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THE ROAD TO VICTORY
Michael F. Ziff, D.D.S.

After years of struggle and travail, victory is in sight!! Unmistakable signs of the demise of the mercury amalgam filling are readily apparent. As this will be a prime topic in the months to come, it is imperative that we summarize and are familiar with the progress that has been made in all areas of the controversy.

THE RELEASE OF MERCURY FROM DENTAL AMALGAM:
In 1926 Professor Alfred E. Stock scientifically demonstrated that mercury was not "locked into" dental amalgam. Since then, numerous studies, particularly those done at the University of Iowa Dental School in the 1970's and 1980's by Dr. Carl Svare and others, have confirmed the release of mercury from dental amalgam during function. Even the American Dental Association has finally acknowledged this fact (J.A.D.A., Vol. 109. Sept 1984). Recent studies (1985) done in New Zealand and Sweden have demonstrated that toothbrushing and hot fluids will increase the release of mercury from amalgam.

THE AMOUNT OF MERCURY RELEASED:
The new position of the American Dental Association is that not enough mercury is released to be harmful to patients unless they are hypersensitive to mercury. This publicly stated position is dangerously speculative. If the A.D.A. were ever required to substantiate that position in a court of law they would be in dire jeopardy since, to date, no research has been done that determines the total amount of mercury released or its pathological effect on the patient. The A.D.A. position cannot be scientifically defended.

The research of Dr. Murray Vimy has just been published in the August 1985 issue of Journal of Dental Research. Utilization of the "Vimy Vapor Test" will permit practitioners to calculate a weekly dose of mercury vapor from dental amalgam and relate that dose to current World Health Organization standards.

Some champions of amalgam maintain that the release of mercury from amalgam in toxic amounts is impossible because the amalgam fillings would supposedly all be rapidly disintegrating when they reached the 40% mercury level. This argument is ludicrous and irresponsible. For the sake of argument let's assume, very liberally and graciously, that the N.I.O.S.H. TLV for mercury is valid; 0.05 mgHg/cubic meter as a time weighted average over a forty hour work week. Simple arithmetic calculation reveals that the amount of mercury required to provide that Reading for a period of one year is 4.68 milligrams. The textbook on dental materials by Craig and Associates, states that the mass of amalgam used for the average filling is 780 mg of alloy plus mercury. The average filling would therefore contain 600 mg of mercury if initially 43% and up to 780 mg if initially 50%. At a loss of 4.68 mg per year (the N.I.O.S.H. toxic dose), it would take one average amalgam 17.09 to 55.56 YEARS to be reduced to the 40% mercury level (520 mg of mercury).
DOES THE MERCURY RELEASED FROM AMALGAM ENTER THE PATIENTS BODY?
It would be hard to conceive of circumstances whereby it wouldn't. However, there is no need for assumption. The two autopsy studies done in Europe in 1984 by Schiele and associates and Nylander and associates, establish and confirm that levels of mercury in the brain correlate to the number and surfaces of amalgam fillings present in subjects.

IS MERCURY FROM DENTAL AMALGAM READILY ELIMINATED FROM THE BODY?
At an amalgam controversy debate in Denver, Colorado in March of 1985 an eminent amalgam champion declared to over two hundred dentists that the mercury exposure from dental amalgam is eliminated from the patient's body (believe it or not, audio tapes of this debate are being distributed). This expert (?) offered no scientific evidence to support his bold (and foolhardy) declaration, which is diametrically contradictory to the results of the 1984 Schiele and Nylander autopsy studies.

In addition, scientific research has documented that a single dose of mercury is eliminated from the body in three different phases with half-times of 1) a few days (35% of the dose), 2) 30 days (50% of the dose), and 3) 100 days (15% of the dose). Amalgam victims are subjected to multiple doses every day. The contribution to body burden of mercury from amalgam fillings will be slowly cumulative over a period of time.

THE TOXICITY OF MERCURY TO HUMANS:
The established Threshold Limit Values (TLV's) for mercury are based only on the appearance of signs of neurological damage as an end point (ie-'tremors'). By their own admission no consideration is given to pathological damage to other organs and systems. For example, recent research at the University of Pennsylvania has determined that mercury exposure at environmental levels of mercury inhibits the normal protective function of human white blood cells.

If TLV's are to be utilized at all (a highly questionable posture) the Environmental Protection Agency (EPA) TLV of 0.001 mg Hg/cubic meter would be more logical. Mercury exposure from amalgam fillings is not limited to a 40 hour work week.

