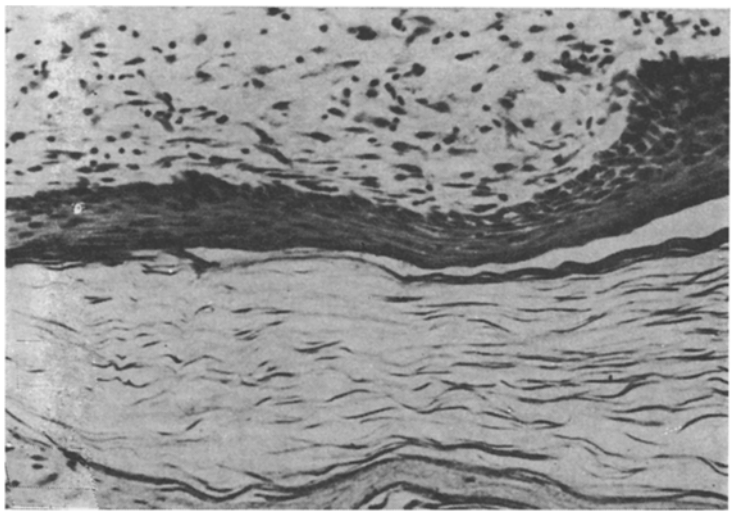

Fig. 3. Transplanted epidermis with developed stratum corneum 28 days after transplantation.

The epidermis, after separation from the dermis by means of a reduced pressure, and transplantation in the pure form on the surface of a full-thickness skin defect, can thus survive, grow, and differentiate in the characteristic manner. Taking this into account, the model described above, together with others, can be used to study the morphogenetic properties of transplanted epidermis.

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