〈総説〉

生体角層水負荷試験による外用剤の保湿効果の評価法

田上 八朗*

Evaluation of Moisturizing Efficacy of Topical Agents with in Vivo Water Sorption-Desorption Test Using Electromeasurement

Hachiro TAGAMI, M.D.*

Abstract

It has become possible to evaluate the hydration state of the superficial portion of the stratum corneum, which plays a crucial role in determining the softness and flexibility of the skin surface, by measuring conductance of the skin to high frequency electric current using dry electrodes in a non-invasive manner. Moisturizing efficacy of topical agents were assessed by carrying out in vivo water sorption-desorption test using this electromeasurement before and 2 hr after application of 0.02 ml of each preparation to 4 x 4 cm^2 skin area. The test procedure consists of electromeasurements before and after artificial hydration for 10 seconds, i.e. measurements are performed on non-treated skin and just after blotting out of applied water with a pad of gauze to obtain data about the hydration state and hygroscopicity of the straturm corneum, respectively, and of 4 later repeated measurements at every 30 seconds until 2 minutes to evaluate the water holding capacity. The water holding capacity was calculated as follows; water holding capacity (%) = (average reading of 4 later repeated measurement)/(maximally hydrated level immediately after blotting out of water droplet) x 100.

1) In a test panel consisting of 8 healthy subjects the skin area on the flexor aspect of forearm treated with hydrophilic ointment revealed a slight increase in the 3 functional parameters, whereas that treated with petrolatum showed a decrease in hygroscopicity and a marked enhancement of water holding capacity probably due to the formation of an occlusive film of ointment on the skin surface.
2) The efficacy of the substances being referred to as representative humectants i.e. glycerin, sodium pyrrolidone carboxylate, urea and sodium lactate, were assessed similarly by applying their 10% aqueous solution on the extensor surface of the legs of 7 healthy subjects. However, it was disclosed that they produced no measurable increase in those functional parameters of the stratum corneum.
3) The applicability of this method for actual assessment of various proprietary moisturizing creams have been confirmed by evaluating the efficacy of several moisturizing creams which are claimed to contain active humectants or hygroscopic ingredients such as soluble collagen, natural moisturizing factor (NMF), various electrolytes or lecithin on the flexor aspect of the forearms of 7 healthy subjects. All these creams have measurable efficacy; they increased the hydration state of the skin surface by enhancing water holding capacity of the stratum corneum without causing any prominent effect on the hygroscopic property of the stratum corneum.

* Department of Dermatology, Hamamatsu University School of Medicine (3,600 Handa-cho, Hamamatsu 431-31, Japan)

* 浜松医科大学皮膚科教室(浜松市半田町3600番地)

要　旨

皮膚のしなやかさやなめらかさをきめる大きな要因となる角層，とくにその表層の水分含有量が，高周波に対する伝導度を測ることで生体的で定量的に測定できるようになった。この方法を用い，角層の水分含有量に影響する外用剤，とくに moisturizer の塗布の効果を科学的に，客観的に評価する方法を述べた。

4 × 4 ㎠の正方形の皮膚部に20μl の外用剤を塗布する前と，2時間後とで比較をおこなった。方法は角層に10秒間水分を吸収させ，2分間それが失われてゆく状態を追跡し，角層の水分含有量（hydration state），吸水性（hygroscopicity），水分保持能（water holding capacity)の各因子を分析する角層水負荷試験を用い，外用剤の効果を検討するものである。白色ワセリンおよび親水軟膏という基剤だけの塗布の影響，種々の保湿剤の塗布の影響を調べたあと，実際の製剤としてのいくつかの moisturizer の効果を解析的に調べ，この方法の実用性を確かめた。