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Transcutaneous route for targeting antigen presenting cells by HIV-1 virus-like particles

Zahra Afraz (1,2), Fiorenza Rancan (2), Sabrina Hadam (2), Ralf Wagner (3), Monika Schäfer-Korting (1), Ulrike Blume-Peytavi (2) and Annika Vogt (2)

(1) Institute of Pharmacy (Pharmacology and Toxicology), Freie Universität Berlin, Germany
(2) Clinical Research Center for Hair and Skin Sciences, Department of Dermatology and Allergy, Charité-Universitätsmedizin, Berlin, Germany
(3) Institute of Medical Microbiology, University of Regensburg, Germany

The idea of easy accessibility of cutaneous antigen presenting cells (APC) fostered the development of various transcutaneous (t.c.) vaccination strategies. Binding of vaccine to particles could improve skin penetration and APC activation. Virus-like particles (VLPs) are highly interesting carrier structures because they are biodegradable and because candidate antigens are incorporated in the particle's capsid.

We investigated the effect of skin vaccination strategies on the cellular uptake and penetration of three different VLP models, carrying HIV-1 antigen, on the skin tissue explants. Non-invasive t.c. administration after cyanoacrylate tape stripping (CSSS), was compared to skin pricking, and intradermal (i.d.) injection. To evaluate the migration of activated APCs out of the skin tissue, we established a skin culture model for human skin explants. The isolated epidermal and dermal cells as well as migrated cells from the medium were stained with HLA-DR marker and analysed by flow cytometry and fluorescent microscopy. Skin penetration of fluorescently labelled VLPs was assessed microscopically on cryosections.

In almost all skin samples, we were able to isolate VLP-positive cells from epidermal and dermal cell suspensions. Interestingly, the highest uptake was observed with VLP-Pr55gag, which could be a result of faster migration activity in response to this special VLP-type.
Although cellular VLP uptake in epidermis and the dermis was higher in pricked skin, the number of VLP-positive migratory cells after 40 hours did not significantly differ from CSSS-treated skin. In case of i.d., uptake was mainly in dermal and not in epidermal APCs.

These results suggest that the non-invasive method could have the same efficacy in the activation and migration of APCs and eventually the immune response afterward. The differences observed between the different VLPs on APC migration rate could be due to different antigenic properties of each VLP vaccine model.