In 1972 renowned mercury experts Friberg and Vostal stated that there probably is no toxic threshold for mercury: They felt that the toxic effect of mercury was a linear dose-effect relationship.

TOXICITY OR "HYPERSENSITIVITY"?
The American Dental Association has publically declared that there is no reason to remove amalgam fillings unless the patient is hypersensitive to mercury. This position has ominous implications.

Does this mean that the ADA recommends removal of amalgams on all patients who are hypersensitive to mercury? Is the private practitioner negligent and liable if amalgams are placed or replaced in a hypersensitive patient? Is the practitioner who places amalgams defenseless and at risk because the ADA has publically absolved itself of responsibility? For personal protection, must every patient now be
evaluated for hypersensitivity?

The ADA states that less than 1% of the population is hypersensitive to mercury; yet they have not produced one single scientific study to substantiate that figure. The scientific research indicates that the percentage is considerably higher, at least 10% and possibly much higher. This is a considerable number of people.

Is "hypersensitivity" the same as "toxicity"? Dorland's Medical dictionary defines hypersensitivity as "a state of altered reactivity in which the body reacts with an exaggerated immune response to a foreign agent." Sooner or later the A.D.A. will have to admit the obvious, that toxicity and hypersensitivity are separate issues. The true issue is TOXICITY, not HYPERSENSITIVITY, and more importantly MICROMERCURIALISM and CHRONIC MERCURIALISM. If the A.D.A. representatives don't read the textbooks and learn the basics they are going to look very foolish, indeed.

DIAGNOSTIC PROCEDURES:
The National Institute of Dental Research and the American Dental Association have now publically acknowledged the position found in the scientific literature since the early 1960's: that measurements of mercury in the blood and urine do not correlate to the body burden or toxic effects of mercury. The limited and highly questionable "proof" of dental amalgam safety has now been totally negated. The value of blood and urine mercury measurements is also severely limited by the critical technical requirements for prevention of the rapid vaporization of mercury from samples. These two factors cast severe doubt on the A.D.A.'s "Mercury Testing Program". It is totally worthless for determination of individual risk.

The value of mercury levels in hair samples is still debatable, but its true significance has yet to be determined. Electrical currents and potentials generated from metal fillings can definitely be demonstrated. However, conditions in the oral cavity present numerous critical complicating factors: inhomogenous alloys, varying electrolytes, polarization, multiple currents, and multiple potential and resistance factors. Accurate measurements and correlations between restorations are impossible with current technology. The measurements can be used for demonstration and research protocols, but utilization of these measurements for diagnostic purposes can not be justified.

The value of skin patch testing has been effectively eliminated. Oral cavity exposure is not comparable to skin exposure. Toxic effects are not comparable to allergic response (hypersensitivity). Patch testing does not even evaluate systemic hypersensitive response (T-cell response), and the patch test protocol itself is highly debatable. The fact that the American Dental Association and N.I.D.R., supposedly scientific organizations, recommend referral to qualified physicians for patch testing generates suspicion as to the credibility and scientific qualifications of the leadership of these organizations.
Hopefully, scientific groups will soon develop enzyme or immune system tests for differential diagnosis of mercury poisoning. Until then we are left with two preliminary screening techniques: symptomatology and mercury vapor measurements. The new "Vimy Vapor Test" will hopefully provide us with an acceptable protocol for determining the contribution to body burden of mercury vapor released from amalgams.

PERIODONTAL DISEASE:

A recent article printed in Volume II, Issue 5 of the Bio-Probe Newsletter has factually delineated the scientific evidence listed in dental and medical textbooks, references, and research studies indicting mercury and/or dental amalgams as etiologic factors in periodontal disease. The references are credible, there is no refuting scientific evidence; and the pathological conditions are readily demonstrable. Amalgam apologists can neither refute this position nor claim that it is not within the purview of dental therapy.

In addition, every dentist is aware that the preponderance of dental malpractice lawsuits are related to periodontal disease. The revelation of this article contributes new significance to the treatment protocols for periodontal disease and the routine placement of dental amalgam fillings.

It may be advisable for the anti-amalgam movement to redirect its emphasis. The presence of periodontal disease can be utilized as a defendable rationale for amalgam removal, while efforts continue to determine systemic effects and diagnostic techniques. The credibility of the documentation supporting the rationale in such a treatment plan should eliminate any negative consideration of such plans by insurance carriers.

THE INTERNATIONAL ACADEMY OF ORAL MEDICINE AND TOXICOLOGY

A great many individuals have labored intensely and courageously for many years in attempting to convince the world that dental amalgam fillings are harmful to patients. The formation in October of 1984 of a multidisciplined, scientifically oriented organization, the I.A.O.M. T., represents a dramatic alteration in the complexion of the Third Amalgam War. This Academy is working in close cooperation with Bio-Probe, Inc., which is accumulating and disseminating pertinent scientific documentation, to unify anti-amalgam forces and provide scientific foundation for the movement.

Their joint efforts have, in a very short time period, succeeded in carrying the attack to the pro-amalgam establishment and placing a great deal of inescapable pressure upon them. Upon formal challenge, the A.D.A. has been unable to provide primary biocompatibility studies supporting their public position that amalgam fillings are not harmful to patients. The inadequacies and inconsistencies of the N.I.D.R./A.D.A. Workshop on Biocompatibility of Metals in Dentistry have been formally reviewed and revealed. This information has been presented to the A.D.A., dental schools, and appropriate government agencies. Efforts in the scientific and research areas are continuing and proliferating. So far, the two organizations have concentrated their efforts in the professional and governmental arenas.
THE PRO-AMALGAM ESTABLISHMENT

In January of 1984 the American Dental Association still maintained that combining the mercury with the other metals in dental amalgam rendered its toxic properties harmless. In July of 1984 the A.D.A. was obliged to alter their position, after the NIDR/ADA Workshop on Biocompatibility of Metals in Dentistry. The A.D.A. News printed that the "Workshop Reaffirms the Safety of Dental Amalgam". However, the Workshop transcripts and the September 1984 issue of J.A.D.A. printed that mercury is released from dental amalgam fillings during function and that measurements of mercury in the blood and urine do not correlate to toxic effects. In addition, the Workshop failed to present any primary biocompatibility studies demonstrating the harmlessness of dental amalgam to patients.

The new A.D.A. position is that the amount of mercury released is not enough to be harmful to patients unless they are hypersensitive (allergic) to mercury and that these patients should be referred to a qualified physician for evaluation. This latter position is designed to protect the A.D.A. and effectively leaves the private practitioner alone on a very thin limb. Any individual cases of patients harmed by dental amalgam are now the sole responsibility, and liability, of the practitioner. "These are the rare hypersensitive patients that we warned you to look out for", so to speak.

The official overall strategy appears to be that of an "Establishment Stonewall" (i.e.-"Amalgamgate!"). Do everything possible to hide the issue from the press and public; ignore challenges for scientific documentation; keep the rank and file of the dental profession uninformed; shrug off or attempt to discredit anti-amalgam activists; develop and approve posterior amalgam substitutes as fast as possible; and close your eyes and hope that the issue doesn't explode totally before these substitutes are approved. Their unwillingness to confront the issue is a certain sign of weakness and uncertainty if not outright fear.

THE NEAR FUTURE - ROAD TO VICTORY!

Research: New research results are being published almost monthly; so far all of it has been favorable to the anti-amalgam position. The release of mercury from amalgam as a result of toothbrushing and hot fluids has now been scientifically established. Low (environmental exposure) levels of mercury inhibit the protective function of human white blood cells. New studies are indicting dental nickel and beryllium alloys. In progress studies are demonstrating the harmful effect of amalgams on the immune system. The scientific evidence is inexorably mounting.

Meanwhile, pro-amalgam forces are still, incredibly, relying on studies utilizing blood and urine mercury measurements. This is not only unsupported, but contradictory to their own public statements!

Amalgam Alternative: The A.D.A. has already approved FULFIL for use in posterior deciduous teeth. New posterior resin products are appearing on the market virtually every month; the manufacturing companies obviously see the handwriting on the wall. The obvious A.D.A. strategy would be to start approving posterior composites for
use in posterior adult teeth as soon as possible. Conversely, the
dental use of amalgam is steadily diminishing. At last estimate,
the use of composites is now 55% of the restorative market, up from
28% in 1981. Posterior composite use is rapidly becoming "usual and
customary practice".

MEDICO - LEGAL:
In March of 1984 a debate on dental amalgam was held in Denver,
Colorado. The debate moderator, an attorney, informed the two hundred
or so dentists in attendance of "Negligent Misrepresentation". He
defined it as "giving false information or failing to exercise
reasonable care in determining the accuracy of the information you are
giving. The information you give must accurately reflect the
scientific documentation and available data." Audio tapes of this
debate are being distributed. Because of this public revelation any
individual, organization, or institution that claims that amalgam
fillings are not harmful to patients is in legal jeopardy. That
position is directly contradictory to the documented scientific
literature. Even the dental and medical textbooks and reference
books state that mercury and/or dental amalgam can cause periodontal
pathology.

The medico-legal position of anti-amalgam individuals is
constantly improving. The medico-legal position of amalgam advocates
is constantly worsening; the worse possible circumstance for them
would be a court case. In a court case, they would be forced to admit
they have no scientific documentation for their defense. Their
"expert witnesses" would be subject to the doctrine of "Negligent
Misrepresentation".

A class action type suit is, as yet, financially prohibitive.

THE MEDIA:
At least six national media outlets have stories on the amalgam
controversy under consideration. For whatever reason, they are
holding back. A dramatic breakthrough of some nature would most
likely stimulate them. Until then, we can do nothing more than
to continue to strengthen our case and keep up the pressure on the
establishment. Some day a key individual with enough courage or
public conscience to buck the establishment will cause the story to
break in a national news outlet. When that occurs, it is essential
that we all respond properly! Stick to the scientific facts; state
knowledge and positions that we can scientifically defend; do not make
statements or claims that are unsupportable.

STRATEGY:
Approximately 100,000 dentists in the United States alone are
still placing amalgam fillings, simply because they believe in the
establishment (The A.D.A. and components, the dental schools, and the
government agencies). This means that at least 3/4 million mercury
fillings are placed in american mouths every single working day. We
have an obligation to these people; we simply CANNOT allow this to
continue or allow amalgam to die a slow death! We must increase our
efforts! We should:
1. ALTER OUR APPROACH: Let's utilize the periodontal connection as our primary rationale for amalgam removal. It is demonstrable; it is defendable; it is dental! Utilize this when submitting for insurance coverage. Anyone who disagrees or objects will have to oppose the textbooks and scientific documentation, not us. This key issue will also dramatically serve to bring the entire controversy to a focus and encourage additional exposure, particularly to the profession.

2. CONTINUE INVESTIGATION: Research and documentation is essential. The I.A.O.M.T. has already begun investigation in many areas of concern, including vapor exposure, the thyroid gland, the immune system, Type II diabetes, periodontal disease, and alternative techniques and materials.

3. BUILD STRENGTH THROUGH UNITY: We will be more effective when we speak in unified numbers. Join and help support either the International Academy of Oral Medicine and Toxicology (I.A.O.M.T.) or the Toxic Element Research Foundation (T.E.R.F.). Help these groups with your efforts, even if minimal. Actively encourage others to do the same.

4. BECOME EXPERT: Do not be satisfied with mere competence. Learn all that you can. Subscribe to the best information sources, and read them. Learn and improve by attending meetings whenever possible. If nothing else, you owe this much to your patients and to your own future.

5. KEEP UP THE PRESSURE: Maintain communications with the A.D.A. and its components, the dental schools, politicians and governmental agencies. The periodontal connection should make them particularly uncomfortable.

6. BE READY: Arm ourselves with knowledge and facts. Be ready to answer the media confidently and factually when they finally decide to face the issue. Be ready to assist the profession when they come to us for advice and assistance. Most importantly, be ready to serve our patients and the public health expertly.

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REVIEW/ABSTRACTS

Fourteen dental casting alloys were analyzed for release of nickel and beryllium into acidic salivary solutions in vitro. Corrosion rates of varying pH levels and time in solution were calculated through the 120 day level, and the possible significance of these rates to allergic reactions or other health hazards were postulated. Alloys that contained both nickel and beryllium showed a potentiated leakage effect, with beryllium dissolution several orders of magnitude greater than expected.

NICKEL: The prevalence of nickel sensitivity in the general population has been estimated to range from 5.7% to 17.5%. It has been shown that nickel release is proportionate to the acidity of the
environment. "The link between the solubilizing capacity of the forearm compared with the complex chemistry of the oral cavity is not strong; therefore, patch testing is not thought to be the most effective way to detect sensitivity to metals."

BERYLLIUM: "Beryllium and its salts are toxic and should be handled with the greatest of care" was quoted from the CRC Handbook. The authors also quoted from the Merck Index thusly "death may result from short exposure to incredibly low concentrations of beryllium and its salts. Pulmonary granulomatous disease may appear in three months to fifteen years, often after short exposure to low concentrations."

Beryllium fluoride (BeF₂), a severe poison and carcinogen, is freely soluble in water and is listed as one of the most toxic compounds of beryllium. Polished medical implants have been implicated as carcinogenic through the release of nickel, beryllium, and chromium.

Even negating the effects of transient acidity through food and drinks, the bacterial plaque adhering to the surface of restorations bathes the surface in a constant acidic solution presenting a formidable source of dissolution.

The authors described intracellular chemical reactions ending in "beryllium hydroxide, which is insoluble and unlikely to be cleared by the body, much the same as mercury". "Even the lowest levels would be expected to have a cumulative effect (also similar to mercury) in terms of chronic exposure."


"Respiratory Burst" describes the striking increase in non-mitochondrial oxidative metabolism in polymorphonuclear leukocyte white blood cells (PMN's) for the formation of reactive oxygen species that participate in the destruction of microorganisms.

This study demonstrated that low levels of mercuric ions (10-100 nanograms per milliliter) profoundly inhibited the PMN respiratory burst. The inhibition was immediate and no pre-incubation of the cells with mercury was required. The mercury inhibition was not readily reversed when cells were washed and retested. It was noted that the effects of mercuric ions were not merely due to cell death.

The authors stated that "The observation that inhibition occurs rapidly even at low mercury concentrations suggests that environmental exposure to this cation may compromise the normal protective function of human PMN's."

The experiment found that divalent silver and copper ions also severely inhibited the respiratory burst. Mercury, silver and copper were far more inhibitory than either cadmium or lead at all concentrations. Malamud D., Dietrich S.A. and Shapiro I.M. Dept. of Biochemistry, School of Dent Med, Univ of Penn. Low levels of mercury inhibit the respiratory burst in human polymorphonuclear leukocytes. Biochem Biophys Res Commun, 128 (3): 1145-1151, 1985.
Experiments were conducted to ascertain if exposure of goldfish (Carassius auratus) to L-cysteine, L-glutathione, calcium pantothenate, pantethine, or coenzyme A modifies the acute toxicity of mercuric and methylmercuric chlorides. It was found that exposure to L-cysteine, together with a mercurial, protected all the fish despite substantial accumulations of mercury by them. Coenzyme A was effective against methylmercury when exposure was simultaneous with the mercurial, while it was effective against mercuric chloride when exposure was 24 hr before exposure to the mercurial. These observations are consistent with our hypothesis that at least part of the toxic action of mercury is due to its combination with coenzyme A. Sharma D.C. and Davis P.S. Studies in search of modifiers of the toxicity of mercurials and speculations on its biochemical mechanism. Biochem Pharmacol, 30 (22):3105-3107, 1981.

A number of studies have already shown that mercury is an allergen. Since the dental community is constantly being exposed to mercury through the preparation of silver amalgams, the objective of this study was to see if the rate of hypersensitivity to mercury increased as students progressed through the dental curriculum. A total of 171 students (51 freshmen, 52 sophomores, 37 juniors, and 31 seniors) volunteered for the project. Each student filled out a questionnaire and information was collected on all previous exposures to mercury and the presence of other allergies. Two telfa pads were placed on a piece of waterproof adhesive tape. One of the pads had been treated with 0.5 ml of a 0.1% solution of HgCl₂. The other pad, which served as a negative control, was treated with 0.5 ml of water. The tape containing the pads was placed on the student's forearm. After 48 hours, the patch was removed. The only positive reactions that were seen were simple contact dermatitis and these cutaneous reactions were only seen under the pad containing HgCl₂. Fifty-four students had a positive reaction, and the rates of mercury hypersensitivity from freshmen to seniors were 31%, 27%, 32% and 39% respectively. Through the use of chi-square analysis, it was found that these differences were not significant. From the questionnaires it was found that the average number of alloy restorations in the students with positive reactions was 9.5. The average for the negative reacting group was 7.7. By using the chi-square test it was found that there was a significant correlation between the number of amalgams and the incidence of mercury hypersensitivity. A similar analysis showed that there was no significant relationship between a previous history of allergies and a positive reaction to HgCl₂. Miller E.G., Perry W.L. and Wagner M.J. Prevalence of mercury hypersensitivity in dental students. J Dent Res, 64 (Spec Issue Abstracts) Abstract 1472, page 338, March 1985.

