

Mercury Quantification

*Research to Quantify Mercury Emissions
from Dental Amalgam in Crematoria*

Project Results

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Work Plan

Pilot Project:

Goal 1: Quantify surfaces of mercury-containing dental amalgam restorations in teeth of Minnesotans born between 1934 and 1950 (aged 63 to 79 – one standard deviation from average age of cremation = 71)

- § **Task A:** Review 1000 dental records in U of M* School of Dentistry (based on sample size calculation)
- § **Task B:** Examine 100 donors in U of M Anatomy Bequest Program (whole body donation for professional training)
- § **Task C:** Evaluate the amount of dental amalgam under molar and premolar (bicuspid) crowns

*University of Minnesota

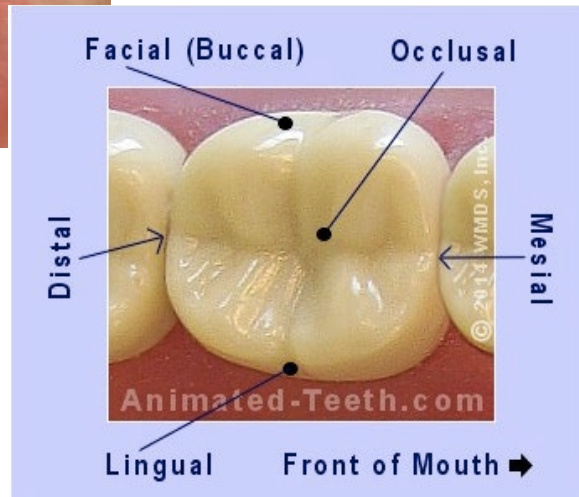


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Surfaces of Dental Amalgam



article.wn.com



www.animated-teeth.com



www.identalhub.com



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Charting

AxiUmÔ Dental Chart Screen Cap

The screenshot displays a dental charting interface. At the top, there are two rows of numbers representing dental codes: 3 2 3, 4 2 3, 2 2 3, 3 2 4, 3 2 3, 2 2 2, 3 2 3, 3 1 3, 2 2 2, 3 2 3, 3 2 3, 3 1 4, 3 3 3, 4 2 3, 3 5 7, 3 2 3, 3 2 3, 3 2 4, 3 2 3, 2 2 2, 2 2 3, 3 2 2, 2 2 3, 3 2 3, 4 3 3, 3 2 3, 3 2 3, 3 2 4. Below these are labels P 1 through P 16. The main chart area shows a grid of tooth icons with various colors (green, orange, grey) and patterns (diagonal lines, solid colors). A sidebar on the right contains 'Alerts', 'Problems', 'Current Medicat', '***Medication', 'Trazodone, F', 'Other Drug, C', and '***Forms***'. At the bottom, there are more rows of numbers: 3 3 4, 4 4 4, 3 2 4, 4 2 2, 4 2 3, 3 2 2, 2 2 2, 2 2 3, 2 2 2, 3 2 4, 3 2 3, 3 2 4, 4 3 3, 3 3 3, 4 3 3, 4 3 4, 4 2 3, 3 2 4, 3 2 4, 3 1 3, 3 1 3, 3 1 2, 3 1 3, 3 2 3, 3 2 3, 3 2 3, 4 2 3, 3 3 3.

Research ID #	Zip Code	Gender	Month/Year Birth
1683	55407	F	03/1949
Surfaces of Amalgam			
	Molars	Premolars	Anterior Teeth
Maxillary Teeth	8	4	2
Mandibular Teeth	0	6	0
Crowns			
	Molars	Premolars	Anterior Teeth
Maxillary Teeth	0	2	0
Mandibular Teeth	4	0	0



Dental Amalgam

Composition: Dispersalloy[®] Physical Description

Elemental Mercury* & Metals

Silver	69%
Tin	18%
Copper	12%
Zinc	1%

***45-50% by weight**



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Results

Task A: Dental records 1000 subjects

Age			
Mean	Std Dev	Minimum	Maximum
70.865	4.326	63.054	79.000
Gender			
	Percent	Cumulative Frequency	Cumulative Percent
Female			
475	47.50	475	47.5
Male			
525	52.50	1000	100.00



Results

Subjects: (n = 1000)

Total number of teeth evaluated: 23,088

125 subjects (12.5%) had no dental amalgam

17 had no teeth (1.7% edentulous)

