

## Finite Element Analysis of Surface Loop Resonators for EPR Dosimetry

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Surface loop resonators have been developed for tooth EPR dosimetry as a way to assess exposure to ionizing radiation. In an effort to increase the accuracy of dose prediction, numerical finite element analysis (FEA) has been used to characterize existing surface loop resonators and optimize the loops specifically for tooth dosimetry. Ansoft's High Frequency Structure Simulator (HFSS) was used to determine the resonant frequency and Q of several existing resonators. The model of the resonator was combined with a microCT model of human teeth (both incisors and molars) to calculate the filling factor and signal amplitude for a variety of loop/tooth configurations. Figure 1 shows a rectangular loop resonator and three microCT molars. Figure 2 shows the magnitude of the magnetic field for the model shown in Fig. 1.

Because the resonator geometry and electrical parameters can be easily varied in HFSS, it is possible to optimize the size and shape of the loop, the loop wire diameter and the length of the transmission line. We desire a loop geometry that gives a large signal amplitude and is relatively insensitive to positioning errors. We have investigated several loop configurations and variety of different loop/tooth positions. The results from extensive FEA simulations are summarized and the design of an optimized surface loop resonator for tooth dosimetry is presented.

