Percutaneous penetration of topical corticosteroids: effect of skin occlusion

C. Pellanda1,3, C. Strub2, V. Figueiredo1, T. Ruffi2, G. Imanidis3, C. Surber1

1 Hospital Pharmacy, University Hospital Basel, Switzerland
2 Department of Dermatology, University Hospital Basel, Switzerland
3 Institute of Pharmaceutical Technology, University of Basel, Switzerland

Introduction

Background
- Occlusion by covering the skin with an impermeable wrap enhances skin hydration, affects drug penetration, and can induce a drug reservoir within the stratum corneum.1 This is desired in local therapy with topical corticosteroids: the longer the local effect, the better.
- Tape stripping is adequate to investigate the phenomenon of drug accumulation in stratum corneum, which has especially been investigated in the context of corticosteroid-therapy.2
- Triamcinolone acetonide (TACA) is a medium potency topical glucocorticoid often used in dermatology.

Aim
- The aim of the present study was to investigate the effect of:
  - occlusion before application (pre-occlusion) (experiment 1)
  - occlusion after application (post-occlusion) (experiment 2)
on the penetration of triamcinolone acetonide into stratum corneum.

Methods

Background
- Occlusion after application
  - Tape stripping is adequate to investigate the phenomenon of drug accumulation in stratum corneum.
  - TACA permeated through the stratum corneum and reached deeper tissues.
  - TACA accumulated on the skin surface.
  - A total of 28-70 tapes were stripped off each skin site.
  - The whole stratum corneum was removed to compare individual penetration profiles.

Triamcinolone acetonide (TACA) is a medium potency topical glucocorticoid often used in dermatology.
- Occlusion by covering the skin with an impermeable wrap enhances skin hydration, affects drug penetration, and can induce a drug reservoir within the stratum corneum.1 This is desired in local therapy with topical corticosteroids: the longer the local effect, the better.
- Tape stripping is adequate to investigate the phenomenon of drug accumulation in stratum corneum, which has especially been investigated in the context of corticosteroid-therapy.2

Results

Penetration Profiles
- The whole stratum corneum was removed to compare individual penetration profiles.
- A total of 28-70 tapes were stripped off each skin site.
- TACA accumulated on the skin surface: about 50% of the applied dose remained on tapes 1 to 3.
- TACA permeated through the stratum corneum and reached deeper tissues.

Experiment 1: Pre-Occlusion
- For statistical evaluation, the total TACA-amount penetrated into the stratum corneum was calculated for each skin site.
- The TACA-amounts were evaluated in a multifactor ANOVA.

Experiment 2: Post-Occlusion
- The stratum corneum was completely removed by standardized tape stripping.5
- This is the prerequisite to determine the thickness of stratum corneum of the individual volunteers.

Corneocytes were quantified directly on the tapes.
- Pseudo-absorption of the corneocytes at 430 nm was measured against a blank tape.4

Curiosity
- Occlusion hydrated the stratum corneum and loosened its structure.
- larger amounts of skin were removed on single tapes as skin ‘sheets’; less tapes were required to remove the entire stratum corneum.
- This happened after 5-10 tapes.

Special’ tapes after 24 h occlusion:
- Tape #4: large skin amounts were removed at the lateral sides of the tape.
- Tape #5: a big skin sheet was removed.
- Tape #6: the central skin was removed.

‘Normal’ tapes:
- Tape #2: no skin occlusion, no skin ‘sheets’.

Conclusions

- Occlusion before application shows no effect on the TACA-penetration into stratum corneum.
- Occlusion after application enhances TACA-penetration into stratum corneum by a factor of 2, favoring the development of a desired drug reservoir.
- Occlusion causes an enhanced hydration of the stratum corneum and a loosening of its structure.

References