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USEFULNESS OF TRANSDERMAL DELIVERY OF TRANEXAMIC ACID WITH A CONSTANT-VOLTAGE IONTOPHORESIS PATCH CONTAINING CHEMICAL ENHANCER

Hiroaki Todo and Kenji Sugibayashi
Faculty of Pharmaceutical Sciences, Josai University, 1-1 Keyakidai, Sakado, Saitama 350-0295, Japan

ABSTRACT

Recently development of printing technology helps to make a very thin dry-cell battery. Iontophoresis (IP) patch has been utilized to increase the skin permeation of mal permeation compounds to conduct a mild electrical current through skin surface by voltage application. Several IP-assisted patches have already been approved by FDA and these patches are equipped with a voltage adjustable controller to apply adequate constant current (0.2 – 0.5 mA/cm^2) through skin. On the other hand, an IP patch based on constant voltage is simply composed of a dry-cell battery and a drug loaded compartment. Maintenance of constant current using constant-voltage IP might be difficult due to variable electric skin resistance. A constant-voltage IP, however, has advantages of simple design and cost-efficiency. Decrease in the electric skin resistance would be useful to obtain stable electric current by disrupting the lipid structure in the stratum corneum with chemical enhancers. In this experiment, effect of chemical enhancers on the skin permeation of tranexamic acid (TXA) was investigated with a constant-voltage IP patch. Isopropyl myristate (IPM), DL-lactic acid (LA), l-menthol (LM), urea (UR), and ethanol were selected as model enhancers. Skin permeation experiment was performed with side-by-side diffusion cells using excised hairless rat abdominal skin. Anodal- or cathodal-IP combined with chemical enhancer was applied with TXA containing solution or 5% PVA gel. Adequate current and improved skin permeation of TXA were obtained using TXA solution by applying constant-voltage IP combined with chemical enhancers. Among chemical enhancers, LA showed low electric skin resistance with high ion conductivity. Furthermore, TXA permeation could be enhanced from TXA in PVA gel with anodal-IP having 1.5 voltage dry-cell batteries. There results suggested that effective permeation of chemical compounds would be achieved using constant-voltage IP combined with chemical enhancers.