Effect of Mercury from Dental Amalgams on Mercury Concentration in Urine

İşin Ulukapi¹, Salih Cengiz² and Nüket Sandalli¹

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Abstract

A study was conducted to determine the mercury concentration in urine after placement of dental amalgam restorations. The 24-h urine mercury levels in 10 children with a mean age of 8 years were determined before the amalgam restorations had been placed, and after placement. The urinary mercury content was measured by the cold vapor atomic fluorescence method.

Mercury levels in the urine samples before placement of the amalgam restorations were below the detection limit, and the values obtained after placement, although detectable, were far below the limits stipulated by the World Health Organization. Under the conditions of this study, it is considered that the mercury levels released from dental amalgams are not high enough to cause any systemic toxic effect.

Introduction

Dental amalgams release small amounts of mercury in the form of metallic vapor and particulate matter¹².

In recent years, increasing concern over mercury toxicity has focused on the evaporation of mercury from amalgam restorations in the oral cavity³. Allergic reactions, headaches, concentration difficulty, multiple sclerosis, and lichenoid lesions have been suggested to result from mercury toxicity⁴⁵.

In persons with amalgam restorations, increased amounts of mercury vapor have been observed after chewing and tooth-brushing, and it is reported that the amount of mercury vapor is affected by the number of amalgam fillings and the amalgam surface area⁵⁶⁷⁸. The amount of mercury released from amalgam fillings is limited by the formation of a passive layer of corrosive products on its surface⁹⁰.

In practice, the total mercury body burden of persons with amalgam restorations, irrespective of the route of absorption, may best be assessed from measurements of mercury concentrations in their blood and urine⁴⁷.

Materials and Methods

This study was performed on 4 healthy girls and 6 healthy boys (aged 4-12 y) attending the Pedodontics Department of the Dental Faculty of Istanbul University for treatment of decayed teeth.

From all subjects, 24-h urine samples were collected before the amalgam fillings were placed. The subjects were instructed to void the urine samples into plastic containers (control group). Then, two teeth of each patient were restored with amalgam fillings (Degussa-Standalloy, Germany), having a surface area of approximately 15 mm². After this procedure, the patients were again instructed to bring their 24-h urine samples, collected after the fillings had been placed.

Mercury concentrations in the urine samples were determined by the cold vapor atomic fluorescence method (Atomic Absorption Spectrophotometer A-160 unit, Chem Tech Analytical.). This is a sensitive and accurate form of analysis, although some sample pretreatment is necessary. The method⁹⁰ is essentially that which was developed by Campe et al.⁹¹ for determination of total mercury in urine.

Calibration of the apparatus was done with standard mercury solutions containing 0.20, 0.60, 1.80

¹ Department of Pedodontics, Faculty of Dentistry, University of Istanbul, Turkey
² Faculty of Medicine, University of Istanbul, DETAM, Turkey
To whom all correspondence should be addressed: Dr. işin Ulukapi, Department of Pedodontics, Faculty of Dentistry, University of Istanbul, 34390 Çapa-Istanbul, TURKEY
To each 2-ml urine sample, 0.3 g of KMnO₄, 2 ml of conc. H₂SO₄ and 2 ml of deionized water were added, followed by dropwise addition of HONH₂Cl(25%) solution until the urine solution became colorless. The total volume was then approximately 6 ml, and 1-ml aliquots were injected into the reaction cell containing a 1-ml aliquot of stannous chloride solution, for measurement.

**Results**

In all of the urine samples collected before the amalgam fillings had been placed, the mercury levels were below the detection limit. The mercury levels in the samples after placement of the fillings are presented in Table 1.

In this study no statistical analysis was used because the mercury levels in the control group were below the detection limit.

**Discussion**

Mercury has been used for more than 2,000 years in preparations such as diuretics, antibacterial agents, laxatives, skin antiseptics, and other ointments [7].

Since the 1800s, mercury has been an important component of dental amalgams. At present, there is insufficient evidence to justify claims that mercury from amalgam restorations has an adverse effect on health.

Biologic monitoring of mercury concentrations is often done using blood and urine [4,7,10]. The World Health Organization (WHO) has recommended a health-based occupational exposure limit of 25 μg/m³. This concentration has been found to produce average concentrations of 20 μg/l in blood and 75 μg/l in urine. If one recalculates these figures for the recommended limit of 1 μg/m³ for continuous exposure of the general population, the corresponding allowable maxima are 4 μg/l for blood and 15 μg/l for urine.

In persons with amalgam restorations, average mercury concentrations have been reported to be between 0.6 and 1.9 μg/l in blood and 1.66 μg/l in urine [4,8]. These are well below the various maximum acceptable and "normal" levels given above.

In a previous study [7], the concentrations of mercury in urine were observed to rise for 24 h after amalgam placement, but returned to the pretreatment levels after 7 days.

In another investigation, morning spot samples of urine were collected from children having wide variations in the number and size of amalgam restorations placed at different dates. The results showed that the urine mercury levels were far below the minimum limit [10].

The present results are in accord with these findings; the mercury levels in 24-h urine immediately after amalgam placement were far below the minimum WHO value. However, the results for the control group in this study were not in accordance with those of other studies. This difference may be due to the eating habits of Turkish people, especially the low amount of fish consumed; mercury enters the body naturally through the environment and the food chain, as reported previously.

Finally, there is no evidence in the scientific literature that the tiny amounts of mercury that may be released from amalgam restorations cause mercury poisoning.
Conclusion

Under the conditions of this study,

1) Mercury levels in urine produced by fresh amalgam fillings are far below the minimum values stipulated by the WHO.

2) Amalgam fillings are apparently nontoxic.

References


