

The Possible Site Of Trauma In Leucodermic/Vitiligenous Skin

V. C. SHAH., S. C. LAKHOTIA., N. J. CHINYOY., K. S. SHARMA., M. V. MOJAMDAR

*Zoology Department, University School of Sciences,
Gujarat University, Ahmedabad-380009.*

ABSTRACT

The histological, histochemical and ultrastructural changes in leucodermic skins are compared with those of normal human skins in order to find out if the former represents a traumatized skin. There were no significant differences in the histochemical features between the normal and leucodermic human skins. Ultrastructural studies however revealed that the melanocytes in the affected areas were undergoing degenerative changes such as loss of melanosomes, structural alterations in melanosomes and the presence of wide intracellular spaces. It is, therefore, suggested that in leucoderma, there occurs cellular traumatization rather than traumatization at the organ level.

INTRODUCTION

Histologic response to repeated trauma of the skin includes increase in skin thickness, increase in stratum corneum layers, increase in the diameter of the hair follicles and an increase in the number of blood vessels and nerves¹. Melanin is known to protect the skin from radiation damage^{2,3}. However, it is not known whether its absence, as in the case of leucoderma/vitiligo, results in traumatization of the depigmented skin. Behl⁴, on the other hand, suggests that trauma or local irritation may result in depigmentation of the normal skin. The present studies were therefore conducted in order to find out the site of trauma in leucodermic skin.

MATERIALS AND METHODS

A. *Histochemistry.* Leucodermic and corresponding normal human skins were obtained by a punch biopsy (4 mm) after local anesthesia. They were immediately blotted free of blood and 10 μ sections were cut on a freezing microtome. The sections were then stained for alkaline phosphatase activity⁵, which selectively stains the blood vessels and capillaries in the skin¹.

B. *E. M. Studies.* The leucodermic and corresponding normal skins were obtained by a 4 mm punch biopsy after local anesthesia from 4 individuals from the region of the forearm. The depigmented lesions, new and old (2,8,15 and 20 years of duration) were used for this study. All biopsy materials were fixed in glutaraldehyde, post fixed in osmium

tetroxide and embedded in epon or epon-araldite mixtures. The sections were stained with uranyl acetate and Reynolds lead citrate and observed in Phillips 300 or AEI EM 6 electron microscopes.

RESULTS

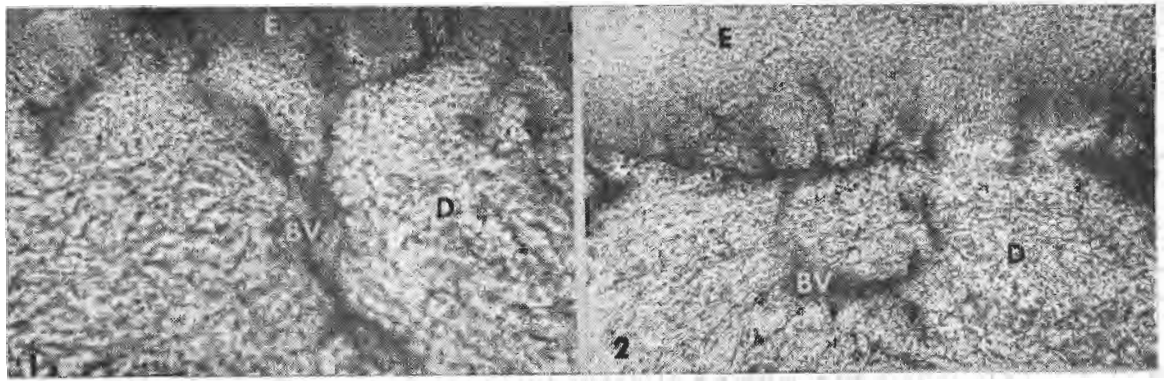
A. Histochemical. As can be seen from Figs. 1 to 4, the distribution of alkaline phosphatase activity was found to be similar in normal and leucodermic skins. Since the alkaline phosphatase activity localisation in the skins is known to be indicative of the distribution of blood vessels and capillaries¹ we may infer that the blood vascular system is similarly organized in normal and leucodermic skins.

