Assessing the MR compatibility of dental retainer wires at 7 tesla
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The RF safety of dental retainer wires in a 7 tesla MR scanner has been investigated. In the Netherlands up to 40\% of the younger adults have such a dental retainer wire, which at the moment is listed as a contra-indication for 7 T head scans. The radio frequent (RF) field transmitted by the MR excitation head coil is responsible for heating of the wire and its surroundings, of which the electric fields directly contribute to tissue heating.

Head model electromagnetic simulations provided results, in which a wire of common retainer length did not create a 1g SAR higher than than the maximum 1g SAR present in the head without the wire. It could be argued that due to the fact that the wire is not creating the highest SAR, this wire can be rated MR-compatible. However worst case scenario’s are difficult to predict for the head model. An electrically non-conductive spacer around the wire that lowers the local SAR has therefore been investigated.

A spacer, fully surrounding the wire, does not allow conduction currents in the tissue to flow to and from the wire. A spacer layer of 0.38 mm thickness reduces the 1g SAR of a resonant wire by a factor of 8. The head model with a 3 mm spacing between tongue and wire even had no local SAR increase compared to the model without wire, making the retainer wire with spacer MR-compatible. Practically, a silicone sports mouth guard could function as a spacer.

The head model simulations are supported by phantom electromagnetic simulations, thermal simulations and thermal measurements following the ASTM F2182-02a standard test method for measurement of radio frequency induced heating near passive implants. The simulated temperature rise around the wire during 15 minutes of excitation is compared to actual temperature measurements during MR scans of the phantom containing a set of different wire lengths. By confirming that phantom simulation and measurement results agree well and therefore are reliable we can make valid conclusions extending to the head.

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\caption{Head model in MR bird cage coil}
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\begin{figure}[h]
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\includegraphics[width=\textwidth]{figure.png}
\caption{Dissipated power in the tongue due to the retainer wire and reduction due to the separation with the wire}
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