

PIEZOELECTRONICS

Slip sensors help surgeons get a grip

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Credit: Hidekuni Takao

Laparoscopic, or keyhole, surgery can benefit patients but also places greater demands on the skill of the surgeon. One reason for this is that the surgeon is limited to only visual information, while tactile information is lost. This makes it difficult, for example, for an inexperienced surgeon to judge if an organ is held firmly by laparoscopic forceps or is about to slip. Hidekuni Takao and colleagues have now developed a slip sensor that can visualize the grasp of a forceps even under very low friction conditions.

The device consists of eight piezoresistive gauges that are integrated onto a silicon chip and mounted on the gripping region of the forceps. Instead of measuring the surface shear forces, the researchers — who are based at Kagawa University and

Takamatsu Red Cross Hospital — developed an algorithm that detects slipping based on changes in position of the reactive (that is, normal) forces and load centre. This is important as many organs are surrounded by a fluid-filled layer, meaning the organ can slip at this inner surface with no shear occurring at the grasping interface between forceps and outer layer. The device was tested on a silicone gel ‘organ’ wrapped in polyethylene film, and was able to successfully detect slipping under the film even when the shear forces at the surface were zero.

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