B. E. M. Studies. The distribution of the melanosomes in the keratinocytes and melanocytes of the normal skin was essentially the same as described by earlier workers^{7,8}. The melanocytes contained mostly stage III and stage IV melanosomes. In the keratinocytes the fully mature melanosomes were dispersed as discrete units (Fig. 5). The average long and transverse axis of the melanosomes were 0.73μ and 0.28μ respectively. In the 2 and 8 years old leucodermic lesions, however, a number of melanocytes undergoing degenerative changes were found (Figs. 6 to 7). These degenerative changes included the presence of wide intracellular spaces, a highly indented nucleus (Fig. 6), clumping of mitochondria and loss of cristae in mitochondria (Fig. 7). In the 15 and 20 year old lesions no regressing melanocytes could be observed.

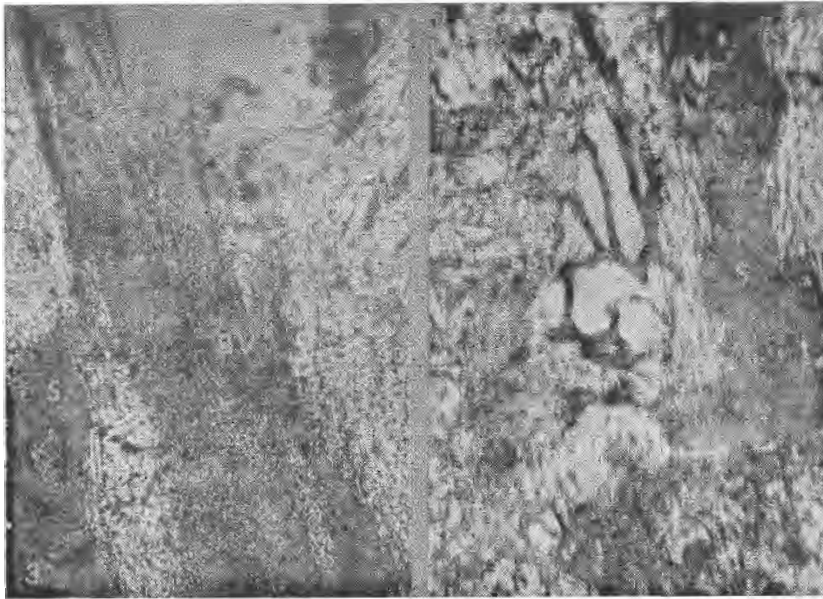
DISCUSSION

Routine histological observations of the leucodermic skins revealed that there were no anatomical changes in the skin. There was neither an increase in the diameter of the skin and hair follicles nor there was an increase in the stratum corneum layers. Since the alkaline phosphatase activity in leucodermic skin was same as in normal skin, leucodermic skin does not seem to represent traumatized skin^{1,6}.

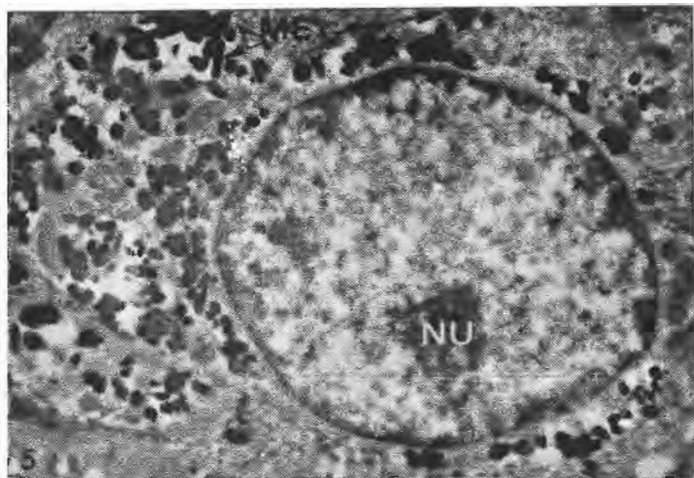
A number of biologically active phenols have been shown to be potent depigmenting agents⁹. Based on the hypothesis that vitiligo could be a phenomenon similar to chemically induced leucoderma a number of workers have tried to find out the mechanism of depigmentation of the skin by these compounds⁸⁻¹⁰. Chavin¹¹ has shown that neither the skin nor the melanocytes have any special affinity to hydroquinone, a potent depigmenting agent. Spleen, intestine, skeletal muscle, gall bladder, liver & kidney show almost the same affinity to this compound as the integument¹¹. Electron microscopic observations of the phenol treated depigmenting skin have revealed that the melanocytes were undergoing necrotic changes¹². In the present study, similar degenerative changes in the melanocytes have been observed in the leucodermic lesions (Fig. 6 and 7). Since the leucodermic urine and blood manifests increased concentrations of phenols^{13,14}, it is suggested that the endogenous as well as exogenous phenols cause traumatic changes only in those cells which have a high capacity to oxidize phenols. Since only the melanocytes in the integument have a high capacity to oxidize phenols, the degenerative changes occur in these cells alone. It is, therefore, suggested that in leucoderma/vitiligo there occurs cellular traumatization rather than traumatization at organ level.



