Racial Differences in Corneocytes

A Comparison between Black, White and Oriental Skin

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It is well known that spontaneous desquamation and corneocyte size can reflect respectively stratum corneum cohesiveness and epidermal cell proliferation. The influence of skin pigmentation on these parameters has been investigated on the upper-outer arm of black, white and oriental volunteers, using the detergent scrub method. We found no difference between race in corneocyte surface area, a mean size of 900 μm² agreeing closely with that generally encountered in Whites on the upper-outer arm. By contrast, spontaneous desquamation is increased in black vis-à-vis white and oriental skin (factor 2.5, $p < 0.001$). Taking into account the importance of the intercellular cement for the cohesion between corneocytes, racial differences in epidermal lipid composition should be investigated.

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Racial differences in physicochemical properties of the skin include, in blacks, increased resistance to stripping (1), increased electrical resistance (2) and increased skin lipid content (3), compared with white skin.

Corneocytes differ markedly from the keratinocytes that produce them, an obvious difference being the corneocyte's disc-like shape, which presents a large surface area in the horizontal dimension. In humans, the corneocyte surface area is not constant; there are site (4, 5) and age (5, 6) differences. However, most such investigations were performed on Caucasians.

In the present study, non-invasive measurements including determination of the spontaneous desquamation (corneocyte count) and the corneocyte size have been compared in black, white and oriental volunteers.

MATERIAL AND METHOD

All subjects (18–25 per group) were American citizens and free from dermatological disorders. The black subjects were American negroes (33.5 ± 7.5 years), the oriental group comprised individuals of Chinese extraction only (26.5 ± 7.5 years) and the Caucasians were white Americans of European origin (31 ± 7 years). Prior to entering the study, the subjects read and signed the human experimentation consent form approved by the UCSF Committee on Human Research.

Corneocytes were collected from the upper outer arm. To standardize the sampling method, we built a 'turbine engine' based on the detergent scrub method described by McGinley et al. (7) to collect corneocytes in suspension. The apparatus, designed to minimize mechanical friction of the skin surface (8), consisted of a low-voltage revolving motor driving a helical wheel inside a cylindrical perspex chamber. The chamber was in contact with 3 cm² sampling area. The screw stirred 3 ml of detergent solution consisting of 0.05 M phosphate buffer, pH 7.9, containing 0.1% Triton X-100. The detergent solution was injected from a syringe via an opening in the chamber. The procedure took 1 min. The corneocyte suspension was then extracted with the syringe, which had been left in position.

The corneocyte suspension was stained with a mixture of fuchsin and gentian violet, and an aliquot placed in a hematocytometer. Automatic counting and measurement of the corneocyte surface area were performed using an image analyser (Quantimet 900, Cambridge Instruments, GB).

RESULTS

As shown in Table I there were no differences in corneocyte surface area between races. The numbers of corneocytes harvested with the turbine did not differ statistically between white and oriental volunteers. On the contrary, the spontaneous desquamation was increased in Blacks by a factor of about 2.5 ($p < 0.001$).

DISCUSSION

A mean size of 900 μm² agrees closely with that generally encountered on the upper-outer arm (4, 5). There is an inverse correlation between epidermal cell proliferation and corneocyte size (9). Thus,

Table I. *Racial differences in corneocytes*

Race	Corneocytes	
	Mean surface area ($\mu m^2 \pm SE$)	Number/cm^2 desquamating spontaneously
Black	911 ± 20	26500 ± 4900
White	899 ± 22	11800 ± 1700
Oriental	909 ± 24	10400 ± 2100

in anatomical sites exposed to environmental factors (including sunlight), corneocytes are smaller (5). The upper-outer arm being partially protected by clothing, we do not know the possible relation between the degree of skin pigmentation and cell proliferation.

With ageing and UV light injury, the number of corneocytes harvested either by stripping or by using the detergent scrub method increases (6, 10). In Caucasians and for the anatomic site involved in this study, spontaneous desquamation of about 10,000 corneocytes per cm^2 skin surface area can be considered normal (8). On the other hand, the increased desquamation in Blacks seems not to fit the observation made by others, viz. increased resistance to stripping (1), increased electrical resistance (2), or increased TEWL (11). Additional work is needed to elucidate these apparent contradictions.

Differences in permeability between black and white human skin have been considered. However, agreement between investigations is rare. Thus, it has been shown that the in vivo skin penetration of diflorasone diacetate was the same in black and white subjects (12). By contrast, total absorption of dipyrithione was, on average, 34% less in black than in white subjects (13), and the topical anesthetic EMLA was less effective in Blacks (14). In vitro, permeation of fluocinolone acetonide was greater through normal-appearing white skin than through black skin (excised from legs amputated for gangrene or tumours) (15). These observations could be related to greater density and the more compact stratum corneum in Blacks (1).

In Whites, it has been demonstrated that corneocyte size constitutes an important factor in the differences in permeability of the skin to water loss and percutaneous absorption of topically applied compounds (5). Recently, in vitro measurements have shown increased water loss in black vis-à-vis white skin (11). Moreover, it has been shown that the stratum corneum is of equal thickness in blacks and whites (16). Since corneocyte surface area does not differ statistically between black, white and oriental subjects, the differences observed in TEWL might depend more on the composition of the intercellular cement than on the volume of intercellular spaces. Whether there is a difference in epidermal lipid composition between races is a question we have undertaken to answer.

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