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SYMPOSIUM

Gel Encapsulation of Glucose Nanosensors for Prolonged *In Vivo* Lifetime

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Abstract

Background:

Fluorescent glucose-sensitive nanosensors have previously been used *in vivo* to track glucose concentration changes in interstitial fluid. However, this technology was limited because of loss of fluorescence intensity due to particle diffusion from the injection site. In this study, we encapsulated the nanosensors into injectable gels to mitigate nanosensor migration *in vivo*.

Methods:

Glucose-sensitive nanosensors were encapsulated in two different commercially available gelling agents: gel 1 and gel 2. Multiple formulations of each gel were assessed *in vitro* for their nanosensor encapsulation efficiency, permeability to glucose, and nanosensor retention over time. The optimal formulation for each gel, as determined from the *in vitro* assessment, was then tested in mice, and the lifetime of the encapsulated nanosensors was compared with controls of nanosensors without gel.

Results:

Five gel formulations had encapsulation efficiencies of the nanosensors greater than 90%. Additionally, they retained up to 20% and 40% of the nanosensors over 24 h for gel 1 and gel 2, respectively. *In vivo*, both gels prevented diffusion of glucose nanosensors at least three times greater than the controls.

Conclusions:

Encapsulating glucose nanosensors in two injectable gels prolonged nanosensor lifetime *in vivo*; however, the lifetime must still be increased further to be applicable for diabetes monitoring.

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Abbreviations: (ARS) alizarin red S, (DOS) bis(2-ethylhexyl) sebacate, (PBS) phosphate-buffered saline, (PEG 550) 1,2-distearoyl-*sn*-glycero-3-phosphoethanolamine-N-[methoxy(polyethylene glycol)-550] (ammonium salt) in chloroform, (PVC-COOH) poly(vinyl chloride) carboxylated, (TDMAC) tridodecylmethylammonium chloride, (THF) tetrahydrofuran

Keywords: diabetes, glucose nanosensors, injectable gels, optode

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