A Parametric Study to Improve the Efficiency of Implantable Antenna Sensors for Continuous Glucose Monitoring

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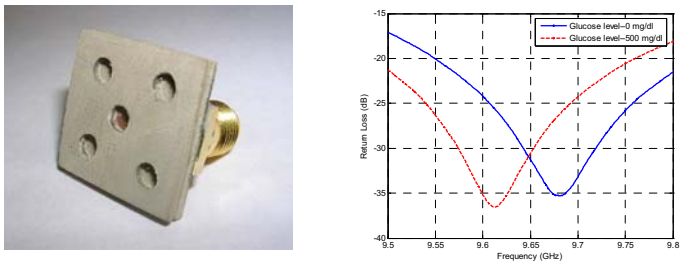
The development of a reliable continuous glucose monitoring technology is a key to improving the quality of lives of patients living with diabetes. In recent years, considerable progress has been made in developing implantable biosensors that can continually monitor glucose levels. The biosensors developed thus far can only remain functional up to 10 days after their implantation in the body. While researchers explore potential solutions to improve the current implantable biosensors, there is an *urgent need* to investigate other alternative technologies. Unless a reliable technology for a long term glucose monitoring is developed, continuous glucose monitoring is expected to remain problematic and patients will continue to face the life-threatening complications associated with poor glycemic control.

In this study, our aim is to design miniaturized implantable antenna sensors which will offer an alternative to the current implantable biosensors for continuous glucose monitoring. It was shown that the glucose concentration in the blood plasma does change the electrical properties (*T. Karacolak, E. C. Moreland, and E. Topsakal, URSI General Assembly, Chicago, Illinois, August 7-16, 2008*). Thus, changes in the glucose levels in the medium surrounding the antenna will affect the antenna parameters such as input impedance and resonant frequency, and these changes can be used to predict the patient's plasma glucose levels. Fig. 1a shows one of the designed die-shaped antennas. The channels are filled with blood plasma with different glucose concentrations, and the return loss comparison for 0 mg/dl and 500 mg/dl glucose levels is shown in Fig. 1b. As seen, there is a shift of almost 70 MHz which can be utilized for the prediction of the glucose concentration. *In vitro* measurements regarding the effects of various numbers of channels and the channel orientation will be presented.



(a) (b)

Fig. 1. (a) Die-shaped antenna and (b) Return loss comparison for 0 mg/dl and 500mg/dl glucose levels.