O29. MR SCANNING, TATTOOS AND REPORTED SKIN BURN, FACT OR MYTH?

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Background: Adverse events following magnetic resonance imaging (MRI) is a relevant concern when tattooed persons are examined with MR. The vast majority of papers highlight adverse skin burn grade 1-2 and especially the sensation of burn, in some reports associated with documented redness and edema of the tattoo. Deep dermal burn has not been reported. We aimed to study MRI induced thermal effect and magnetic behavior of commercial tattoo ink products and experimental formulations of known tattoo pigments.

Method: Initially, MRI effects on three commonly used commercial ink stock products marketed for cosmetic tattooing was studied. Pigments were iron oxides. The main experiment with study of 22 test formulations based on11 pigment raw materials, studied as one line of 11 realistic tattoo ink products, called pastes, and another line of 11 inks with 50% pigment v/v dispersed in the same carrier, called dispersions.
Samples were spread in capped Petri discs and initially tested with a 0.97 T neodymium solid magnet to observe visual magnetic behavior. Outside the scanner room and immediately before MRI, the surface temperature of the ink was measured using an infrared probe. Samples were placed in a clinical 3T scanner at the height of the isocenter. Two separate scans were performed on the samples, i.e. positioned in the isocenter and moved 30 cm away from the center. Immediately after scanning the surface temperature of the inks was measured again. Chemical analysis of samples was performed by mass spectroscopy (MS) after microwave dissolution in nitric acid and hydrochloric acid, with measurement of total concentrations (sum of soluble and metallic content) of the metals cadmium, chromium, cobber, nickel, lead, zinc and mercury.

Results: Only few inks were magnetic on contact with the solid magnet. Mean temperature increase measured in the isocenter of pastes and dispersions ranged between 0.14 to 0.26 degree C ($p<0.01$), and in the off centre position from -0.16 to 0.21 degree ($p<0.01$). Magnetic inks on solid magnet exposure showed no special increase of temperature. Chemical analysis of the inks showed high concentrations of iron, but also nickel and chrome were found as contaminants. High concentration of iron in the inks, i.e. the iron oxide pigment, was not associated with any special increase of temperature. The measured minute increase of temperature was seen as clinically not relevant and far below what could ever induce a thermal tissue burn.

Conclusion: The study could not confirm any clinically relevant temperature increase of tattoo inks and pigments, in particular iron oxides after MRI and, thus, not support the widely held belief or myth that MR scanning can produce thermal burn in the tattooed skin. Sensation of burn is essentially sensory. MR is a powerful stimulus, which among others may induce electromagnetic effects on pigments that for presently unknown reasons may elicit the sense of “burn” in a tattoo during MRI.