Multifunctional Articulating Surgical Robot for NOTES

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Intra-abdominal surgery has taken large steps away from the conventional method of open incisions in the last 2 decades. Minimally invasive methods have proven to be successful replacements in performing these surgeries. Recently, a newer approach known as natural orifice translumenal endoscopic surgery (NOTES) takes minimally invasive surgery further by eliminating external incisions and instead performs surgery via natural orifices such as the esophagus. NOTES concepts have been in existence during the past decade, but this approach is not widely adopted in human surgeries due mainly to the technological limitations imposed by such surgeries. In this paper, a new robotic platform for natural orifice surgery is described. The robot is designed to carry multiple tool tips in a single end-effector arm that is attached to a steerable and shape lockable drive mechanism. Tool changing capability is achieved by indexing the tool cartridge and advancing the tool of choice. The overall diameter of the robot is small enough for it to navigate through a human esophagus. The steerable and lockable drive mechanism allows easy navigation through the twists and turns of an orifice and also provides a stable platform for the robot while surgery is performed. Design and calculations are presented in this paper, followed by experimental validation. Initial results suggest that the new robotic tool will enable dexterous abdominal surgery with improved force transmission.

Design of a Mobile Head Support Based on a Compliant Mechanism

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In the Netherlands, approximately 100,000 people have a muscle disease. Often this disease is progressive, so patients' disabilities get worse over time. They end up in a wheelchair and will be dependent on technical supports. Head supports are often not used because of bad cosmetics, comfort, and control. This paper presents a slim, disguisable, and body supported innovative head rest. The prototype is tested in two ways: by tilting the setup to simulate accelerations and observing it during a car drive. It proved to withstand accelerations varying up to around 5 m/s^2, comparable to normal driving conditions in a bus. While there remains scope for improvement, the prototype was appreciated by the patient. A company is willing to further develop the design.