Figs. 1 and 2 : Normal and leucodermic human skins respectively showing the blood vessels and capillaries as revealed by alkaline phosphatase activity. Note the intense anastomosis of the blood vessels $\times 150$. BV = blood vessels, D = dermis, E = epidermis and S = sebaceous glands.



Figs. 3 and 4 : Showing the rich net work of blood vessels and capillaries in the hair follicle of normal and leucodermic skin respectively. The darkly stained body is the highly alkaline phosphatase positive sebaceous glands $\times 150$. Abbreviations same as in Figs. 1 and 2.



Figs. 5 to 7 : Electron micrographs of normal and leucodermic skins to show the ultrastructural changes in depigmenting skins. ME - melanosomes, MS - Mitochondria, Nu - nucleolus, V - vacuole.

Fig. 5 : Normal human skin showing the distribution of melanosomes in the keratinocytes. Note that the melanosomes are distributed as discrete units. The nucleus shows a regular outline with electron dense chromatin present along the inner nuclear membrane $\times 7,700$.

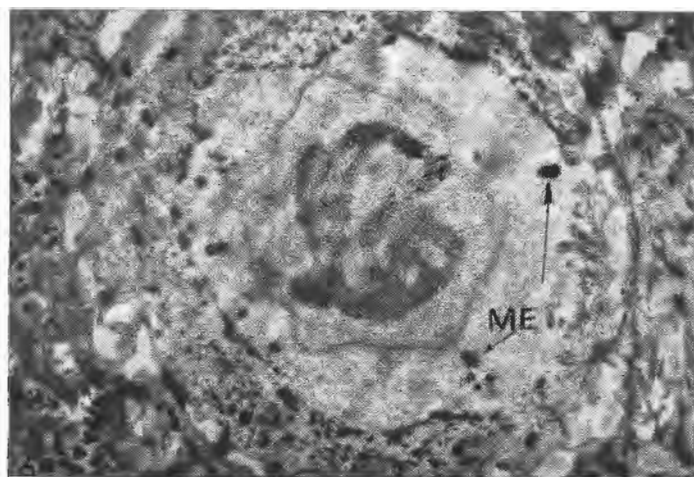


Fig. 6 : An α -dendritic cell in the basal layer of 11 years old leucodermic skin. The nucleus is highly indented and the electron dense chromatin is clumped in the centre. The cytoplasm appears almost empty and there are very few melanosomes $\times 7,700$.