Previous studies have shown that high volume evacuation, water spray, and the use of rubber dam minimize the patient's exposure to mercury vapor. Investigators have also documented that seafood intake, alcohol consumption, and exposure to cigarette smoke alter the level of mercury in mouth air. Twenty pediatric dental patients (ages 5 to
12) with low environmental exposure to mercury, low fish intake, and no ethanol intake were randomly divided into two groups. The mouth air mercury levels were compared before and after the insertion of an amalgam restoration (experimental group) or a composite restoration (control group). Atomic absorption spectrophotometry (Model 1235, Lab. Data Control) was utilized to measure the mercury levels at the following intervals: one week pre-operative resting and chewing; immediate pre-operative resting and chewing; immediate post-operative resting and chewing; and one week post-operative resting and chewing. The pre-operative mercury vapor levels of all twenty subjects was zero. The mouth air mercury vapor level rose following amalgam insertion. In this experimental group, both the post-operative resting ($\bar{X} = 0.28$ ng/cc) and chewing ($\bar{X} = 0.26$ ng/cc) vapor levels reflected this change. At one week the post-operative resting level of mercury vapor had returned to zero in all ten subjects. Chewing, however, still elicited a rise in mercury mouth air levels ($\bar{X} = 0.20$ ng/cc). The data were analyzed using an ANOVA and Scheffe's test, (P<0.01).


This paper reports the results of measurements of mercury vapor concentrations in the exhaled breath of a test population of 167 adults who all had silver-tin amalgam fillings. Breath samples from a sub-group of 106 persons were taken both before and after brushing their teeth for one minute with a soft tooth brush and a commercial toothpaste.

The large increases in mercury release caused by brushing the teeth also occurs after any form of even mild abrasion of the tooth surface such as eating a meal or chewing gum.

The enhanced values of mercury concentrations in the breath, obtained by brushing the teeth, decreased slowly over the following hour to about one third their peak value.


Intra-oral air was analyzed for mercury (Hg) vapor concentration in 46 subjects, 35 of whom had dental amalgam restorations. Measurements were made with a Jerome Hg detector both before and ten minutes after chewing stimulation. Subjects with dental amalgams had unstimulated Hg vapor concentrations that were nine times greater than basal levels in control subjects with no amalgams. Chewing stimulation in subjects with amalgams increased their Hg concentration six-fold over unstimulated Hg levels, or a 54-fold increase over levels observed in
control subjects. Larger concentrations of Hg measured in intra-oral air than those reported in expired air were attributed to the rate and direction of air passage across amalgam surfaces. There were significant correlations between Hg vapor released into intra-oral air after chewing stimulation and the number and type of amalgam restorations. It is concluded that intra-oral air is a reliable physiological indicator of Hg released from dental amalgam that may reflect a major source of chronic Hg exposure. Vimy M.J. and Lorscheider F.L. Intra-oral Air Mercury Released from Dental Amalgam. J Dent Res, 64: 1069-1071, August 1985.

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Serial measurements of Hg concentration in intra-oral air were made during and after chewing stimulation in 35 subjects with occlusal amalgam restorations. Hg concentrations remained elevated during 30 min of continuous chewing and declined slowly over 90 min after cessation of chewing. By curve-fitting and integration analysis of data during these time periods (including corrections for respiratory volume, retention rate of inspired Hg, oral-to-nasal breathing ratios, and consumption of three meals and three snacks per day), we calculated that all subjects received an average daily Hg dose of approximately 20 ug. Subjects with 12 or more occlusal amalgam surfaces were estimated to receive a daily Hg dose of 29 ug, whereas in subjects with four or fewer occlusal amalgam surfaces, the dose was 9 ug. These Hg dosages from dental amalgam were as much as 18-fold the allowable daily limits established by some countries for Hg exposure from all sources in the environment. The results demonstrate that the amount of elemental Hg released from dental amalgam exceeds or comprises a major percentage of internationally accepted threshold limit values for environmental Hg exposure. It is concluded that dental amalgam Hg makes a major contribution to total daily dose. Vimy M.J. and Lorscheider F.L. Serial Measurements of Intra-oral Air Mercury: Estimation of Daily Dose from Dental Amalgam. J Dent Res, 64: 1072-1075, August 1985.

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EDITORIAL

AN OPEN LETTER TO THE U.S. SURGEON GENERAL, U.S. SECRETARY OF HEALTH AND HUMAN SERVICES AND THE PRESIDENT OF THE AMERICAN MEDICAL ASSOCIATION

Sam Ziff

The scientific studies reported in this issue of Bio-Probe require the immediate attention and thoughtful consideration of the leaders of the medical community most responsible for dictating the future direction of scientific medical research both in substance and in funding.

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The release of mercury from dental amalgam fillings is an established scientific fact that transcends any parochial interests of the American Dental Association or The National Institute of Dental Research. It can no longer be viewed as simply a component of the arguments being exchanged between the pro-amalgam and anti-amalgam advocates. It must be viewed in its true historical importance. For 150 years, the dental profession, with the blessings of the medical establishment, have been installing one of the most toxic substances known to man in the mouths of millions of innocent patients, without ever once proving its safety or harmlessness to the human organism.

