

Sebum and Water Content in the Skin of Aged Immobilized Patients

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In the present study we investigated the sebum content and hydration of the skin in aged immobilized patients. Healthy aged as well as young and aged immobilized patients were evaluated by photometry, using a sebum tester and capacitance meter to detect sebum and hydration, respectively, in various skin areas. Sebum content was significantly higher in the young groups as compared to the aged ones, including those of the immobilized patients. Similar values of water content were observed in the healthy young and aged volunteers. However, surprisingly, a significantly marked decrease was detected in each tested area of the immobilized patients. We may assume that a cascade of events caused by the immobilization status of the patients leads to a significant decrease in water content within the dermis. **Key words:** skin hydration; dementia; stroke; hip fracture.

(Accepted September 27, 1996.)

Acta Derm Venereol (Stockh) 1997; 77: 142–143.

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Aged skin is characterized by a variety of clinical and histological changes (1, 2). The visible changes are noted primarily in exposed skin and represent extrinsic age-related effects rather than intrinsic age-related alterations (3). Most research in cutaneous gerontology has focused on elucidating environmental changes (2, 3). Alterations due to intrinsic aging have received less attention. These intrinsic changes lead to the most common features of aged skin: dryness and seborrheic dermatitis (1, 4). Xerosis or dry skin could be the result of a decreased barrier function of the stratum corneum. Indeed, Lorincz (5) and Chudzokowski (6) found excessive loss of water through a defective horny layer barrier as the stratum corneum becomes dehydrated and brittle with aging. However, Christophers & Kligman (1, 7) determined that transepidermal water loss (a marker of barrier function) did not vary with age for normal adult skin.

Another common skin problem observed among the aged population is seborrheic dermatitis. This phenomenon occurs despite decreased sebum secretion in aged skin (8). The literature reveals various studies focused on the issue of sebum secretion and hydration in an aged but healthy population. The aim of the present study was to ascertain whether prolonged immobilization of aged patients may effect sebum secretion and hydration of the skin. Unfortunately, prolonged immobilization is common among the elderly. The immobilization state causes various functional disturbances in internal organs, and the question is whether these alterations reflect skin unviability.

MATERIALS AND METHODS

Seven young subjects (2 males and 5 females, mean age 30.8 ± 10.1 years) and 45 aged subjects (14 males and 31 females, mean age 75.7 ± 15.3 years) volunteered for this study. All subjects were free of any active skin disease. The aged subjects were further divided into four groups:

- (1) Eleven immobile patients with dementia.
- (2) Twelve patients who had suffered a hemispheric stroke within the last 3 months that caused immobility.
- (3) Fifteen patients who had suffered a hip fracture causing immobility within the last 3 months.

Immobile patients were patients that were dependent for walking, transfer, bathing and dressing.

- (4) Seven aged healthy mobile volunteers. The skin was evaluated at four different anatomic locations: forehead, lateral aspect of the arm, face and chest. The skin was not washed or treated with any skin care 24 h before measurement. Volunteers rested before measurement for at least 1 h at constant room temperature ($20 \pm 2^\circ\text{C}$) and at a steady relative air humidity (50%).

Sebum

Sebum content was evaluated photometrically using a Sebumeter Skin Tester, manufactured by IMS Ltd., Haifa (9). The sebum is collected from the skin by pressing a special frosted glass plate with a constant pressure for 20 s. The glass plate becomes transparent with fat absorption. Change in the optical transparency is measured.

Hydration

Capacitance was measured as a measure of hydration using a capacitance meter (manufactured by IMS Ltd., Haifa) based on the method published (9). A probe is applied to the skin with a constant pressure. The measurement principle is based on the distinctly different dielectric constants of water and other materials (10).

Statistical analysis

The ANOVA test was used throughout the study to determine whether there were significant differences between the mean values measured for each group.

