

Microneedle-Based Automated Therapy for Diabetes Mellitus

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Abstract

This article discusses the use of microneedles in automated diabetes therapy systems. Advanced bioengineered systems have the potential to close the loop between diagnostic and therapeutic elements of diabetes treatment, thus constituting a “smart” system. Prevalent insulin therapies, and most glucose sensing techniques, involve the transfer of physical entities through the skin. Micromachined needles (microneedles) can achieve this in a noninvasive or minimally invasive manner while contributing various other technological merits. The dynamics of autonomous diabetes therapy systems include highly complex interdependencies between the various physical and biological entities involved, thus warranting multidisciplinary research initiatives. The iterative development of a noninvasive, bioengineered interface such as microneedles necessitates a better understanding of the human skin, its molecular architecture as a polymer film, and its role as a functional biological unit. This review addresses application-specific requirements of a microneedle-based interface system specifically for autonomous diabetes therapy. Key design issues and related parametric interdependencies specific to this application are discussed.

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Abbreviation: (ISF) interstitial fluid

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