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MINIMUM BUT SUFFICIENT ULTRASOUND POWER SENSING FOR SAFE AND INTUITIVE ULTRASONIC SURGERY.

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For patient safety in ultrasonic surgery, adverse effects in tissue adjacent to the intended site of ultrasonic instrument or unexpected ultrasonic exposure to surrounding tissues due to lack in senses through port access operation should be avoided. In this study, we propose an intuitive ultrasonic surgery system by developing the additional function of ultrasonic resonator based contact impedance sensing on an ultrasonic surgery device. The sensing element can be easily equipped on the blade by pasting PVDF sensing element in order to detect vibration amplitude and phase, which enables the system to (1) detect the moment of contact when the ultrasonic blade touches tissues, (2) gradually increase the ultrasonic power depending on the contact force applied on the tissue, and (3) turn off the ultrasonic power immediately after detecting no more loads on the blade, which means tissues are dissected. Ultrasonic power changes depending on the physician's hand force, as a consequence, the system makes the physician feel like using a normal surgical knife. The novel sensing system may be benefit for the safety operation of the ultrasonic surgery and for intuitive operation in robotic surgery.