RESULTS

Sebum content was significantly higher in each area of the young controls as compared to the aged ones: the aged controls and the immobilized ones ($p < 0.001$, Fig. 1). In the young controls, sebum concentration was mostly high in the face and forehead ($137.5 \pm 20 \mu\text{g}/\text{cm}^2$) and lower in the chest ($69 \pm 14 \mu\text{g}/\text{cm}^2$). In the aged controls as well as the aged immobilized patients, sebum concentration was very low in all tested areas, including the face, forehead, arm and chest (10, 11).

Water content in the skin of the aged and young controls was found to be similar in all tested areas (Fig. 2). However, in the aged immobilized, the water content was significantly lower in all tested areas as compared to the other groups ($p < 0.001$ and $p < 0.001$, respectively).

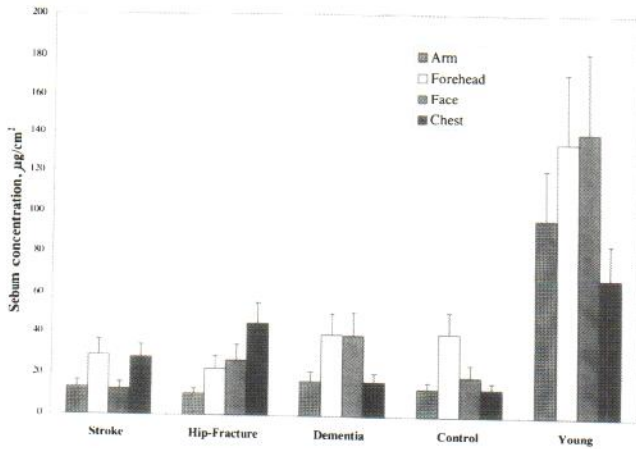


Fig. 1. Differences in sebum content between young, aged control and aged immobile groups (ANOVA, $p < 0.001$).

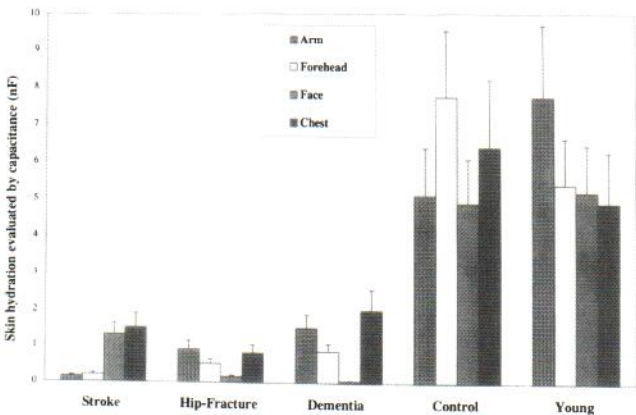


Fig. 2. Differences in skin hydration as evaluated by capacitance measurements, between young, aged control and aged immobile groups (ANOVA, $p < 0.001$).

DISCUSSION

The present study confirmed previous observations focused on sebum secretions and skin hydration of aged skin (10). The study showed clearly decreased sebum output in aged skin, whereas no age-related changes were observed in skin hydration. In fact, Kligman (1) previously showed that the ability of the horny layer to restrain diffusional water loss did not decline with age, stratum corneum was not thinner in the elderly, and the barrier seemed to be competent. Pearce & Grimmer (12) determined that the water content of the dermis increased from about 58% in the young to 68% in the elderly. In the present study, however, a significantly reduced hydration was found in the skin of prolonged immobile aged patients, as compared to the healthy matched population. This surprising observation could be related to the systemic physiologic effects of the immobilization status. The changes include hemodynamic variations including reduced plasma volume (13–15), orthostatic hypotension (16, 17), muscle weakness and atrophy (15–18), and impaired function of the respiratory system (19). Bone loss due to immobility is well established and known as diffuse osteoporosis (20, 21). Collectively, all the above described changes caused by the immobilized status

of the patients may lead to the significant decrease in water content of the dermis.

In conclusion, aged immobilized patients showed various physiological changes, which may affect skin function. The present study is the first one dealing with this population. The result of this study may encourage the performance of further research in aged skin, including that of the immobilized patient.

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