59 (5.9%) subjects were missing one **complete**
arch of teeth (maxillary or mandibular teeth)



Results: Surfaces of Dental Amalgam

n = 1000 subjects

Tooth Type	Surfaces Amalgam	Weight/Surface (g) ¹	Weight Amalgam (g)	Content Mercury @45% (g)
Non-molars	3523	0.2543	895.89	403.1
Mandibular molars	1727	0.4426	764.37	343.9
Maxillary molars	2151	0.3380	727.03	327.1
Total:	7401		2387.30	1074.28

¹Adegbembo AO, Watson PA, and S Rokni. Estimating the Weight of Dental Amalgam Restorations J Can Dent Assoc. 2004 Jan;70(1):30.



Charting: Crowns

AxiUm[®] Dental Chart Screen Cap

3 2 3		4 2 3	2 2 3	3 2 4	3 2 3	2 2 2	3 2 3	3 1 3	2 2 2	3 2 3	3 2 3	3 1 4	3 3 3	4 2 3	PD(F) - 04/21/2014
3 5 7		3 2 3	3 2 3	3 2 4	3 2 3	2 2 2	2 2 3	3 2 2	2 2 3	3 2 3	4 3 3	3 2 3	3 2 3	3 2 4	PD(L) - 04/21/2014
P 1	2	P 3	4	P 5	6	7	8	9	10	11	P 12	P 13	14	P 15	16
32	P 31	P 30	P 29	P 28	P 27	26	25	24	23	P 22	21	P 20	P 19	18	17
	3 3 4	4 4 4	3 2 4	4 2 2	4 2 3	3 2 2	2 2 2	2 2 3	2 2 2	3 2 4	3 2 3	3 2 4	4 3 3	3 3 3	PD(
	4 3 3	4 3 4	4 2 3	3 2 4	3 2 4	3 1 3	3 1 3	3 1 2	3 1 3	3 2 3	3 2 3	3 2 3	4 2 3	3 3 3	PD(



BEFORE



AFTER

These are full crowns. Before shows old failing amalgam restorations.

