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Editorial

Electromagnetic Radiation-Based Imaging Modalities May be Associated with Increased Release of Mercury from Dental Amalgam Fillings

Ghazal Mortazavi[1], Maryam Paknahad[2,3], SMJ Mortazavi[4*]

[1]*Dentist, Tangestan Health Network, Bushehr University of Medical Sciences, Bushehr, Iran*

[2]*Prevention of Oral and Dental Disease Research Center,School of Dentistry,Shiraz University of Medical Sciences,Shiraz,Iran*

[3]*Department of Oral and Maxillofacial Radiology, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran*

[4]*Ionizing and Non-ionizing Radiation Protection Research Center (INIRPRC), Shiraz University of Medical Sciences, Shiraz, Iran*

**Corresponding author: Dr. SMJ Mortazavi, Ph.D, Professor of Medical Physics Ionizing and Non-ionizing adiation Protection Research Center (INIRPRC), The Head Medical Physics & Medical Engineering Department, The Head Shiraz University of Medical Sciences(Medical Physics & Medical Engineering Department School of Medicine, Imam Hossein Square, Post Code: 7134845794 ,Shiraz, Iran), Tel: +98-711-2349332; Fax1: +98-711-2349332 Fax2: +98-711-2289113; Email: mmortazavi@sums.ac.ir*

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Abstract

Radiography and MRI are among the most efficient widely used diagnostic imaging modalities. It is now well documented that mercury even at low doses may lead to toxicity. We have previously shown that exposure to MRI or electromagnetic fields emitted by mobile phones can increase the release of mercury from dental amalgam fillings. X-ray exposure has also been linked to increased mercury release from dental amalgam fillings. Although, the increased levels found in our studies normally cannot led to toxicity, it may be a significant health risk in specific subpopulations such as pregnant women, children, people with hypersensitivity to mercury or individuals whom are rountiely exposed to above-the-background levels of electromagnetic fields (e.g. power line or radar workers). It may be concluded that the use of these imaging modalities should be limited in hypersensitive subpopulations with amalgam dental fillings.

Keywords: Imaging Modalities; MRI; X-ray; Mercury Release; Amalgam

Introduction

X-ray based radiography/radioscopy and magnetic resonance imaging (MRI) are among the most efficient widely used diagnostic imaging modalities. Dental amalgam has been used as a filling material during the last 150 years[1]. However, the use of dental amalgam is of concern because of continuous release of mercury from amalgam restorations [2]. In the present study, we have reviewed the effect of electromagnetic radiation emitted by MRI and X ray radiography on the release of mercury from dental amalgam fillings.

MRI

MRI is a noninvasive diagnostic imaging modality for diagnosis of the lesions especially in the soft tissues. This imaging modality uses static and time varying magnetic fields (MFs) as well as radiofrequency radiation (RFR) to provide tissue images through the magnetic resonance (MR) of nuclei. Dental amalgams are generally considered to be safe because of their minimal deflection in the static magnetic field. However, one of the most challenging issues is the increased mer-

cury release from amalgam filling materials after MRI. Recent studies, however, have questioned the safety of the procedure by detecting mercury release from amalgam after MRI. Mercury is a toxic element which has adverse biological effects even at low doses [3].

Over the past years, our laboratory has focused on studying the health effects of exposure to some common and/or occupational sources of electromagnetic fields such as mobile phones [4-11] and their base stations [12], mobile phone jammers [13], laptop computers [14], radars [5], dentistry cavitrons [15] and MRI [16,17]. Mortazavi et al. have previously investigated mercury release from amalgam restorations following exposure of the patients to a magnetic field of 0.23 T for 30 minutes in 30 people with amalgam restorations. They showed that magnetic fields of MRI significantly increased the mercury release from amalgam restorations [18]. Mortazavi et al. also evaluated the effect of high-field MRI of 1.5 Tesla on mercury release from dental amalgam fillings. The difference between urinary mercury in the exposed and control groups 96 hours after restoration was statistically significant [3]. Recent studies performed on either release of mercury or microleakage of amalgam after MRI confirm our findings [19,20]. However, these findings were not in line with early reports such as that published by Berglund et al. who applied magnetic fields with flux densities of 20 micro Tesla at 30 kHz to evaluate the influence of low frequency magnetic fields on the release of mercury vapor from amalgam restorations. In their study; no effects were found on the release of mercury vapor from the amalgam restorations after exposure to magnetic fields [21]. Müller-Miny et al. evaluated the amalgam-related mercury release under typical MRI conditions, separated both the static and the variable magnetic fields in a 1.5 T MR-unit. They found that in the static magnetic field group, the mercury release was between 0.5 to 2.5 ng/ml and the ratio between exposed and not exposed specimen was between 0.5 and 1.2. However, the higher release of mercury due to MRI was not statistically significant. The release of mercury in the gradient echo sequence exposed experiment ranged from 1.1 to 4.1 ng/ml. The ratio between the exposed and not exposed samples was 0.6 to 1.6 with no significant increase of mercury release after exposure [22].

X-ray

Kursun et al. have recently found a significant increase in mercury in the X-ray-exposed samples compared to those of the control group. However, they could not find a significant difference in mercury release between the MRI-exposed group and the control group [23]. It is worth mentioning that we have previously shown that this paper which reported no increased release of mercury after MRI, may have some methodological flaws [24].

Although, the increased levels found in our studies (e.g. urinary mercury levels of 20-30 μg/L compared to the 95% upper confidence limit of <20 μg/L as the reference level [17]) normally cannot lead to toxicity, it may be a significant health risk in specific subpopulations such as pregnant women, children, people with hypersensitivity to mercury or individuals whom are rountiely exposed to above-the-background levels of electromagnetic fields (e.g. power line or radar workers).

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