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Transcutaneous immunization via rapidly dissolvable microneedles protects against hand-foot-and-mouth disease caused by *Enterovirus 71*

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Recent large outbreaks of hand-foot-and-mouth disease (HFMD) have seriously affected the health of young children. *Enterovirus 71* (EV71) is the main causative agent of HFMD. Herein, for the first time, rapidly dissolvable microneedles (MNs) loaded with EV71 virus-like particles (VLPs) were evaluated whether they could induce robust immune responses that confer protection against EV71 infection. The characteristics of prepared MNs including hygroscopy, mechanical strength, insertion capacity, dissolution profile, skin irritation and storage stability were comprehensively assessed. EV71 VLPs remained morphologically stable during fabrication. The MNs made of sodium hyaluronate maintained their insertion ability for at least 3 h even at a high relative humidity of 75%. With the aid of spring-operated applicator, EV71 MNs (approximately 500 μm length) could be readily penetrated into the mouse skin *in vivo*, and then rapidly dissolved to release encapsulated antigen within 2 min. Additionally, MNs induced slight erythema that disappeared within a few hours. More importantly, mouse immunization and virus challenge studies demonstrated that MNs immunization induced high level of antibody responses conferring full protection against lethal EV71 virus challenge that were comparable to conventional intramuscular injection, but with only 1/10th of the delivered antigen (dose sparing). Consequently, our rapidly dissolving MNs may present as an effective and promising transcutaneous immunization device for HFMD prophylaxis among children.

Biography

Zhuangzhi Zhu completed his Bachelor of Bioengineering at School of Bio-pharmaceutics, China Pharmaceutical University in 2006; and completed his Doctoral degree in Pharmaceutics at National Pharmaceutical Engineering Research Center, China State Institute of Pharmaceutical Industry in 2015. His research focuses on “Transdermal delivery system, especially in microneedles for bio-macromolecules delivery and transcutaneous vaccination. He is focusing on “Novel solid oral drug delivery systems”.

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