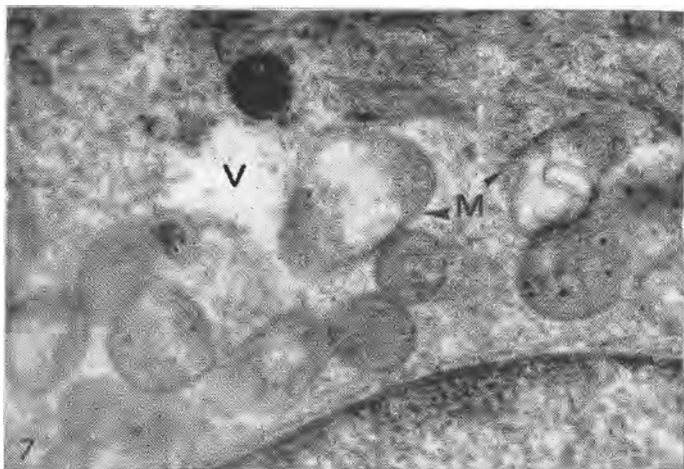


Fig. 7 : Higher magnification of an α -dendritic cell from a 2 year old leucodermic lesion showing the degenerative changes in the mitochondria and in general cell cytoplasm $\times 27,000$.

ACKNOWLEDGEMENTS

This work was supported by Research Grants from the Indian National Science Academy, University Grants Commission and a Philanthropic grant from Shri Manibhai Ashabhai Patel, Anand.

REFERENCES

- 1 JOHNSON, W. C. AND BUTTERWORTH, T.Th. Histologic response of skin to repeated trauma. *Dermatologica*, 1971, **142**, 7 - 13.
- 2 MASON, H. S., INGRAM, D. J. E., AND ALLEN, B. The free radical property of melanins. *Arch. Biochem.* 1966, **86**, 225 - 227.
- 3 BLOIS, Jr. M. S. Physical studies of the melanins. *In* Biology of normal and abnormal melanocytes. Kawamura, T., Fitzpatrick, T. B. and Seiji, M., Ed. University Park Press, Tokyo, 1971, 125 - 139.
- 4 BEHL, P. N. Practice of Dermatology. Oxford - Printcraft. India, 1972. 335.
- 5 Pearse, A. G. E— Histochemistry Theoretical and Applied. J. & A. Churchill Ltd., London, 1968, 716.
- 6 SHAH, V. C., SHARMA, K. S. AND MOJAMDAR, M. V. Blood vessels and Capillaries of normal and leucodermic skins. *Curr.Sci.*, 1975, **44**, 348 - 349.
- 7 SZABO, G., GERALD, A. B., PATHAK, M. A. AND FITZPATRICK T. B. The ultrastructure of racial colour differences in man. *In* Pigmentation : Its genesis and biologic control Ed. Riley, V. Appleton - Century - Crofts, New York, 1972, 23 - 41.
- 8 MOJAMDAR, M. V. Autoradiographic and histochemical studies on vertebrate cells. I. Histochemical, biochemical and autoradiographic studies on pigment synthesizing and non-pigment synthesizing skins. Ph.D. Thesis, Gujarat University, 1975.
- 9 BRUN, R. The presumptive role of amino acid derivatives and catecholamines in the etiology of vitiligo. *J. Soc. Cosmet. Chem.*, 1974, **25**, 61 - 66.
- 10 MCGUIRE, J. AND HENDEE, JR. J. Biochemical basis for depigmentation of skin by phenolic germicides. *J. Invest. Derm.*, 1971, **57**, 256 - 261.
- 11 CHAVIN, W. Approaches to the study of melanocyte and melanophore. *In* Biology of normal and abnormal melanocytes. Kawamura, T., Fitzpatrick, T. B. and Seiji, M., Ed. University Park Press, Tokyo, 1971, 71 - 98.
- 12 JIMBOW, K., OBATA, H., PATHAK, M. A. AND FITZPATRICK, T. B. Mechanism of depigmentation by hydroquinone. *J. Invest. Derm.*, 1974, **62**, 436 - 449.
- 13 SHARMA, K. S., MOJAMDAR, M. V., CHINYOY, N. J. AND SHAH, V. C. Studies on the urinary metabolites of normal and leucoderma patients. *Ind. J. Med. Res.* 1973, **61**, 1404 - 1409.
- 14 MOJAMDAR, M. V., SHARMA, K. S. AND SHAH, V. C. Studies on the blood metabolites of normal and leucoderma patients. *Ind. J. Med. Res.* 1975 (Communicated).