

A Promising Solution to Enhance the Sensocompatibility of Biosensors in Continuous Glucose Monitoring Systems

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Abstract

Background:

Continuous glucose monitors (CGMs) measure glucose in real time, making it possible to improve glycemic control. A promising technique involves glucose sensors implanted in subcutaneous tissue measuring glucose concentration in interstitial fluid. A major drawback of this technique is sensor biostability, which can lead to unpredictable drift and reproducibility. The biostability is partly due to sensor design but is also affected by naturally occurring subcutaneous inflammations. Applying a nonbiofouling coating to the sensor membrane could be a means to enhancing sensocompatibility.

Methods:

This study evaluates the suitability of a polyethylene-glycol-based coating on sensors in CGMs. Methods used include cross hatch, wet paper rub, paper double rub, bending, hydrophilicity, protein adsorption, biocompatibility, hemocompatibility, and glucose/oxygen permeability testing.

Results:

Results demonstrate that coating homogeneity, adhesion, integrity, and scratch resistance are good. The coating repels lysozyme and bovine serum albumin, and only a low level of fibrin and blood platelet adsorption to the coating was recorded when testing in whole human blood. Cytotoxicity, irritation, sensitization, and hemolysis were assessed, and levels suggested good biocompatibility of the coating in subcutaneous tissue. Finally, it was shown that the coating can be applied to cellulose acetate membranes of different porosity without changing their permeability for glucose and oxygen.

Conclusions:

These results suggest that the mechanical properties of the coating are sufficient for the given application, that the coating is effective in preventing protein adsorption and blood clot formation on the sensor surface, and that the coating can be applied to membranes without hindering their glucose and oxygen transport.

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Abbreviations: (BSA) bovine serum albumin, (CGM) continuous glucose monitor, (NaCl) sodium chloride, (PBS) phosphate-buffered saline, (PEG) polyethylene glycol, (PET) polyethylene terephthalate, (SMBG) self-measurement of blood glucose, (UV) ultraviolet

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