Biomedical Applications of Magnetically Controlled Soft Microrobots

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Abstract

Medical microbots are widely studied for a variety of applications, such as targeted drug delivery, biopsy, hyperthermia, etc. The microrobots offer minimally invasive, precise interventions and are mainly driven by a magnetic field. Previous studies were investigated on the use of biocompatible and magnetically activated microrobot for cell culture and targeted transport. More recently, we have researched the fabrication, control and applications of soft magnetic microrobots. We developed a novel, magnetically activated, soft microrobotic system that improves the controllability of a conventional guidewire used for percutaneous coronary intervention (PCI). The soft microrobot consists of a flexible structure with a magnet. Then it is attached to the tip of the guidewire and is magnetically controlled by changing the direction and intensity of an external magnetic field. We developed a mathematical model mapping deformation of the soft microrobot using a feed-forward approach. The steerability was confirmed by two-dimensional (2D) in-vitro tracking. Finally, the application was tested using a three-dimensional (3D) phantom of the coronary artery to verify steerability in 3D space.