Enhancing rapid SARS-CoV-2 antibody detection using a Quartz Crystal Microbalance

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Healthcare systems faced unprecedented challenges during the Covid-19 pandemic, grappling with overwhelming patient loads and a need for efficient diagnostic tools. Considering this, it has become imperative to develop diagnostic systems that meet the complexities of modern patient care. To address these concerns, we conducted research focusing on the early development of an enhanced antibody detection and quantification tool designed to identify blood serum SARS-CoV-2 antibody levels. Our primary objective was to explore the feasibility of a plug-and-play mobile device incorporating quartz crystal resonance sensors as the foundation for an improved rapid test for SARS-CoV-2 seropositivity. Our innovation incorporates antibody quantification - an invaluable aspect in managing the pandemic effectively - and a device possessing the capability to accurately detect variations in molecular mass within the applied serum. To gauge the detected mass differences when antibodies are bound, we conducted tests with both the receptor binding domain and the whole spike protein and analyzed the differences. Introducing each component to the sensor showed distinct resonances, which could be translated into mass data and analyzed to determine seropositivity. Due to unforeseen circumstances, we are not able to analyze any data. The hope for future research is to streamline this machinery into a transportable and reliable test for regions that don't have access and to be able to determine levels of seropositivity based on the mass difference after antibody binding. With this data we hope to be able to determine effectiveness of various treatments or whether patients may need treatments at all.