Hundreds of the world's leading scientists, researchers, academicians, and medical specialists have devoted great time and effort in establishing "safe" exposure limits to mercury from environmental and industrial sources. Not once in all of these deliberations throughout the world has consideration been given to the additional mercury contribution to body burden provided from dental amalgam fillings. Yet now we have a proliferation of studies, confirming evidence presented in 1926, that the mercury escaping from dental amalgam presents a serious health consideration.

The data presented by Vimy and Lorschieder clearly indicate that, for the majority of people in the world with amalgam fillings in their teeth, exceeding cumulative dosages considered to be toxic would be the rule rather than the exception. This exposure potential is corroborated by most of the other studies reflected in this issue, which in reality may be just the tip of the iceberg. A study soon to be published in Sweden will reveal releases of mercury related to drinking hot fluids that are comparable to those recorded by chewing. There are a multitude of other conditions that have to be investigated to really determine the extent of mercury release from amalgams during any 24 hour period. For example, do carbonated phosphorous based beverages cause an increased release? Does hot smoke from a cigarette drawn into the mouth cause an increased release? Do changes of pH related to different liquids being ingested cause increased release? In addition to those factors, there are those related to increased release of mercury associated with the presence of different metals in the oral cavity.

It is no longer a hypothesis that mercury is released from dental amalgam. What is a hypothesis at this time is what bearing does this cumulative assault of mercury have on the human organisms? Autopsy studies of accident victims done in Germany and Sweden scientifically established a relationship between mercury content of the brain and kidney and the number and surfaces of amalgam fillings. Preliminary work at the Univ. of Southern California has shown a depression of the immune system by mercury and nickel. Results from the Univ. of Pennsylvania show an inhibition of function in white blood cells related to extremely low environmental exposures to mercury. It is known that mercury inhibits various primary enzyme systems of the body. It has also been demonstrated that mercury can cause DNA strand breakage, abnormal mitoses, induce chromosomal aberrations and genetic effects. There is growing evidence involving mercury in neurological and pathological defects in newborns and causal relationships and biochemical pathways have been indicated for cardiovascular problems.
The list could go on and on.

It is imperative that the medical profession now validate its position scientifically that mercury escaping from dental amalgam has no causal effect to any of the signs, symptoms, or disease states contained in the literature and indicated as attributable only to environmental or industrial exposure.

There is another side to this issue that is important to our nation as a whole and that is the potential to dramatically reduce the costs of medical care. For example, in a recent study published in the Am J Clinical Pathology by Nolan et al., the 1981 costs for performing various laboratory tests to determine thyroid function was a staggering $972,240,000. Not once in the 29,140,000 tests that were done was any consideration given to mercury and its relationship to thyroid function. Since Trachtenberg’s monograph in 1969, scientific evidence has been available showing a causal relationship between mercury and thyroid dysfunction. Of the 29 million plus tests conducted not one epidemiological consideration relating the presence of amalgams to thyroid function was performed. The same can be said for every other area of medical diagnosis. Not once in 150 years has mercury from dental amalgam been seriously considered by the medical profession as an etiological factor. HASN’T THE TIME ARRIVED TO DO SO?

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MATERIALS

EVALUATION OF GLASS IONOMER CEMENTS AS LINERS UNDER POSTERIOR COMPOSITE RESTORATIONS

Michael W. Hardee, D.M.D.

Post placement tooth sensitivity has been a continuing, perplexing problem for operators using posterior composites in place of amalgam. The sensitivity may be due to thermal shock of the pulp from use of a curing light with too high a light exit temperature, irritation of the pulp due to caries removal (a common problem with use of either amalgam or composite, but usually reversible), irritation to the freshly cut dentinal tubules from either bonding agent or acid etching gel, or perhaps, due to infection in the smear layer. Open contacts or worn occlusal surfaces can be repaired readily in composites, but a chronically irritated pulp can not.

Our approach to avoiding post placement sensitivity has been to cover all freshly cut dentinal surfaces completely with a glass ionomer liner as soon after tooth preparation as possible. Glass ionomers are equivalent to ZOE in cell toxicity and pulpal inflammatory response, even when applied over exposures or in very deep cavities. In our practice we place a calcium hydroxide liner under the glass ionomer only if an indirect or direct pulp cap is required; calcium hydroxide is not used routinely, even in deep cavities. The glass ionomer bonds to the dentin and protects the odontoblastic processes.
from insult by either acid or bonding agent. After setting, any ionomer that may have flowed over the DEJ onto enamel is removed easily using the same high speed bur used to make the preparation, and the glass ionomer liner is then etched along with the enamel periphery of the preparation and dentin bonding agent and composite placed. No special precautions with the acid etch gel, or (alcohol containing) bonding agents are required because the dentin is protected. It is absolutely necessary to allow the liner to set until hard before etching, and to protect the liner from moisture while setting. We have found that placing cotton rolls to the lingual and buccal of the lined teeth, then having the patient also close lightly on a cotton roll works well.

