

Dobrev H. Value of non-invasive bioengineering investigation of the skin mechanical properties in vivo. Doctoral Thesis at the Medical University of Plovdiv, Bulgaria, 2000.

Summary

During recent years several modern non-invasive bioengineering methods and devices for evaluation of the skin mechanical properties have been introduced. They provide the physicians with in vivo, reliable, objective and quantitative information.

The present studies were undertaken with the aim of assessing the effects of age, sex, anatomical region, moisturizing and cosmetic products, as well as some skin diseases on mechanical properties of the skin.

Skin elasticity was measured by a newly developed suction skin elasticity meter (Cutometer SEM 474, Courage & Khazaka, Köln, Germany) equipped with two measuring probes with an aperture of 2 mm and 8 mm in diameter. Some studies included measurements of epidermal hydration by means of skin capacitance meter (Corneometer CM 820 PC, Courage & Khazaka, Köln, Germany).

Our results confirmed that the mechanical properties of healthy human skin are not sex related but are influenced by the anatomical region and the aging process. Moisturizers and cosmetic preparations increase the water content of the epidermis and improve its mechanical properties. The changes observed depend on the vehiculum and active ingredients included.

Skin diseases such as scleroderma, morphoea, scleredema of Buschke, psoriasis, erysipelas and keloids alter significantly skin mechanical properties. Cutometer measurements correlated well with clinical scoring systems. They can be used for evaluation of the degree of skin induration, thickness and dermal oedema. The use of two different measuring probes gives information on epidermal and dermal mechanical properties.

We observed differences in skin elasticity during oedematous and indurative phase of scleroderma. Our studies on patients with scleredema of Buschke suggested a slowly and spontaneous improvement of this disease. In another patient with an association of scleredema and multiple myeloma we confirmed that the skin involvement responded to myeloma polychemotherapy. We established statistically significant differences in skin mechanical parameters between clinically uninvolved volar forearm skin in psoriasis patients and skin of healthy individuals. We observed a significant improvement of skin mechanics of psoriatic plaques after three different treatment regimens: dithranol ointment, plastic occlusion with ointment containing salicylic acid, flumethasone pivalate and coal tar, and hydrocolloid occlusive dressing in combination with betamethasone dipropionate cream. In patients with erysipelas of the lower legs we found that 20-day therapy did not completely restore the altered skin mechanics. Our measurements confirmed the effectiveness of cryosurgery in keloids.

We consider the measurements with Cutometer very useful for evaluation and monitoring of the mechanical properties of healthy and diseased human skin.

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