COMBATTING FUTURE BIOLOGICAL THREATS – HOST-DIRECTED INTERVENTIONS TO EMERGING THREATS FOR RAPID RESPONSE

Enhancing Dna Vaccine Delivery Through Microneedle Patch Technology With Low-voltage Electroporation

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Electroporation is a commonly used technique for DNA vaccine delivery. however, its clinical application is limited due to the technique relying on high voltages for DNA delivery to target tissues, which can cause pain and skin damage. For this reason, we have developed an electroporation device incorporated with the DNA vaccines into microneedle patches that operates at significantly lower voltages than traditional methods. This approach enables self-administration reduction for the burden of cold-chain, and the increase of storage duration. In this study, we loaded COVID-19 DNA vaccines onto microneedle patches. The patches were attached to hamsters and successfully expressed the vaccine by application at lower voltages (25V and 50V) after the needles were completely dissolved. Importantly, antibody titers were exceeded over the efficacy threshold in animal models. We specifically demonstrated the vaccine has ability to prevent infection in hamsters challenged with SARS-CoV-2 at lower voltages. The results in vaccinated hamsters showed lower virus titers and better histopathological scores, compared to those using traditional methods. These findings suggest that using a microneedle patch with low-voltage electroporation can effectively prevent SARS-CoV-2 infections. Furthermore, our studies offer the convenience for self-administration, making it more accessible and convenient to use. Additionally, its long storage period makes it a viable option for military stockpiling to respond to biological emergencies.

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