

The Experimental Study on Corneocytes of Chronically Irritated Skin (II)

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An experimental study concerning the effect of chronic irritation of corneocytes was made in relation to their number, size and shape. The desquamating portion of the stratum corneum was sampled with the detergent scrub technique using Triton X-100[®]. The experimental subjects were scrub nurses who had worked in the operating room for more than 3 years and ward nurses were used as a control group.

The corneocytes of skin irritated by daily scrubbing differed, from those of the non-irritated skin of the ward nurses. About twice as many cells were collected per cm² skin surface from the scrub nurses on the first experimental day. Two and four days later the number was markedly decreased and became similar to that of the control group. The surface of the corneocytes was 15% smaller in the experimental group than that of the control group, through out the experiment. There was no significant difference between the two groups as regards corneocyte morphology.

Key Words: Corneocytes - Chronic Irritation.

The important functions of the stratum corneum are first, that it is the body's major barrier possessing the vital properties of physical toughness that mutes the injurious effects of trauma, such as mechanical irritation and second, that it is relatively impermeable to water and electrolytes, which prevents dehydration (by loss of internal fluids) and limits penetration by external fluids and gas (Ackerman, 1975).

The nurses two worked in the operating room had chronic irritation to their hands and arms from scrubbing with brush and soap. The effect of the soap on the skin was mild irritation in

part, because of the alkalinity of the soap solution, and in part because of the inherent qualities of the fatty acid and detergent molecules which are contained in soap (Lowney, 1975).

The purpose of this experiment was to investigate the effect on the number, size and morphology of human corneocytes which was subjected to chronic irritation.

MATERIALS AND METHODS

Subjects. Six healthy nurses, aged 24 to 26 who have been scrubbing in the operating room for 3 years were selected.

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Six healthy volunteer nurses aged 23 to 26 who worked in a ward, were selected as controls.

Corneocytes were sampled on Monday, Wednesday and Friday and the following Monday.

Preparation of Samples. The samples were prepared by the same method as our previous paper (part I).

Measurements. Quantitative cell counts, cell surface and cell outlines were measured by the same method as our previous paper (paper I).

RESULTS

Cell counts. On the first Monday, more cells, almost 123,280/cm² could be removed from the skin of the scrub nurses as compared to the skin of the ward nurse which were at 64,490/cm² ($p < 0.01$). On the following Wednesday and Friday the count decreased to the level of the control group and there were no significant differences statistically between the two groups. However, on the next Monday, the cell count recovered again to the previous Monday's level (Table 1, 2 and Fig. 1).

Cell size. Corneocytes from the scrub nurses are almost 10 to 15% smaller than those from the control group ($p < 0.01$) through all experimental days from the first Monday to the next. But there were no significant differences among the experimental groups statistically (Table 3, 4 and Fig. 2).

Table 1. Number of corneocyte per sq cm in control group

Subject No.	Experiment Day			Mean
	1st	3rd	5th	
1	63180	63180	57910	61423
2	52650	47380	42120	47383
3	52650	50010	68440	57033
4	60540	57910	52650	57033
5	78970	107920	105290	97393
6	78970	89600	68440	79003
Mean \pm SE	64490 ± 5360	69330 ± 10810	65810 ± 9740	66550 ± 8200

Table 2. Number of corneocyte per sq cm in chronically irritated skin

Subject No.	Experiment Day			
	1st	3rd	5th	8th
1	165840	84230	71070	160570
2	105290	52650	47380	263230
3	131620	78970	68540	121090
4	107920	100030	84230	118450
5	105290	44750	36850	100030
6	123720	78970	63180	92130
Mean \pm SE	123280 ± 10520	73270 ± 9250	61880 ± 7660	142580 ± 28480
P-value	< 0.01	> 0.01	> 0.01	< 0.01

Cell shape. In the experimental group, 51% of the corneocytes were regular in shape, 26%

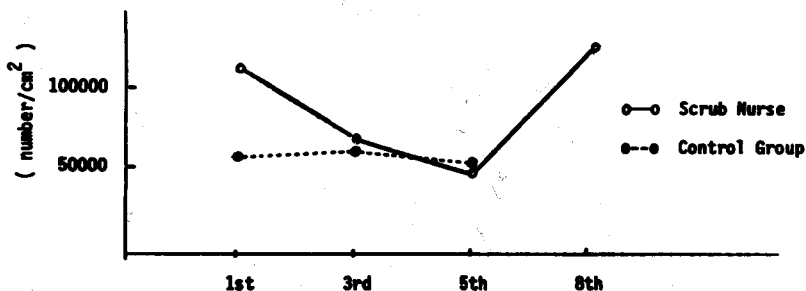


Fig. 1. Changing pattern of corneocytes on number.

