Blood Testing to Determine Mercury Toxicity from Amalgam Fillings

Received……..…...9/25/00 Scientific Review……......1/11/01 IAOMT Board Review……9/27/02 Reevaluation…….	**Scientific Review Biological Support**	Approval Provisional Approval No Opinion **No Approval**

Explanation of IAOMT position: Blood values give no indication of the total mercury burden of the patient. Inhaled or absorbed mercury remains in the blood for only a short period of time before being deposited into various organs or excreted. Blood mercury levels may be good indicators of recent exposure but tell little about chronic exposure from the slow release of mercury from dental amalgam fillings

Name of Scientific Review: Blood Testing to Determine Mercury Toxicity from Amalgam Fillings

Alternative name(s) of Scientific Review: N/A

This Scientific Review is related to Dentistry and Medicine

This Scientific Review is a Procedure

Purpose of the Scientific Review: Mercury is a heavy metal and a known toxin, which is rapidly absorbed into the human body. Consequently, blood testing has been considered a means of evaluating the mercury burden in individuals.

Scientific Review History and Background: There is a growing awareness among health care practitioners and researchers that dental amalgam filings release a significant amount of mercury. Mercury makes up about 50% of the total composition of an amalgam filling in order to give the material a more fluid consistency during placement in teeth. The amalgam filling then becomes a chronic source of mercury poisoning for the individual. Enough mercury is released to cause health problems, especially in susceptible individuals. Research demonstrates that mercury vapor is continuously released from amalgam fillings in measurable quantities from the moment the fillings are placed in teeth. This mercury is inhaled, swallowed, and absorbed directly through the oral cavity. (1,2)

An indication of the mercury burden in an individual has traditionally been acquired by analyzing the mercury content of hair or by measuring the mercury levels in urine and in fecal samples. The blood has also been considered a reservoir for mercury in the body and a means of measuring mercury levels in an individual. However, the number of published reports dealing with mercury in blood is quite small when compared with those concerned with mercury in urine.

A brief description of the Scientific Review: This Scientific Review describes to the public, dentists, and physicians the problems of using blood levels of mercury to determine toxicity or body burden.

A specific description of this Scientific Review:

Facts about Mercury in Blood: Mercury is transported in the various elements of the blood before being deposited in the tissues. At the University of Rochester, Clarkson determined the uptake of mercury by whole blood, plasma, and solutions of hemoglobin to be 0.5 ug/hr/ml, 0.11ugm/ml and 1.0 ug/hr/ml respectively. (3)

After the inhalation of mercury vapor, mercury occurs in blood partly unchanged and partly oxidized. Clarkson Also found that mercury vapor initially accumulates in red blood cells (RBCs) and is transformed rapidly into plasma compartment until the ratio of mercury in RBCs to plasma is about 2:1 within 20 hours.(4) This transfer of mercury from RBCs to plasma occurs through the oxidation of elemental mercury vapor to ionic mercury via the hydrogen peroxide catalase pathway.(4,5)

Although mercury in all its forms is distributed via the blood stream to all tissues in the body, the oxidative state of mercury effects its absorptive properties. Elemental mercury diffuses easily into tissues and across cell membranes because of its lack of electrical charge, making it very lipid soluble. This form of mercury readily crosses the blood-brain and placental barriers. Ionic

mercury in the plasma is bound to plasma proteins and in the RBCs to hemoglobin. This process effectively increases the uptake rate of mercury vapor by plasma in the presence of RBCs. However, ionic mercury crosses cell membranes much slower than elemental mercury.(6,7)

Furthermore, it has been found that ionic mercury from fish is only found mainly in RBS's(8,9), whereas the elemental mercury vapor exposure, as from amalgam fillings, is almost equally distributed between plasma and RBCs(10)

Finally, mercury remains in the blood for a very short period of time. The biological half-time of mercury in RBCs and plasma is between 3-4 days.(4,11)

Normal Blood Mercury Concentration: The upper limit of levels of "normal" concentration of mercury in blood is controversial. Mercury is not a normal trace element in man, so levels will vary with occupation, diet, and geographic location. Levels accepted as "normal' in western medicine have been established by performing a blood analysis on individuals in different locations around the world, with varying results. For this reason, various references will list different normal levels of mercury in the blood.

For example, Goldwater analyzed 812 samples from 15 countries and determined that 3.0 ug Hg/100ml blood was the upper limit of normal.(12) The World health Organization in 1991 claimed that mean concentrations of total mercury in whole blood is probably in the order of 0.5-1.0 ug/100ml.(13)

Blood Research: The number of published reports dealing with mercury in blood is quite small when compared with those concerned with mercury in urine. The few studies that have investigated blood mercury levels have attempted to find a correlation between urine mercury levels and blood mercury levels. The majority of these studies found a good correlation between mercury in blood and in urine on a group basis but that no such correlation occurred with any degree of regularity in individuals. This may be due to the fact that individuals absorb, transport, metabolize, deposit, and excrete mercury at different rates due to individual genetics.(7,14,15) Present concepts of heavy metal toxicology lean heavily on binding mechanisms to explain modes of action. This means that the site of action rather than the amount of metal present may be the controlling factor in toxic reactions. It follows therefore , that quantitative determinations of metal in blood tell, at best, an incomplete story.(14)

Friberg and Vostal. in their *Mercury in the Environment* state, "There is no good biological indicator available for evaluating the risk of mercury intoxication through the inhalation of mercury vapor. Neither mercury in blood nor in urine is satisfactory. It is true that on a group basis mercury levels in blood and urine will parallel exposure, but probably mainly recent exposure. There is no evidence that the concentration in blood and urine during exposure will reflect concentrations in critical organs, and intoxications may occur at low levels of mercury in urine, while high levels are not necessarily accompanied by signs of intoxication. For evaluating recent exposure, blood and urinary mercury levels may be of importance."(16)

