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**Comments of Boyd E. Haley, Ph.D.
To Amalgam Presentation to Dental Board by
Florida Dental Association
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The following is my comments on the content and specific statements made in the Sept. 29th Florida Dental Board where the FDA presented "Amalgam Related Material" to support their proposed rule. Please feel free to share it with whomever you wish and especially the Florida Dental Board (FDA). Sincerely, Boyd Haley

First, related to the presentation by Dr. Lynn regarding analysis of the "poll" of Florida dentists. Her conclusions are well presented in the text but anyone with good sense and knowledge of the amalgam controversy would look at this data differently. I am not a pollster but I know this area is fraught with problems that lead to misconceptions. For example, it is well known that the FDA and ADA look down on any dentist practicing "mercury free dentistry" and may try to take their means of living away---note the rule being discussed in support of this contention. Therefore, any dentist inclined against dental amalgam use would not likely participate in such a potentially self-incriminating survey due to fear of impending FDA action against them. Perhaps this is why only 12.6% of the dentists choose to participate leaving 87.4% choosing not to express their feelings. Most professional groups support their central organizations better than this. In spite of the low 12.6% total response the poll analysis presented the conclusion on page 4, line 24 that 82% of the dentists were against amalgam removal. This is really 82% of 12.6% or 10.3% of Florida dentists and does not represent a majority opinion at all. They listed on 16 dentists as having no opinion whereas 87.4% plus these 16 choose not to express an opinion. This is a case of the old Disraeli line of liars, damned liars and statisticians. In fact, the FDA does not have a majority of dentists agreeing with their position. In my opinion they appear to have been successful in scaring off those dentists who would disagree.

With regards to statements made by Dr. Baratz. First, to be an esteemed academic as claimed one should hold an academic position and publish articles in refereed journals on his subject of expertise. I have been unable to find a single research article on mercury or amalgams or about anything authored by Dr. Baratz. I further could not find any source of academic appointments in tenure leading positions. With my personal knowledge of numerous outstanding and productive academic research scientists available to the FDA for consultation I am somewhat perplexed that they would select someone with such weak credentials---unless they were searching for someone who would adamantly support their preconceived position of amalgams being totally safe. Dr. Baratz is evidently well known for taking that position. Finally, statements made by Dr. Baratz concerning amalgams and chemistry in general are so pathetic that they almost defy sensible analysis. I WOULD CHALLENGE THE FDA TO TRY TO GET THE DEPARTMENT CHAIRS OF CHEMISTRY AT THE UNIVERSITY OF FLORIDA

AND FLORIDA STATE UNIVERSITY TO AGREE WITH DR. BARATZ'S COMMENTS REGARDING THE CHEMISTRY OF AMALGAMS AND MERCURY. However, knowing this is unlikely I will deal as best I can with Dr. Baratz's statements one at a time in order of presentation.

Page 6, line 27-28. Dr. Baratz has no published basis for making this statement. Absence of proof is not proof of absence. How can Dr. Baratz say that a patient on a kidney dialysis program is not further injured by additional mercury (a potent kidney toxicant) exposure from their amalgams? I don't think such a study has ever been undertaken. When exposing a person to years of a chronic level of toxic mercury it is the responsibility of the pro-amalgam group to prove it does no harm, not vice-versa. Can Dr. Baratz or the FDA confirm that the 22,000-fold increased mercury levels in the hearts of inter-city young men who die of Idiopathic Dilated Cardiomyopathy did not come from dental amalgams? {*Frustaci, A., Magnavita, N., Chimenti, C., Caldarulo, M., Sabbioni, E., Pietra, R., Cellini, C., Possati, G. F. and Maseri, A. Marked Elevation of Myocardial Trace Elements in Idiopathic Dilated Cardiomyopathy Compared With Secondary Dysfunction. J. of the American College Cardiology v33(6) 1578-1583, 1999,*}

Page 6, lines 31-32. One grain of standard sucrose does not weigh near one milligram. Therefore his visual aid is totally misleading and indicates that he has not, or does not, remember experiments where weighing small amounts was involved.

Page 6, lines 37-41. Sodium metal when added to water burns violently, but it does not explode when added to a glass of water. I have done this as a demonstration so I know the results first-hand. No one would be killed or even injured unless they touched the burning metallic sodium. Yes, chlorine gas is toxic and is a man-made material (as is metallic sodium) that does not exist naturally. Dr. Baratz wants to claim that metallic sodium and chlorine gas are toxic but become non-toxic on conversion to a compound, sodium chloride, and therefore, mercury in an amalgam is not toxic because it is surrounded by other (toxic) metals that he feels produces something that is not mercury. This is banal.

