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The development of an MRI-Compatible Focused Ultrasound Device for the  
Treatment of Rectal Cancer

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Rectal cancer is the fifth most common type of cancer worldwide, and it is treated at present only with invasive procedures. In this work, focused ultrasound surgery has been tested as a treatment approach for rectal cancer. It is a pioneering method and its potential clinical application in this type of cancer could reduce the mortality and morbidity rates as it is a non-invasive technique.

A focused ultrasound transducer has been designed and fabricated specifically for rectal cancer application. It has the ability to be combined with both a 30° laparoscope and an MRI scanning system for guidance, and to be connected with a water circulation cooling system. Two piezo-ceramic single bowls have been accurately located in this device, in a way that their delivered energy is focused in the same focal point. The characterization of the transducer has been accomplished with a series of tests: ultrasound field profile mapping, frequency bandwidth, linearity and efficiency detection. Its ability to cause coagulation necrosis in tissue has been tested with *ex-vivo* applications in poultry tissue, and its MRI compatibility has been investigated in 1.5T MRI Scanning system, GE Signa HDx.

The possibility to apply focused ultrasound surgical technique for the treatment of rectal cancer has been presented in this early-stage magnetic resonance guided focused ultrasound (MRgFUS) transducer. It is a promising method with a number of advantages for the patients, through the avoidance of an invasive surgery.