Abstract

Peripherally-inserted central catheters (PICCs) are essential medical devices that deliver medications, nutrients, and fluids to neonatal newborns. Between 120,000-320,000 PICCs are placed annually in the United States, and the length of their implantation can be up to several months. During this time, the natural movement and growth of the child may displace the PICC causing serious complications including death. X-ray imaging is the gold standard in verifying catheter tip position; however, the negative health risks to newborns from radiation exposure limits weekly inspection of catheter position. We hypothesize that catheters can be constructed from a polymeric composite with optical contrast materials that can be visualized using near-infrared (NIR) fluorescence, forgoing the use of ionizing radiation. Thus, the object of this study was to design and characterize novel optical polymer composites that can ultimately be used for PICCs. These composites would allow for the early detection of a migrating tip to be corrected before adverse side effects could occur without the use of ionizing radiation.

In this study medical grade polyurethane was dry mixed with IR Dye 800 and extruded to produce hollow composite tubes. Characterization studies involved the use of scanning electron microscopy to analyze surface morphologies, tensile testing to determine mechanical strength, fluorescent imaging to verify successful incorporation of dye in the polymer matrix, and leeching studies to determine the amount of dye that is retained. Preliminary results suggest the incorporation of a NIR fluorescent dye at only 0.01 wt% with medical grade polyurethane can be successfully extruded and imaged confirming presence of dye. Furthermore, the retention of the dye in the polymer matrix over time suggests that composite materials can be visualized in situ without significant loss of contrast agent.

Bio

André Stevenson Jr. is a PhD student in the MSE Department at Virginia Tech. He received his B.E. in biomedical engineering from Vanderbilt University in 2012. He is co-advised by Drs. Abby Whittington and Gary Pickrell.