Catheter Design Using Transmission of Antimicrobial Blue Light to Fight Catheter Related Infections

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PURPOSE Catheters inserted into the human body are lifesaving. However, microorganisms can attach to their surface and form a biofilm resulting in life threatening infections. There are no practical alternatives to antibiotic treatment. Antimicrobial blue light that is nontoxic to human cells is a promising new alternative. ENGINEERING GOAL To determine the efficacy of antimicrobial blue light on the prevention or destruction of the biofilm associated with catheter related infections and to develop a device that delivers antimicrobial blue light to all surfaces of a catheter. PROTOTYPE Methods of delivering antimicrobial blue light was investigated. A blue LED (450 nm) was chosen as the light source. A luminal fibre optic cable, wall embedded fibre optic and an edge lit catheter hub were explored as delivery methods. The wall embedded fibre optic with a polyvinyl chloride catheter was chosen as the final prototype. TESTING The efficacy of antimicrobial blue light on the destruction of a catheter biofilm, using scanning electron microscopy was investigated. Light transmission along the length of the catheter was assessed with a smartphone lux meter. RESULTS Destruction of the biofilm was demonstrated. Light transmission decreased with increasing distance from the source. The wall of the PVC catheter adequately reflected and refracted the blue light. CONCLUSION Antimicrobial blue light is an effective means of penetrating and destroying biofilms. A catheter system that utilizes blue light in a wall embedded fiber optic design may help control, prevent and treat catheter related infections that are resistant to antibiotic therapy.

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