Title: Development of a novel cableless radiolucent RF coil for MR-guided radiation therapy (MRgRT™)

Introduction: The IMRIS-Varian MRgRT system incorporates a movable MR system that can be brought into a radiotherapy vault, and a patient couch that rotates between MR and treatment positions. Internal organ motion drives the requisite rapid transition between MR imaging and treatment delivery. For MRgRT, conventional RF coils that employ cables for signal transmission are undesirable, owing to the need to remove and disconnect the coils prior to radiation treatment, combined with potential cable and treatment couch interference. With the presented cableless coil technology, it is possible to expedite the transition from imaging to treatment by eliminating cables/connectors and permitting RF coil presence during treatment.

Cableless coil technology: Recent technological innovation in RF coil design has targeted reducing or eliminating the burden of cables (1). In this abstract, we utilized a novel cableless phased-array RF coil based on inductively coupling a remote surface coil to the MR scanner body coil. In this design, all the image acquisition is performed by the scanner body coil, and the remote cableless RF coil does not require preamplifiers, detuning circuits or cables - components that we not be exposed to radiation in our proposed design. The prototype half-birdcage coil provided sufficient signal (Figure 1), and with application of a second, anteriorly-positioned coil, will offer uniform image quality throughout the sample.

Radiation testing of coil materials: Figure 2 provides the results for the radiation testing of transmission and surface dose for the various coil materials. It is clear that the level of attenuation was not significant and that relative surface dose for all coil components was much less than the radiotherapy couchtop. Since we measured surface dose increases with no air gap present, results reported represent ‘worst case scenario’. Future work will investigate long term impact of radiation on the critical coil components to assess potential impact of radiation on the coil performance.

References: