Oral galvanism and Electromagnetic Fields (EMF)

factors along with mercury's high volatility and

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oral effects from amalgam fillings.

B. Windham (Editor)

Contents

1 Oral galvanism and Electromagnetic Fields (EMF): factors along with mercury's high volatility and extreme toxicity in significant exposure levels and oral effects from amalgam fillings

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Having dissimilar metals in the teeth (e.g.-amalgam, or gold and mercury, or stainless steel and mercury) causes galvanic action, electrical currents, and much higher mercury vapor levels and levels in oral tissues. (1-11, 30) The amount of mercury released into saliva has been found by large studies to be about 1.5 to 1.9 micrograms per liter for each additional amalgam filling (26). The amount of mercury released by a gold alloy bridge over amalgam over a 10 year period was measured to be approx. 101 milligrams (mg)(60% of total) or 30 micrograms (μg) per day (7), and other studies have found similar results (4). Average mercury levels in gum tissue near amalgam fillings are about 200 ppm, and are the result of flow of mercury into the mucous membrane because of galvanic currents with the mucous membrane serving as cathode and amalgam metals as anode (1-4). Concentrations of mercury in oral mucosa for a population of patients with 6 or more amalgam fillings taken during oral surgery were 20 times the level of controls (14), and levels in root tips of 41 ppm (5). Amalgam also releases significant amounts of silver, tin, and copper which also have toxic effects, with organic tin compounds formed in the body being even more neurotoxic than inorganic mercury. Amalgam containing zinc produced higher galvanic currents (3b).

Mercury and other metals accumulate in the oral cavity in fibroblasts, macrophages, and multinuclear giant cells of connective tissue, in blood vessel walls, along nerve sheath fibres, in basement-membranes of mucosal epithelium, striated muscle fibres, along collagen bundles and elastic tissue, in acini of salivary glands, and in tooth roots and jaw bones (5, 11). Such mercury including that in the commonly formed amalgam tattoos moves to other parts of the body over time in significant amounts and more rapidly than the other metals. Macrophages remove mercury by phagocytosis and the mercury moves to other parts of the body through the blood and along nerves (5). Most dentists are not aware of the main source of amalgam tattoos, oral galvanism, where electric currents caused by mixed metals in the mouth take the metals into the gums and oral mucosa, accumulating at the base of teeth with large fillings or metal crowns over amalgam base (1-5). Such metals are documented to cause local and systemic lesions and health effects, which usually recover after removal of the amalgam tattoo by surgery (5fghi). The high levels of accumulated mercury also are dispersed to other parts of the body.

Amalgam fillings produce electrical currents which increase mercury vapor release and may have other harmful effects (1-14, 38). These currents are measured in micro amps, with some measured at over 5 micro amps. A clinic with considerable experience dealing with problems of oral galvanism

found that currents over 5 microamps usually cause significant health problems such as headaches, migraines, dizzyness, nausea, etc. which was eliminated when amalgam fillings were replaced.. The central nervous system operates on signals in the range of nano-amps, which is 1000 times less than a micro amp (38). The metals also have electrical potentials which can be measured in millivolts (mV). One clinical study determined that electrical potential differences of over 50 mV were pathological (9b), causing galvanism, leukoplakia, oral lichen planus, or toxic or allergic reactions to restorations (9a, 1-8). In most subjects with amalgam fillings, potential differences of more than 50 mV are present between restorations (9a), with potentials ranging from -417 mV to +150 mV. Negative potentials may be more pathological than positive ones. The average potential for metal crowns and bridges was 154 mV and for brace brackets was 71 mV (9a).

Negatively charged fillings or crowns push electrons into the oral cavity since saliva is a good electrolyte and cause higher mercury vapor losses (11, 1-6). Patients with autoimmune conditions like MS, or epilepsy, depression, etc. are often found to have a lot of high negative current fillings (11). The Huggins total dental revision (TDR) protocol calls for teeth with the highest negative charge to be replaced first (11). Other protocols for amalgam removal are available from international dental associations like IAOMT (45) and mercury poisoned patients organizations like DAMS (46). For these reasons it is important that no new gold dental work be placed in the mouth until at least 6 months after replacement.

Some studies have also found persons with chronic exposure to electromagnetic fields (EMF), microwaves, or MRIs to have higher levels of mercury exposure and excretion (33c, 38, 48). The post MRI saliva mercury levels for a sample of patients was on average 31% higher after MRI than before (48). Such fields are known to induce current in metals and would increase the effects of galvanism. EMF is also documented in animal and human studies to cause cellular calcium efflux and affect calcium homeostasis (39, 40), which may be a factor in the reduction of melatonin levels caused by EMF exposure in animal and human studies (40, 41). In studies on chicks this had significant adverse effects on viability of embryos and chicks. Melatonin is known to be protective against mercury and free radical activity, as well as regulating the circadian rhythm cycle and sleep cycle. EMF exposure lowers melatonin production and disrupts the sleep cycle (41). Since mercury is known to have some of these same effects and EMF exposure increases mercury exposure in those with amalgam, it is not clear in humans the relative role of the causality mechanisms. Occupational exposure to higher levels of EMF have also been found in many studies to result in much higher risk of chronic degenerative neurological conditions such as ALS (42), Alzheimer's Disease (43, 33c), as well as Leukemia and Cancer (44, 47, 33c). Pooled analysis of 3,247 cases of childhood leukemia in Europe, North America and New Zealand published last year found increased rate of leukemia in those with high EMF exposures, over 4 microgauss (47a). Studies in UK found that one in 200 British children are exposed to high levels of electromagnetic radiation in the home and that this could be doubling their risk of leukaemia (47). Since EMF causes increased mercury exposure in those with amalgam, and mercury is also known to cause these conditions, again it is not clear the relative importance of the factors since the studies were not controlled for mercury levels or number of amalgam fillings.

Studies have shown that mercury in the gums such as from root caps for root canaled teeth or "amalgam tattoos" result in chronic inflammation, in addition to migration to other parts of the body (5, 10, 15). Mercury, tin, and silver from amalgam fillings can be seen in the tissues as amalgam "tattoos", which have been found to accumulate in the oral mucosa as granules along collagen bundles, blood vessels, nerve sheaths, elastic fibers, membranes, striated muscle fibers, and acini of minor salivary glands (5, 10). Dark granules are also present intracellularly within macrophasges, multinucleated giant cells, endothelial cells, and fibroblasts. There is in most cases chronic inflammatory response or macrophagic reaction the the metals (5, 30), usually in the form of a foreign body granuloma with multinucleated giant cells of the foreign body and Langhans types. Mercury levels are often over 1000 ppm near a gold cap on an amalgam filling due to higher currents when gold is in contact with amalgam (8, 9c, 11, 12, 13). Similar levels as high as 5000 ppm

have been found by German oral surgeons in jaw bone under large fillings or gold crowns (37). These levels are among the highest levels ever measured in tissues of living organisms, exceeding the highest levels found in chronically exposed chloralkali workers, those who died in Minamata, or animals that died from mercury poisoning (29). The FDA Action Level for mercury in fish or food is 1 ppm. Warnings are given at 0.5 ppm, and the EPA health criterion level is 0.3 ppm. Some of the oral effects of mercury that have been documented include gingivitis, oral lesions, pain and discomfort, burning mouth, "metal mouth", chronic inflammatory response, leukoplakia, lichen planus, autoimmune response, oral cancer, trigeminal neuralgia, allergic reactions, etc.(4, 5, 9a, 11, 15, 19, 22, 23, 25, 26, 30-35)

The component mix in amalgams has also been found to be an important factor in mercury vapor emissions. The level of mercury and copper released from high copper amalgam is as much as 50 times that of low copper amalgams (16). Studies have consistently found modern high copper non gamma-two amalgams have greater release of mercury vapor than conventional silver amalgams (17-21). While the non gamma-two amalgams were developed to be less corrosive and less prone to marginal fractures than conventional silver amalgams, they have been found to be unstable in a different mechanism when subjected to wear/polishing/ chewing/brushing: they form droplets of mercury on the surface of the amalgams (3, 23, 24). This has been found to be a factor in the much higher release of mercury vapor by the modern non gamma-two amalgams. Recent studies have concluded that because of the high mercury release levels of modern amalgams, mercury levels higher than Government health guidelines are being transferred to the lungs, blood, brain, CNS, kidneys, liver, etc. of large numbers of people with amalgam fillings and widespread neurological, immune system, and endocrine system effects are occuring (25, 26, 27, 28).

Dental amalgam fillings have been documented by medical lab tests and Government agencies to be the *largest source*[1] of mercury in most people who have amalgam fillings (49). Amalgam fillings are often also the largest source of organic mercury in people who have amalgam fillings, since bacteria in the mouth and intestines converts other forms of mercury to methyl mercury (31c, 49). A 2009 study found that inorganic mercury levels in people have been increasing rapidly in recent years (50b). It used data from the U.S. Centers for Disease Control and Prevention's National Health Nutrition Examination Survey (NHANES) finding that while inorganic mercury was detected in the blood of 2 percent of women aged 18 to 49 in the 1999-2000 NHANES survey, that level rose to 30 percent of women by 2005-2006. Surveys in all states using hair tests have found dangerous levels of mercury in an average of 22% of the population, with over 30% in some states like Florida and New York (50c).

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[6]**Internet:** "http://www.greenpeace.org/raw/content/usa/press/reports/mercury-report.pdf".