

Droplet-born Air Blowing(DAB) Technology for the Industrialization of Dissolving Microneedle

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Extended Abstract

The microneedle mediated drug delivery system has been developed to provide painless self-administration of high-potency drug with patient friendly manner [1]. Especially, dissolving microneedles, which deliver the target drugs as the drug-loaded microneedle dissolves into the skin, have been spotlighted recently [2]. Conventional dissolving microneedles have been mostly produced by a stepwise casting method in three-dimensional (3D) molds. In this casting method, filling the mold cavity without drug loss is a challenge. The curing step, which is critical to provide strength to the microneedle-shaped polymer and for solidification, requires conditions that are harsh to biological drugs, such as heat or ultraviolet (UV) light [3]. Also, this time consuming step causes the activity loss of biological drugs. Recently, drawing lithography, which can create three-dimensional microstructures from two-dimensional (2D) thermosetting materials, was suggested to fabricate dissolving microneedles [4]. Although drawing lithography has the advantage of fabricating dissolving microneedles without using a mold, it still requires high temperatures to draw and harden the thermosetting materials and limits the use of heat-sensitive biological drugs.

This study suggests the novel dissolving microneedle fabrication technique, droplet-born air blowing (DAB), in which the polymer droplet is shaped to the microneedle *via* air blowing [5]. Because the air blowing is directly applied to the polymer droplet to solidify and thus to form the microneedle shape, DAB provides gentle fabrication conditions without heat or UV irradiation. Also, the fabrication of dissolving microneedle from each droplet makes it possible to load the drug in the microneedle without drug loss and provides precise drug dose by controlling the droplet volume and the concentration of drug in the droplet. Additionally, the dissolving microneedle can be fabricated within 10 min *via* DAB, and this provides additional benefits in regard to fabrication cost and maintaining the activity of drugs.

Here, we fabricated epidermal growth factor (EGF) and insulin loaded dissolving microneedles *via* DAB. The skin penetration property of EGF loaded microneedles was showed by optical coherence tomography (OCT). And the time *versus* blood glucose level in mice after subcutaneous injection and microneedle patch administration of insulin are shown no significant difference. The blood glucose level was dramatically reduced after a 60 min insulin administration (n=6, p<0.0001) and recovered after 120 min in both groups. Overall, the DAB could provide a solution to the problems of conventional dissolving microneedle fabrication technology, suggesting the potential application of biological drug delivery system.

The reference section at the end of the paper should be edited based on the following:

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