# Body piercing and MRI Scans

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One source of contention that exists between people with body piercings and the healthcare industry is the requirement to remove body jewelry during MRI scans. The issues for the healthcare workers are projectile objects, burns, and MR image artifacts. The issues for a pierced individual are potential hole-closure and the awkwardness of the entire situation.

For the healthcare workers, it is important to evaluate objects with regard to safety and compatibility when an MRI scan is to be performed. Safety refers to the potential for injury to the individual. Compatibility implies the potential for injury to the implant and/or the potential source of artifacts.

Potential sources of concern are related to one or more fields in the MR environment. These fields include the static magnetic field, the RF (radio frequency) electromagnetic field, and the gradient (time-varying) magnetic fields. The interaction between an implant and the static magnetic field of a MR system includes attraction or deflection, and torque. The effect on ferromagnetic materials exposed to static magnetic fields can range from significant projectile motion to modifications in the orientation of the object.

The RF electromagnetic fields can cause a temperature increase in the object, leading to burns of the surrounding tissues. This occurs when the anatomical area that contains the object is exposed to the fields from the transmitting RF coil. Multiple 180-degree RF pulses can produce high levels of RF energy deposition in the body. As the field strength of the MR system increases, the RF power deposited in the body increases. The potential for heating is due to the type of metal, and to the RF fields being concentrated at the area.

For an individual with body piercing, the main issue is the metal content of the jewelry. Studies have been performed on various types of stainless steel, titanium, and titanium alloys. One particular study evaluated the difference between type 304 and type 316L stainless steel (SS).

The process of "cold work" – any mechanical deformation at room temperature - increases the tensile strength for both type 304 SS and 316L SS. In addition, the application of cold work may increase the magnetic permeability of nonmagnetic stainless steel. The resulting permeability is dependent upon metal composition and the amount of cold work. Cold working can transform a nonmagnetic object to a magnetic structure. Minimal mechanical deformation of Type 304 SS increases the ferromagnetic qualities up to 62%, and can produce large artifacts on the MRI scan. For type 316L SS the amount of magnetic changes produced by the cold-working process was 0. No magnetic field attraction or MR image distortion occurred as a result of cold working. This study concluded that manufacturing deformation and/or manipulation of type 316L SS should not produce ferromagnetism. As such, metallic bio-implants made from ASTM surgical implant-grade 316L SS should not be attracted to a 1.5 static magnetic field, nor produce significant artifacts during an MRI scan. For type 316L SS objects, the higher alloy content, particularly nickel, stabilizes the nonmagnetic properties.

Similar studies have been performed to evaluate the magnetic properties of metallic aneurysmal clips in an MR system. Non-ferromagnetic materials such as titanium or titanium alloys are safe for patients undergoing MR procedures.

Therefore, for pierced individuals wearing body jewelry made from titanium, titanium alloys and surgical implant-grade 316L SS, body jewelry removal for an MRI scan should not be an issue of contention unless the jewelry is directly in the area to be examined.

References:

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