PostScript

LETTERS

The confounding effects of intra-oral metals in salivary biomarkers

In their Education article in the March issue (*Occup Environ Med* 2007;64:202–10), Koh and Koh interestingly propose that measurements of heavy metals (for example, lead and cadmium) in saliva may be a novel and promising approach to occupational health, revealing the patient's risk of systemic exposure to toxicants. We would like to share our experience regarding the assessment of metals in saliva matrices.^{1–3}

It is well known that intra-oral metallic dental restorations release various trace elements into saliva, including lead and cadmium.^{1–5} The metal-matrix alloy of dental amalgam fillings may contain approximately 3.4 µg/g of lead and 4.5 µg/g of cadmium (unpublished data), and fillings are therefore a potential source of these elements. However, other dental alloy restorations may also release these metals.

Dental microwear, oral corrosion and galvanic currents are considered the three fundamental factors which trigger the release of a metal into the saliva.^{1–3} The release of intra-oral metals into the saliva from dental alloy restorations may explain the apparent differences between previous studies about the use of salivary heavy metals as biomarkers (Koh and Koh).⁶

Even more importantly, a variable associated with the risk of inadvertent contamination of saliva during handling may come from wearing workers' protective gloves. Upon contact with metals during handling, metal dust and fumes can contaminate the gloves, clothing and skin of occupationally-exposed personnel. In turn, these items may come into contact with the mouth, leading to falsely elevated results in saliva measurements.

In order to assess occupational exposure to metals, other validated outcomes measures such as lead and cadmium concentrations in both blood and urine are currently available.⁷ We suggest that estimates of lead and cadmium in saliva are potentially confounded by the release of intra-oral metals and unintentional contamination, which should be taken into account.

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Authors' reply

We thank Minoia *et al* for their interest in our publication, and for suggesting that intra-oral metallic amalgams and restorations may contribute to salivary levels of heavy metals, such as mercury, lead and cadmium. While the release of mercury from amalgams is well recognised, less is known of the release of cadmium and lead.

The dissolution rate of cadmium from dental gold solder alloys in vitro is estimated to be 40 µg per mm² per year.¹ In the worst simulated oral condition of an exposed solder area of 0.5 cm², up to 2 mg of cadmium could be released into the oral cavity (0.004 µg of

cadmium per min). Considering that it takes about one minute to collect 1 ml of saliva and assuming that all of the cadmium released from the dental amalgam during that time is deposited in the sample, it would contribute only 4 µg per litre of saliva obtained. In a study of workers with exposure to cadmium, mean (standard deviation) salivary cadmium levels of 59.7 (19.2) µg/l in exposed workers, while non-exposed workers had mean salivary cadmium levels of 10.9 (0.8) µg/l.² Thus, dental amalgams may not be a major confounder of salivary cadmium levels among exposed persons, but this will require confirmation with further studies.

Similarly, there is a weak correlation between blood and saliva lead concentrations at blood lead concentrations below 300–500 µg/l,^{3–4} but the correlation is stronger for higher blood lead levels.⁵ Thus, if the release of lead from intra-oral metal restorations confounds measurement of their salivary concentrations, this is likely to occur among individuals with lower levels of lead exposure.

Finally, we agree with Minoia *et al* that contamination during sampling is potentially a major methodological issue, and did emphasise this in our paper. We would like to reiterate that environmental contamination during specimen collection can occur regardless of the specimen collected—saliva, blood or urine—and measures should be taken to minimise this.

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