Reactivity and biological compatibility is the essence of the amalgam issue. Human blood contains about 140 millimolar chloride anion and 124 millimolar sodium cation. These ions are not toxic because they are not very reactive with biomolecules. These ions are used to perform many biological functions necessary for life, including maintaining the ionic gradient and electrical potential across cell membranes. However, mercury is not found to serve any useful purpose in human tissues and is a well known inhibitor of many enzymes, including the enzyme that transports sodium across cell membranes. In contrast to sodium cation, mercury cation, produced from mercury vapor by a blood enzyme, is very reactive and inhibits almost every biological pathway or enzyme driven function in man. To compare amalgam material to sodium chloride in the manner Dr. Baratz has chosen to reveals a total misunderstanding of chemistry and biochemistry of heavy metal toxicity.

Page 6 line 42 to page 7 line 2. Since all of the metal components of amalgam are basic metallic elements with no charge how can someone make the inept statement that there is no mercury in amalgams. It is an "element" and the fact that elements cannot be broken down or changed is a basic tenant of chemistry. The metals in amalgams have no net charge and therefore form only metallic bonds. Mercury is a liquid at room temperature and quite volatile because it forms weak metallic bonds with itself. This makes mercury unlike all other metals. The metallic bonds formed between mercury and other metals in amalgams are stronger and a solid phase is produced---but the bonds between mercury and, say silver, are weaker than silver-silver metal bonds and therefore break easier releasing elemental mercury vapor at a regular rate. This is why you can heat a gold ring covered with mercury and rapidly make it gold again and why dimes made silvery with mercury soon resort to their old form. The bottom line is that inclusion of mercury into an amalgam reduces its vapor pressure but it does not reduce it to the point that mercury cannot be significantly emitted.

Dr. Baratz states that if you detect traces of mercury from amalgams it is because that material has been decomposed by heat and friction. How does he explain the observations of the release of 43.5 micrograms mercury per cm² surface area per day for two years straight in a test tube without additional heat and no friction? {*Chew, C. L., Soh, G., Lee, A. S. and Yeoh, T. S. Long-term Dissolution of Mercury from a Non-Mercury-Releasing Amalgam. Clinical Preventive Dentistry 13(3): 5-7, May-June (1991).*} Bottom line is that it is quite easy to demonstrate mercury release from a dental amalgam. I suggest the FDA not believe either Dr. Baratz or myself but instead make 20-30 amalgams and send them to the state universities in Florida and have them determine how long a single amalgam must be in a gallon of water before the water is considered unsafe to drink by OSHA or EPA standards. Then the FDA can then make a decent decision on the mercury release and toxicity of amalgams using data from an unbiased source.

Page 7, lines 10-13. Sodium chloride intake is necessary for life. Mercury is toxic to every type of cell. Dr. Baratz's comparison amalgams to sodium chloride is ridiculous. Amino acids contain carbon, hydrogen and nitrogen and so does cyanide but the difference is how these molecules react in the body---one is a food and the other a lethal toxin. Amalgams release mercury and other metal ions and solutions in which amalgams are soaked are cytotoxic! {*Wataha, J. C., Nakajima, H., Hanks, C. T., and Okabe, T. Correlation of Cytotoxicity with Element Release from Mercury and Gallium-based Dental Alloys in vitro. Dental Materials 10(5) 298-303, Sept. (1994)*}

Page 7, lines 15-18. Yes, everything is toxic if an overdose is obtained---that is common sense. However, mercury has no food or biological function and is toxic at concentrations much lower than even most other toxicants. Low levels of mercury have been shown to inhibit the same enzymes/proteins that are found inhibited in Alzheimer's diseased brain. {*Pendergrass, J.C. and Haley, B.E. Mercury-EDTA Complex Specifically Blocks Brain □-Tubulin-GTP Interactions: Similarity to Observations in Alzheimer's Disease. pp98-105 in Status Quo and Perspective of Amalgam and Other Dental Materials (International Symposium Proceedings ed. by L. T. Friberg and G. N.*

Schrauzer) Georg Thieme Verlag, Stuttgart-New York (1995). Pendergrass, J. C., Haley, B.E., Vimy, M. J., Winfield, S.A. and Lorscheider, F.L. Mercury Vapor Inhalation Inhibits Binding of GTP to Tubulin in Rat Brain: Similarity to a Molecular Lesion in Alzheimer's Disease Brain. Neurotoxicology 18(2), 315-324 (1997). Pendergrass, J.C. and Haley, B.E. Inhibition of Brain Tubulin-Guanosine 5'-Triphosphate Interactions by Mercury: Similarity to Observations in Alzheimer's Diseased Brain. In Metal Ions in Biological Systems V34, pp 461-478. Mercury and Its Effects on Environment and Biology, Chapter 16. Edited by H. Sigel and A. Sigel. Marcel Dekker, Inc. 270 Madison Ave., N.Y., N.Y. 10016 (1996)}

