

DENTAL AMALGAM

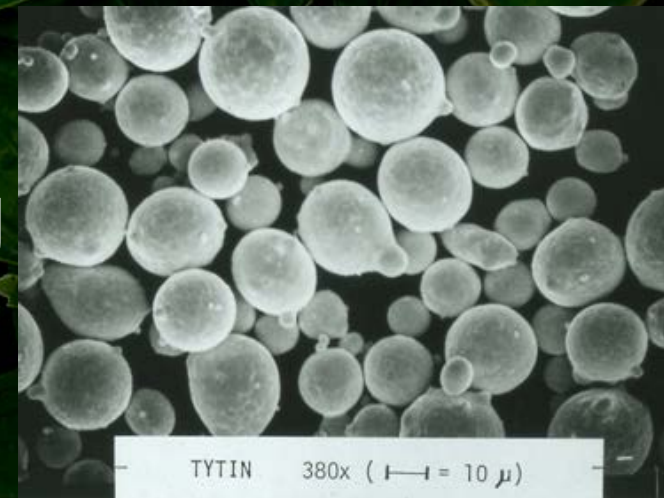
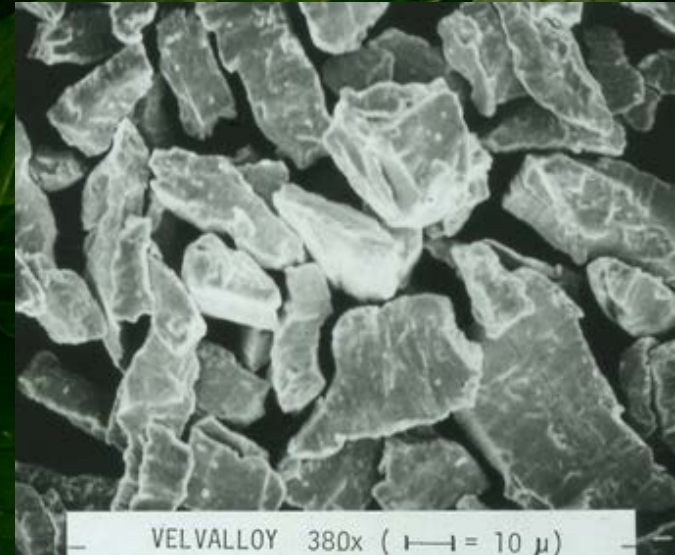
**Presented to: Immunology Devices Panel
of the Medical Devices
Advisory Committee, FDA**

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Dental amalgam alloy

- Particles to be mixed with mercury
 - Silver
 - Tin
 - Copper
 - High-Cu-content (~14%)
 - Zinc (?)
- Alloy mixed with ~ 40% Hg
- **NOT copper amalgam**
 - 70% Hg – 30% Cu



DENTAL AMALGAM SETTING REACTION

- Conversion to condition in the mouth
- Most reaction occurs within minutes
 - 95% in 24 hours
- $\text{Ag}_3\text{Sn} + \text{Hg} \rightarrow \text{Ag}_3\text{Sn} + \text{Ag}_2\text{Hg}_3 + \text{Sn}_8\text{Hg}$
- $\gamma(\text{original particle}) \rightarrow \gamma(\text{unreacted}) + \gamma_1(\text{matrix}) + \gamma_2(\text{matrix})$

Globules on surface

- Bjorklund, 2019 and Fredin, 1988

- Identifies droplets on surface
- Discusses Cu-amalgam

- These do occur early in setting reaction

- EDAX analysis

- Ag_2Hg_3
- γ_1 crystal matrix

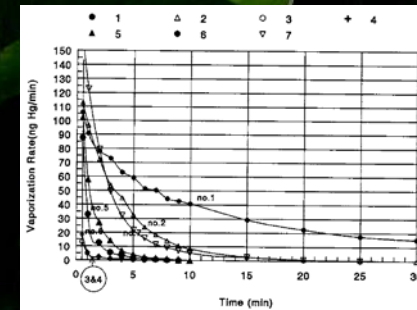
- NOT free Hg

Amalbon A, Nurell S, Rodvall W. *Malacium in Dentists, dental nurses, and brain tumours.* British Medical Journal 292:662, March 8, 1986.



