Artifacts in brain magnetic resonance imaging due to metallic dental objects.

Costa AL, Appenzeller S, Yasuda CL, Pereira FR, Zanardi VA, Cendes F.


Abstract

OBJECTIVE: Artifacts caused by metallic objects, such as dental crowns, dental implants and metallic orthodontic appliances, are a common problem in head and neck MRI. The aim of this retrospective study was to identify the main metal dental objects that produce artifacts on brain MRIs.

STUDY DESIGN: Imaged metallic artifacts and their sources were identified. Artifact image plane was rated on a score of 0 or 1 (0--distinguishable for diagnosis and 1--not distinguishable for diagnosis).

RESULTS: Seventy-eight percent of the artifacts appearing in images were caused by orthodontic appliances, followed by dental titanium implants (18%) and metallic crowns (4%). Orthodontic appliances obtained the highest scores in all planes.

CONCLUSIONS: We concluded that it is difficult to avoid the effect of metallic artifacts in the maxillofacial regions on brain scan. Removing metallic parts of the orthodontic appliance should ensure diagnostically useful quality scans.

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Dental materials and magnetic resonance imaging.

Hubálková H, Hora K, Seidl Z, Krásenský J.


Abstract

The objective of this investigation was to evaluate the reaction of selected dental materials in the magnetic field of a magnetic resonance imaging device to determine a possible health risk. The following dental materials were tested in vitro during magnetic resonance imaging: 15 dental alloys, four dental implants, one surgical splint and two wires for fixation of maxillofacial fractures. Possible artefacts (corresponding with magnetic properties), heating and force effects were tested. Results concerning movement and heating were in agreement with the literature. The artefacts seen were significant: for the surgical splint, a spherical artefact with a diameter of 55 mm; for the wires, up to 22 mm; and for the dental blade implant, an artefact of 28 x 20 mm. The results of our tests of selected dental appliances
indicate that their presence in the human organism is safe for patients undergoing magnetic resonance imaging procedures. The presence of artefacts can substantially influence the magnetic resonance imaging results.

**Magnetic susceptibility and electrical conductivity of metallic dental materials and their impact on MR imaging artifacts.**

Starcuková J, Starcuk Z Jr, Hubálková H, Linetskiy I.


**Abstract**

**OBJECTIVES:** The aim of this study was to test the hypothesis that dental materials vary significantly in MR-relevant material parameters-magnetic susceptibility and electrical conductivity, and that knowledge of these parameters may be used to estimate the quality of MR imaging in the presence of devices made of such materials.

**METHODS:** Magnetic susceptibility, electrical conductivity and artifacts were evaluated for 45 standardized cylindrical samples of dental alloys and amalgams. Magnetic susceptibility was determined by fitting the phase of gradient-echo MR images to numerically modeled data. Electrical conductivity was determined by standard electrotechnical measurements. Artifact sizes were measured in spin-echo (SE) and gradient-echo (GE) images at 1.5T according to the standards of the American Society for Testing and Materials.

**RESULTS:** It has been confirmed that dental materials differ considerably in their magnetic susceptibility, electrical conductivity and artifacts. For typical dental devices, magnetic susceptibility differences were found of little clinical importance for diagnostic SE/GE imaging of the neck and brain, but significant for orofacial imaging. Short-TE GE imaging has been found possible even in very close distances from dental devices made of amalgams, precious alloys and titanium alloys. Nickel-chromium and cobalt-chromium artifacts were found still acceptable, but large restorations of aluminum bronzes may preclude imaging of the orofacial region. The influence of electrical conductivity on the artifact size was found negligible.

**SIGNIFICANCE:** MR imaging is possible even close to dental devices if they are made of dental materials with low magnetic susceptibility. Not all materials in current use meet this requirement.
Artifacts from dental casting alloys in magnetic resonance imaging.

Shafiei F, Honda E, Takahashi H, Sasaki T.


Abstract

The potential advantage of magnetic resonance imaging (MRI) has been limited by artifacts due to the presence of metallic materials. For quantitative evaluation of the magnitude of artifacts from dental casting alloys and implant materials in MR imaging, 11 dental casting or implant materials were imaged by means of 1.5 T MRI apparatus with three different sequences. Mean and standard deviation of water signal intensity (SI) around the sample in the region of interest (1200 mm²) were determined, and the coefficient of variation was compared for evaluation of the homogeneity of the SI. A variety of artifacts with different magnitudes was observed. Only one of the samples, composed mainly of Pd, In, and Sb, showed no artifacts in all imaging sequences. We concluded that selection of specific dental casting alloys according to their elemental compositions could minimize the metal artifacts in MRI; however, titanium alloys currently pose a problem with respect to causing MRI artifacts.

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➡ http://jdr.sagepub.com/content/82/8/602.long

Artefacts in magnetic resonance imaging caused by dental material.

Eggers G, Rieker M, Kress B, Fiebach J, Dickhaus H, Hassfeld S.


Abstract

A common problem in computer tomography (CT) based imaging of the oral cavity is artefacts caused by dental restorations. The aim of this study was to investigate whether magnetic resonance imaging (MRI) of the oral cavity would be less affected than CT by artefacts caused by typical dental restorative alloys. In order to assess the extent of artefact generation, corresponding MRI scans of the same anatomic region with and without dental metal restorations were matched using a stereotactic frame. MRI imaging of the oral and maxillofacial region could be performed without reduction of the image quality by metallic dental restorations made from titanium, gold or amalgam. Dental restorations made from titanium, gold or amalgam did not reduce the image quality of the MRI sequence used in imaging of the oral and maxillofacial region for dental implant planning. In this respect MRI is superior to CT in implant planning.
Magnetic resonance imaging in patients with dental implants: a clinical report.

Devge C, Tjellström A, Nellström H.


Abstract

Magnetic resonance imaging is used more and more frequently as a diagnostic tool. Because high magnetic fields are used, knowledge on how these will affect implanted material and the patient is of great importance. Ferromagnetic properties of implant materials are seldom described by the manufacturer, but a doctor requesting magnetic resonance imaging of a patient must know about these properties. Not only is the composition of an alloy important, but also the size and shape of the metallic material as well as its position in the body. Implants from the Brånemark System were tested; findings indicated that the implants were not influenced when exposed to magnetic resonance imaging. The artifacts caused by the implants were minor and did not jeopardize the evaluation of the scans. However, magnet keepers attached to the implants were found to cause major artifacts and must be removed before an implant patient is referred for a magnetic resonance imaging examination.

[Artifacts induced by dental reconstruction materials: the case of titanium].

[Article in French]

Savane S, N'Dindin AC, N'Dindin GB, Kouame PA, Doyon D.


Abstract

MRI is becoming an important tool of examination of the head and neck. However, certain dental alloys cause artifacts characterized by a loss of signal surrounded by bright line and sometimes distortions. In our work, we studied artifacts caused by Titanium, metallic biomaterial used for oral implantology. Therefore, 2 experimental were investigated in a 1.5 T MR unit, with 2 sequences commonly used (SE, GRE). The investigation showed minor artefacts, without distortions. In order to minimize these "ghost images", the Titanium and its alloys should be an alternative.