

IN-VIVO HYDRATION OF A HYDROCOLLOID CONTAINING DERMATOLOGICAL PATCH AND ITS EFFECT ON TRANSEPIDERMAL WATER LOSS

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One of the most important functions of the skin is to act as a barrier, both by preventing the penetration of substances such as drug molecules into the body, as well as by limiting the loss of water from underlying tissues. Loss of water vapour through the stratum corneum, or transepidermal water loss (TEWL), is thought to be controlled by a number of factors, including, for example, the state of hydration of the corneocytes in the epidermal layers. Occlusion of the skin with plastic film has been reported to increase TEWL over a 5 day period (Faergemann et. al 1983). However, occlusion effected in this manner often causes irritation and maceration of the underlying skin. Occlusion has also been shown to enhance percutaneous penetration of topically applied drugs and has been used clinically to promote their absorption, although the mechanism of this action is not known.

This study investigates the hydration kinetics of a novel hydrocolloid containing patch (Actiderm, ConvaTec, U.S.) in vivo and determines the changes in TEWL that occur when such patches are used to occlude the skin. Four rectangles of the hydrocolloid containing patch (HCP) 4 cm x 2 cm, were placed on each flexor and extensor surfaces of the forearms of 30 human volunteers, (15 male and 15 female), at randomised positions. Increase in weight was monitored after time periods of 24, 48, 72 and 96 hours and "Hirsute Values" were assessed for each site as a measure of hairiness of the volunteer. A number of patches were subsequently analysed for water content using Karl Fischer titration.

Patches increased in weight over the entire 96 hour period of study. Over the first 24 hours the rate of hydration was greater than over the subsequent 72 hours (Table).

TIME (HOURS)	% INCREASE IN WEIGHT	STANDARD ERROR OF THE MEAN
24	5.24	0.27
48	7.71	0.32
72	10.93	0.52
96	12.50	0.53

Table : Percentage increase in weight of patches for all volunteers

Statistical analysis using the Mann-Whitney U-Test, a non-parametric two-tailed test, showed that there was no significant difference ($p < 0.05$) between weight increases of patches on flexor and extensor surfaces or between male and female volunteers. However patches placed on hairier sites showed incomplete occlusion which resulted in a reduced rate of hydration. Analysis of water content showed that 86.7% of the weight increase was attributable to water. The remainder was probably due to salts and electrolytes. Values of TEWL under this type of occlusion were calculated using the increase in water content of the patch and area and duration of occlusion. TEWL over the first 24 hours was 1.66 g/m²/h and this decreased to 0.44g/m²/h over the subsequent 72 hours.

The study shows that the HCP produces a reduction in TEWL over a 96 hour period and this suggests that such patches induce hydration of the outer layers of the stratum corneum, reducing the diffusion gradient for water transmission through the skin. This hydrated skin may facilitate the movement of drug molecules into the body and thus could be one mechanism by which the HCP enhances topical bioavailability of drugs.