Hg Loss from Dental Amalgams

- Ferracane, 1995 and Mahler, 1994
 - Lab measure of Hg loss from grinding.
- Svara, 1981 and Vimy, 1985, and Lorscheider, 1991, and Aronsson 1989
 - Measure of Hg Vapor exhaled air
- Extrapolating those data to clinical exposures would **imply ~20% of 1 amalgam would disappear in 10 years.**



Does heat increase Hg loss from amalgam?

- Image of amalgam dipped in hot water and photographed with IR.



H₂O and Hg both absorb in similar wavelengths.

Therefore, image of water vapor.

Does heat increase Hg loss from amalgam?

- Dispersalloy stored at various temperatures for 1 week.

| Storage Temp (°C) | Hg content (%) |
|-------------------|----------------|
| 22 | 39.76 - 40.27 |
| 37 | 39.74 - 41.16 |
| 60 | 40.81 - 41.78 |

- At 60°C there is no increase in the release of Hg from amalgam.

Dental Amalgams in Oral Condition

- 30 – 20 year old amalgams
- Many still in patient mouth 20 years after photo.
- 45 year old amalgams at time of photo
 - Placed by Dr. Miles Markley



These would not exist from the estimated body burdens extrapolated from Hg loss data.

Suggested Immune Effects

- **Summers et al, 1993**
 - **On mice**
 - **Suggested Hg or Ag could stimulate mouse immune system and autoimmune induction**
 - **Not confirmed our repeated in the literature.**
- **Eggleston, 1984**
 - **Claimed effect on T-cells**
 - **All values were normal**

Lichen Planus

- **There are many references (120+) that attempt to associate amalgam with lichenoid lesions.**
- **Many find an association with such restorations, but cannot eliminate alternative etiologies.**
- **Many such articles find NO relationship with dental amalgams.**

Possible Nephrotoxicity

- Hg can cause nephrotoxicity in higher concentrations.
- No correlation between amalgams and nephrotoxicity
 - Ye, 2009 and de Burbure, 2005

Brain Levels of Hg vs Amalgams

- **Eggleston, 1987**
 - **Statistical problems with study**
- **Nylander, 1987**
 - **Found correlation in small sample**
 - **Later recanted and concluded no hazard**
- **Ahlbom, 1986**
 - **Suggested correlation of glioblastomas with dental profession**

Multiple Sclerosis Accusation

- **No correlation between amalgams and multiple sclerosis or tumors**
 - **Alter, 1962**
 - **Clausen 1993**
 - **McGrother, 1999**
 - **Bangsi 1998**
 - **Rodvall 1998**

Methyl Mercury

- **Strep mutans can convert Hg to MethylHg.**
 - Heintze, 1983
- **Some association of blood levels of Hg and MeHg with amalgams, but more with age factor; but no health effects noted.**
 - Yin, 2012
- **No association with any teratogenic effect.**
 - Larsson, 1992

Summary for Patients

- **RCT on children found no effect of dental amalgam restorations**
 - 7 year study
 - Lauterbach, 2008
- **Multidisciplinary examination of patients with illness attributed to dental fillings found no “amalgam disease”**
 - Langsworth, 2002
- **Multitude of clinical investigations have not supported toxic effects of dental amalgam.**

Dental Office Personnel

- **Early study found MethylHg in blood of dentists**
 - Cross, 1978
- **Several 1980 articles suggested a subclinical neurological effect of Hg.**
 - Ship, 1983
 - Shapiro, 1982
- **Office Hg hygiene has much improved since then.**
- **Pre-capsulated dental amalgam alloy with Hg is greatest safety improvement.**



Environmental Impact

- Potential for waste water contamination with Hg.
 - Drummond, 2003
- Amalgam separators
 - ADA has ISO spec 11143:2008
 - Federal EPA requirement by July 14, 2017.



Minamata Convention on Mercury

- **Annex A recommendations for dental amalgam (9 measures):**
 - (iii) Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration**
 - (iv) Promoting research and development of quality mercury-free materials for dental restoration**
 - (v) Encouraging representative professional organizations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices**

Addressing Minimata measures

- **Glass/Resin Composite restorative materials**
 - Approaching equivalence in prognosis, but not yet
 - Monomers, catalysts, etc. pose other potential health risks
- **Ceramic crowns**
 - More expensive
 - More tooth reduction
- **Schools are teaching these restorative techniques.**

From my mouth:



To the panel members:

Thank you for your attention.

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