The Fabrication and Optimization of an Integrated Microfluidic Test Strip for Prothrombin INR Testing

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Twenty million Americans who suffer from cardiovascular events use anticoagulation therapy. With two million new annual users of Warfarin, accessibility to INR monitoring machines has become important. The price to obtain proper equipment is expensive and requires electricity to function. Developing a cost-effective INR test strip that would return accurate quantitative data to augment accessibility to INR testing, microfluidic test strips were designed to function without requiring an energy source. Utilizing PEG,(polyethylene glycol), a streamflow microfluidic channel was designed. All that is necessary to operate the microfluidic channels is a syringe to insert the PEG into the strip. Different plastic foundations and chemical adhesives were utilized to optimally build the INR strip. The prothrombin time was measured for each trial at 4 different intervals. Thirty-five trials for each prototype was tested to determine which test strip gave the most consistent results. The %CV was calculated to determine which test strip gave the most consistent results. Different materials were used to seal the strips and provide an enclosed environment for the flow of the PEG. Varying layers of adhesive and different types of plastic covering were used to see which combination would offer the strongest stability. Testing five different constructs with the different materials, it was found that additional structural support and hydrophilic plastic layers provide consistent results, especially version 7.2. The deviation between the %CV values throughout the intervals was the lowest as well as the average % CV values for version 7.2. This microfluidic test strip shows potential for an INR diagnostic device.