When using glass ionomer liner we normally note negligible or no post operative sensitivity. Significant post operative sensitivity has been reduced to an incidence of less than 5%.

Until this year, no glass ionomers designed to be used as liners were commercially available, forcing operators to use a thicker or thinner mix of an available glass ionomer cement or restorative. Ketac-Bond and GC Lining Cement are now readily available, and have been evaluated, along with Fuji Type II and Chem-Fil restoratives, summarized in the following table:

<table>
<thead>
<tr>
<th>Product</th>
<th>Mixing Time</th>
<th>Working Time</th>
<th>Setting Time</th>
<th>Handling Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC Lining Cement</td>
<td>15 sec.</td>
<td>75 sec.</td>
<td>5 min.</td>
<td>Flows readily from Dycal applicator to dentin, allowing accurate placement. Ideal working and setting times.</td>
</tr>
<tr>
<td>Ketac-Bond</td>
<td>15 sec.</td>
<td>30 sec.</td>
<td>4 min.</td>
<td>Thicker than GC Lining Cement, does not flow as readily. Working time too short.</td>
</tr>
<tr>
<td>Ketac-Cem</td>
<td>30 sec.</td>
<td>3 min.</td>
<td>8 min.</td>
<td>Mix 1 scoop powder to 2 drops liquid. Flows as well as GC Lining Cement. Bright white color and long setting time are disadvantages.</td>
</tr>
<tr>
<td>Fuji Ionomer Type II</td>
<td>15 sec.</td>
<td>45 sec.</td>
<td>8 min.</td>
<td>Mix 1 scoop powder to 2 drops liquid. Flows as readily as Ketac-Bond.</td>
</tr>
<tr>
<td>Chem-Fil</td>
<td>15 sec.</td>
<td>1 min.</td>
<td>6 min.</td>
<td>Mix 1 scoop powder to 2 drops liquid. Flows as readily as Ketac-Bond.</td>
</tr>
</tbody>
</table>

Ketac-Cem when mixed according to package directions is too thin to be used as a liner; it must be mixed as noted. Conversely, Fuji
Ionomer Type II and Chem-Fil are too thick to flow properly and must be mixed thinner than directed. Only GC Lining Cement and Ketac-Bond are radiopaque.

GC Lining Cement and Ketac-Bond are the only commercially available glass ionomers formulated to be used as liners, though the other products could be used so if desired. We use GC Lining Cement under every posterior composite we place, and recommend its use highly. No attempt is made at present to remove the smear layer before placing the liner, as recommended by Dr. Vimy; however, we are investigating this point and shall report findings in a future paper.

REFERENCES

CASE HISTORIES

A 68 year old white female presented on 6/17/85 with a complaint of nine years duration of feeling a sensation of electric current along the lateral borders of her tongue. She stated that the problem began when a dentist replaced a defective amalgam filling on #14. Over a period of two days her tongue swelled to almost twice normal size, became reddened, and the sensation of current began. It was hard for her to swallow or talk and she often had to stick her tongue out to avoid having it touch her fillings, which intensified the feeling of current. The dentist redid the MO filling on #14 to no avail. Physicians and dentists she consulted could neither explain her problem or offer treatment. Over a period of three years her tongue gradually returned to normal size, though the uncomfortable feeling of current down both sides of her tongue continued. Examination showed 29 surfaces of amalgam only. After having the patient chew gum for 10 minutes, the Jerome analyzer measured an intra-oral Hg concentration of .135 mg/m³. We recommended replacement of all amalgam fillings with posterior composite, accompanied by a regimen of oral Vitamin C and L-cysteine. Over a period of a month all amalgams were replaced by quadrants with "Status" posterior composite (Healthco). All teeth were lined with GC glass ionomer liner and light cured Scotchbond was used as bonding agent. The last amalgams were replaced on 7/15/85, at which time the patient noted that the sensation of electric current had lessened by 50%. By 8/1/85, the patient reported that the current sensation had completely disappeared. We believe this case to be particularly significant because it demonstrated the presence of uncomfortable intra-oral currents with only amalgam present.