

2nd International Conference and Exhibition on

NANOMEDICINE AND DRUG DELIVERY

May 21-23, 2018 Tokyo, Japan

Synergic effect of microneedle and iontophoresis on transdermal delivery of human growth hormone

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The objective of this work was to evaluate the combined effect of microneedle and iontophoresis on transdermal recombinant human Growth Hormone (rhGH) delivery. rhGH was used as a model macromolecule. Methylene blue staining, stereomicroscope and SEM imaging were used to characterize the microchannels. The effect of molecular charge on transdermal delivery was evaluated by permeation study in two different buffer- PBS (pH 7.4) and citrate (pH 4.0). Since hGH is negatively charged at pH 7.4 and positively charged at pH 4.0, cathodal and anodal iontophoresis was applied, respectively. And the effect of current density was evaluated in three different electrical densities of 0.125, 0.25 and 0.5 mA/cm². With the optimized iontophoresis protocol, permeation studies were performed to evaluate combination effect of iontophoretic delivery through microchannels under three different settings: Iontophoresis alone; microneedle pretreatment and microneedle pretreatment with iontophoresis. The cumulative amount permeated and flux in all experiments reached a plateau in 1 hour. Anodal iontophoresis in citrate buffer showed about 10-fold higher flux of rhGH compared to cathodal iontophoresis in PBS. Also anodal iontophoresis with current density of 0.5 mA/cm² showed the 2.32 and 1.11-fold higher flux compared to 0.125 and 0.25 mA/cm², respectively. And compared to microneedle pretreatment and optimized iontophoresis alone, the combination of iontophoresis with microneedle showed 5.82 and 6.33-fold higher flux, respectively. The result suggests that anodal iontophoresis with higher current density enhance permeation of macromolecule through microchannels created by microneedles. In conclusion, combination of iontophoresis and microneedle is potential strategy for enhancing transdermal delivery of macromolecule.

Biography

Gyubin Noh has completed his Bachelor's degree from Keimyung University, College of Pharmacy, Daegu, Republic of Korea. He is currently a MS-PhD candidate at College of Pharmacy, Keimyung University, Daegu, Republic of Korea. His research interest is on transdermal drug delivery, biopharmaceutical delivery, microneedle, etc.

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