Later research with neurons in culture nanomolar (10^{-9} M) levels of mercury caused cell destruction and formation of three of the widely accepted diagnostic hallmarks of Alzheimer's disease. { *Olivieri, G., Brack, Ch., Muller-Spahn, F., Stahelin, H.B., Herrmann, M., Renard, P; Brockhaus, M. and Hock, C. Mercury Induces Cell Cytotoxicity and Oxidative Stress and Increases β -amyloid Secretion and Tau Phosphorylation in SHSY5Y Neuroblastoma Cells. J. Neurochemistry 74, 231-231, 2000. Leong, CCW, Syed, N.I., and Lorscheider, F.L. Retrograde Degeneration of Neurite Membrane Structural Integrity and Formation of Neurofibrillary Tangles at Nerve Growth Cones Following In Vitro Exposure to Mercury. NeuroReports 12 (4):733-737, 2001.* } Therefore, being unnecessarily exposed to continuous low doses of mercury for scores of years is an unhealthy situation. Does the FDA operate with the mantra of allowing itself to do this and eliminate any disagreement by posturing that no one has proven mercury toxic when indeed this has been done over and over. Due to the overall difficulty and complexity there is not one epidemiological study showing any major negative effects of mercury from amalgams, but there are none showing it to be safe either. With all of the data on animal cell culture studies showing mercury toxicity showing concern and eliminating all long-term exposures to mercury is justified.

Page 7 lines 15-34. This paragraph should convince everyone that Dr. Baratz is way off base. I had to replace all of the mercury thermometers in the teaching labs in our department of chemistry because of the OSHA/EPA restrictions where the spill of one thermometer could create a toxic in-building situation and the possible wash-out into the sewage stream caused an unacceptable environmental hazard. Dr. Baratz seems unaware of the long-term affects of mercury accumulation. Sure, he could ingest liquid mercury a single time and walk away but how many industrial workers have been seriously injured by less severe but continuous mercury exposures? Also, if he did ingest liquid mercury then he could pay a severe price later on in his life but he doesn't seem to know this. Why does he think the government has outlawed the sale of mercury thermometers to the general public?

In this paragraph Dr. Baratz states that mercury is not absorbed from the gut. This is totally incorrect. Mercury vapor is rapidly absorbed into all hydrophobic areas of the body. Where is the publication to support his absurd contention? He is further incorrect in his statement that the amount that comes off of an amalgam is equivalent to the amount you get every day by breathing air, drinking water and eating food. In a 1998 NIH study on 1,127 US military personnel it was shown that the blood/urine mercury levels were

much higher in individuals with dental amalgams and the amount of mercury was correlated with the number of amalgams surfaces. The average amalgam bearer had 4.5 times the urine mercury level of individuals who were amalgam free. { *Kingman, A., Albertini, T. and Brown, L.J. Mercury Concentrations in Urine and Whole Blood Associated with Amalgam Exposure in a US Military Population. J. of Dental Research v77(3): 461-471, 1998.* }

Dr. Baratz states that even the most ardent anti-amalgamist have virtually the same amount of mercury in their bodies as does the members of the Florida Board of Dentistry. That would be true only if all of them are free of amalgams. In a published report removing amalgam fillings dropped the level of mercury in the urine in the patients by about 5-fold at a subsequent date. { *Begerow, J., Zander, D., Freier, I. And Dunemann, L. Long-term Mercury Excretion in Urine after Removal of Amalgam Fillings. Int. Arch. Occup. Environ. Health v66 (3), 209-212, 1994.* }

Neither Dr. Baratz nor I have the right to make sweeping statements without providing the scientific literature on the subject that backs up our statements. Under adjudication many of his statements, now on record, such as given on page 7 line 19, "So to say that dental amalgam has mercury in it is false. It has what used to be mercury." will provide a feast for the opposing lawyers. I am very surprised that Dr. Baratz has chosen to pass himself off as an amalgam expert with no publications in the area and this is compounded by what appears to be total ignorance of the relevant literature.

Page 8 lines 1 to 10. My comment is that the EPA and OSHA government units don't think the amount of mercury released from amalgams is safe. If indeed the groups listed by Dr. Baratz say amalgams are safe (are amalgams listed on the Food and Drug Administration list of safe dental materials?) where are the scientific studies that back their claims. Who represents the NIH and says amalgams are safe? I challenge Dr. Baratz to find a single research article where experimental protocols are used that provide proof of safety of dental amalgams. It is easy to compose a "committee mainly pro-amalgam dentists" and have them proclaim amalgams safe, but have them show the relevant basic research that proves this is another thing. Does he really have publications from the Multiple Sclerosis and Alzheimer's Associations that claim amalgams are safe? I would really like to see him produce these documents.

Page 8, line 30. Keeping or bringing science into the dental profession is my goal also. This means both Dr. Baratz and I have to back our statements with refereed scientific publications, not wild, unjustified claims or opinions. I would like to challenge Dr. Baratz to produce the research papers that back his many claims.