Table 3. Corneocyte size in control groups (μ^2)

Subject No.	Experiment Day			Mean
	1st	3rd	5th	
1	914	877	932	907
2	865	901	971	913
3	904	895	901	900
4	983	944	977	968
5	802	980	892	891
6	883	880	841	868
Mean \pm SE	892 ± 24	913 ± 17	919 ± 21	908 ± 14

Table 4. Corneocytes size in chronically irritated skin (μ^2)

Subject No.	Experiment Day			
	1st	3rd	5th	8th
1	829	832	874	826
2	771	859	977	901
3	735	689	744	729
4	762	708	732	759
5	826	790	805	803
6	638	690	733	880
Mean \pm SE	760 ± 29	761 ± 31	810 ± 40	816 ± 27
P-value	< 0.01	< 0.01	< 0.01	< 0.01

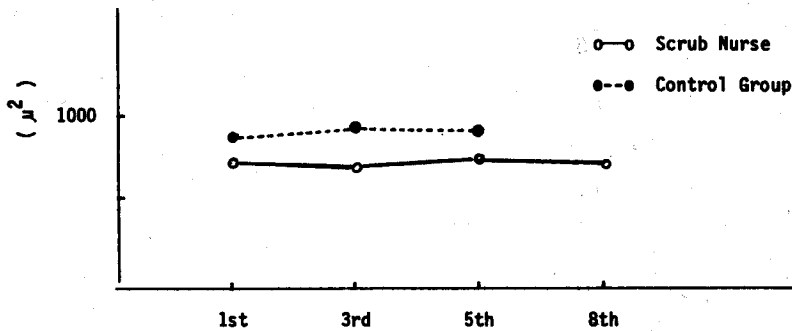


Fig. 2. Changing pattern on corneocytes on size.

pentagonal, 25% hexagonal and 49% were irregular in shape. There were no significant difference between the experimental and the control groups.

DISCUSSION

Measurement of the rate of desquamation is an important parameter for epidermal cell replacement (Robert and Marks, 1980).

Most of the glabrous skin areas of the human body and of mammals have an orderly, arranged columnar stacking of the stratum corneum (Mackenzie, 1967; Christophers, 1972; Christophers *et al*, 1974).

All keratinocytes differentiate into corne-

ocytes and are shed during desquamation at a rate always equivalent to the rate of cell production (Robert and Marks, 1980). Stripping the skin with tape removes the corneocyte layer and produces a burst of mitotic activity in the basal keratinocytes resulting in the regeneration of the corneocyte layer (Mishima and Pinkus, 1968; Pinkus, 1951; Potten and Allen, 1975).

A minimal loss of the horny layers leads to a significant increase of mitoses without appreciable cellular damage or hyperemia (Pinkus, 1951; 1952). In inflammatory skin, as in allergic contact dermatitis and tretinoin induced dermatitis, large numbers of corneocytes could be removed with the scrubbing technique (Hölzle and Plewing, 1977). This is probably due to an effect of cellular cohesiveness (Kligman *et al*

1969).

However, we think that, the scrub nurse shows high counts of corneocytes on the first and second Monday due to an increase of mitoses by repeated irritation over a long period of time. These high counts of corneocyte may be characteristic for scrub nurses and differ from the counts for ward nurses. On Wednesday and Friday, the decrease of cell counts could be explained by the removal of the desquamating portion of the horny layer during daily scrubbing.

Hölzle and Plewig (1977) reported measurements of corneocytes in allergic contact dermatitis. They found corneocytes from untreated allergic contact dermatitis were almost 15% smaller than those from normal skin.

The size of corneocytes in the desquamating portion of the horny layer is supposed to be related to the speed of transit of these cells through the living epidermis and horny layer (Goldschmidt, 1979). The noted decrease in cell size (27%) of psoriatic cells may be due to a more rapid transit time in psoriasis. Goldschmidt (1979) postulated that surface cells are smaller than normal following rapid passage and larger than normal following slow passages.

In our experiment, the decrease of cell size (approx 15%) was seen for all of the experimental days. Based on our experimental data and previous reports we believe that the decrease of cell size compared to that of the control group is probably due to increased epidermopoiesis.

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