An Articulating Tool for Endoscopic Screw Delivery

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This paper describes the development of an articulating endoscopic screw driver that can be used to place screws in osteosynthetic plates during thoracoscopic surgery. The device is small enough to be used with a 12 mm trocar sleeve and transmits sufficient torque to fully secure bone screws. The articulating joint enables correct screw alignment at obtuse angles of up to 60 deg from the tool axis. A novel articulating joint is presented, wherein a flexible shaft both transmits torque and actuates the joint; antagonist force is provided by a superelastic spring. Screws are secured against the driver blade during insertion and with a retention mechanism that can passively release the screw when it has been securely placed in the bone. The prototype has been fitted with a blade compatible with 2.0 mm and 2.3 mm self-drilling screws although a different driver blade or drill bit can easily be attached. Efficacy of the tool is demonstrated by securing an osteosynthetic plate to a rib in a mock surgical setup. This tool enables minimally invasive, thoracoscopic rib fixation.

Hydraulic Remotely Adjustable Pulmonary Artery Banding

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Each year approximately 2000 children are born with a form of congenital heart disease that would benefit from mechanical restriction, or banding, of the pulmonary artery. [1,2] Installing or changing the setup of the banding requires an open chest surgery and during the first 6 months of the patient's life, physiological parameters evolve rapidly, resulting in need for frequent reoperations. Mortality for those treated patients may be as high as 10–20%. [3] While many devices have been patented, none of them have been adopted due to size, adjustability, or reliability constraints with regard to implantation in newborns, especially below 6 months of age. Here we present the conception, design, and scale model testing of a novel pulmonary banding system for infants. This system features a hydraulic mechanical stepper actuator that offers great advantages in both reliability and compactness. As a proof of concept, we built a 5:1 scale working prototype that demonstrated the desired functionality of the device. Further steps involve scaling down the device so first porcine trials can be started.