On the other hand, Molin, et al found a strong statistically significant relationship between plasma mercury values and both the total number of amalgam surfaces and the total surface area of the fillings. In this study, 10 healthy persons had all of their fillings removed and replaced with gold inlays. Blood and urinary levels were measured on 10 occasions during the 4-month period and a 12-month period after amalgam removal. In the immediate post removal phase, plasma mercury rose 3-4 fold, whereas urinary and erythrocyte mercury rose about 50%. These peak values declined to the pre-removal level at about 1 month. Twelve months after the removal the plasma and urinary levels were significantly reduced to 50% and 25%, respectively, of the initial values for the experimental group.(17) This shows that mercury release from amalgam fillings does contribute to the total mercury content in plasma and urine.

Conclusion: Data on mercury in the blood of humans is not extensive. Because of the short half time (approximately 15 days) of mercury in blood, blood levels are a good index of recent exposure.

No evidence has been found to support the theory that blood levels of mercury increase as the duration of the exposure increases. For this reason, using blood test to evaluate long term mercury release from dental amalgam fillings appears to have little, if any, value.

Furthermore, "normal" blood mercury levels have not been standardized, nor universally accepted. If blood mercury data were collected from patients as a diagnostic tool to determine intoxication, no clinically acceptable level is available to evaluate whether or not intoxication exist. Therefore, such testing has little relevance beyond determining the extent of an acute exposure.

Finally, blood values give no indication of the total mercury burden of the patient. Inhaled or absorbed mercury remains in the blood for only a short period of time before being deposited into various organs or excreted. Blood mercury levels may be good indicators of recent exposure but tell little about chronic exposure from the slow release of mercury from dental amalgam fillings.

Based on the current state of scientific research, blood testing as means of evaluating chronic mercury exposure from dental amalgam should **not** be a preferred procedure in standard mercury detoxification programs. However, blood testing may be an

important post removal protocol to determine the contribution the mercury fillings had on the total mercury levels and whether or not other sources (e.i. diet) of mercury need to be explored as a means of detoxification.

Manufacturer(s) & Distributors: N/A

Scientific Literature:

1. Vimy, MJ and Lorscheider, FL. Dental Amalgam Mercury Daily Dose Estimated from Intra-Oral Vapor Measurements. *J. Trace Elem. Exper. Med.* 3:111-123(1990)
2. Lorscheider, FL, et al. Mercury Exposure form "Silver" Tooth Fillings: Emerging Evidence Questions a traditional Dental Paradigm. *FASEB J.*9:504-508(1995)
3. Clarkson, TW, Gatzy, John, and Dalton, C. Studies on the Equilibration of Mercury Vapor with blood. The University of Rochester Atomic Energy Project. Jan 1961
4. Cherian,George, et al. Radioactive Mercury Distribution in Biological Fluids and Excretion in Human Subjects after Inhalation of Mercury Vapor. *Archives of Environ Health.* May/June 1978 pg 109-114
5. Hiroshi Satoh, HurshJ, and Clarkson, T. Selective Determination of Elemental Mercury in Blood and Urine Exposed to Mercury Vapor *in vitro. J of Applied Toxicology,* vol 1, no 3, 1981, pg 177-181
6. Detection and Diagnosis of Biocompatibility of Mercury. *CDA Journal* Oct 1984 pg 41
7. Mathe, H, et al. Maximum Allowable Concentrations of Mercury Compounds. Archives of Environ Health 1969:19:891-905
8. Birke,G, et al. Studies on Humans Exposed to Methyl Mercury Through Fish Consumption. *Archives of Environmental Health* 1972:25:77-91
9. Skerfving, S, Methyl Mercury Exposure: Mercury Levels in Blood and Hair and Health Status in Swedes Consuming Contaminated Fish. *Toxicology* 1974:2:3-23
10. Einarsson, K et al. Intrabronchial Aspiration of Metallic mercury. *Acta Med Scand* 1974:195:527-531
11. U.S. Environmental Protection Agency. *Mercury health Effects Update.* Aug 1984
12. Goldwater, L. Mercury: A History of Quicksilver. Baltimore, York Press,1972
13. World Health Organization. *Environmental Health Criteria 101: Methyl Mercury. 1990*
14. Goldwater, L, et al. Absorption and Excretion of Mercury in Man. *Archives of Environmental Health* 1964:9:735-741
15. Friberg, Lars, Vostal, and Jaroslov. Mercury in the Environment. CRC Press. Cleveland, 1972, pg 91
16. Friberg, Lars, Vostal, and Jaroslov. Mercury in the Environment. CRC Press. Cleveland, 1974, pg 185
17. Molin, M et al. Mercury, Selenium, and Glutathione Peroxidase Before and after Amalgam Removal in Man. Acta Odontol Scand 1990:48;189-202

Legal Aspects of this Scientific Review: N/A

Applicant Name: Sean Freiberg, DMD, AIAOMT		**Office Phone:** 403-286-9175
Mailing Address: 303, 4600 Crowchild Trail, NW		**Office FAX:** 403-286-2897
City: Calgary		**Home Phone:** 403-208-3829
State: Alberta	**Zip Code:** T3A 2L6	**Home FAX:**
Country: Canada		**e-mail:** drf@healthfirstdental.com
IAOMT Member #:		**IAOMT Chapter:** North American