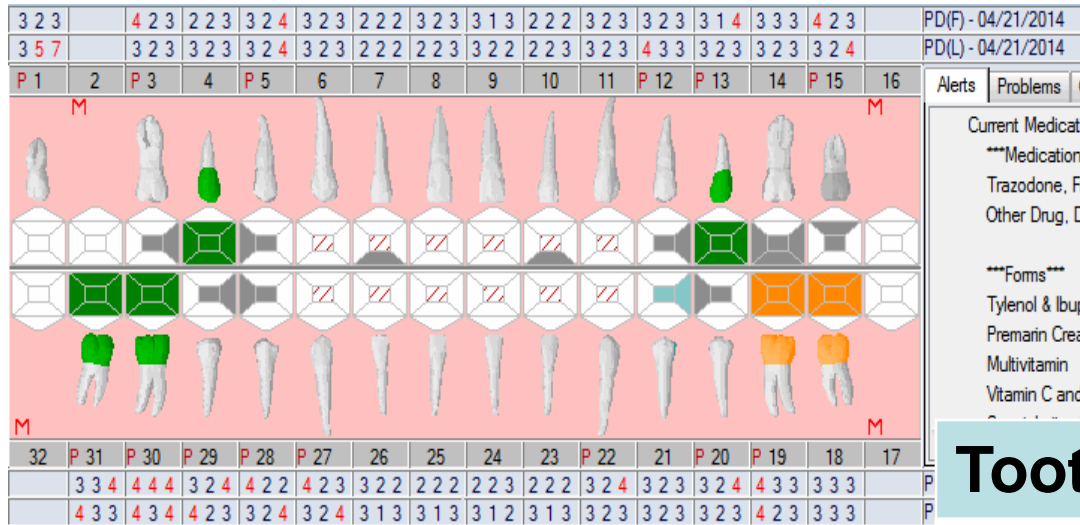
www.darrylsmithdds.com



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Results: Number of Crowns

AxiUmÔ Dental Chart Screen Cap



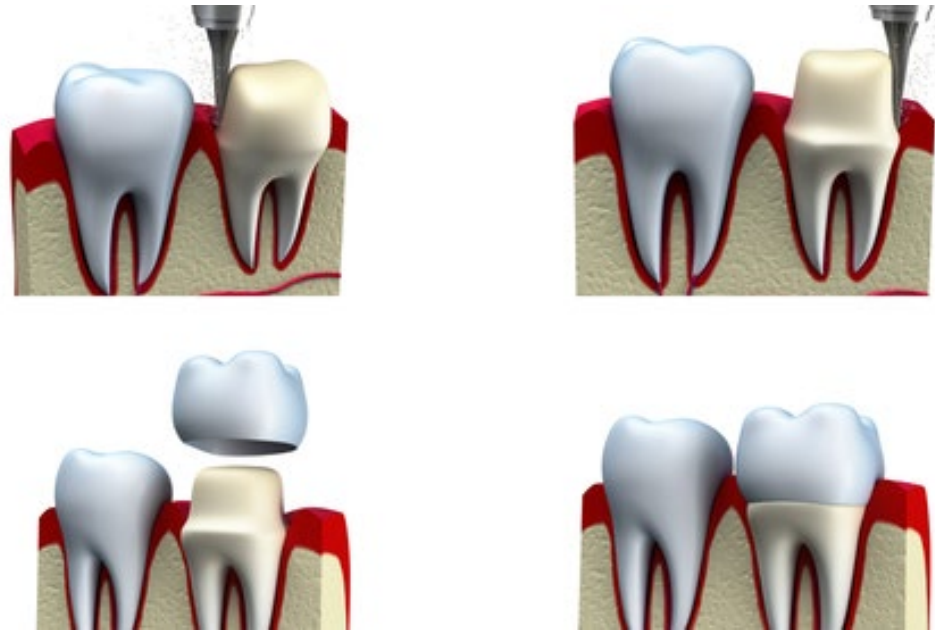
Tooth Type	# Crowns
Non-molar	3694
Molar	3088
Total:	6782
~6.8 crowns per subject	



Crown Preparation



www.scottsdalecerrecrowns.blogspot.com



www.wilshiresmiles.com



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Dental Amalgam Under Crowns

A. Not all crowns cover dental amalgam



cdeworld.com



dentalcrowntoday.blogspot.com



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Dental Amalgam Under Crowns

B. Dental amalgam under crowns varies in amount



urtooth.blogspot.com



Dental Amalgam

dentalcrownnewsnow.blogspot.com



www.dentalpick.com



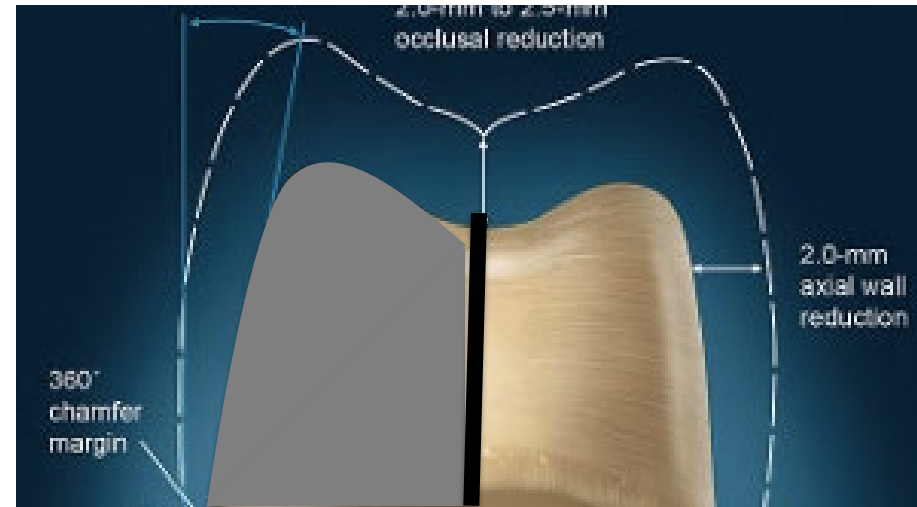
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Dental Amalgam Under Crowns

B. Dental amalgam under crowns varies in amount



drakelab.com



www.infodentis.com

Maximum Amount Under Molar Crowns = 2.20 g

Maximum Amount Under Premolar Crowns = 1.01 g



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Results: Dental Amalgam Under Crowns

Tooth Type	Number Crowns	½ Crowns Cover Amalgam	50% Amalgam under Crowns (g)	Weight Amalgam (g)	Content Mercury @45% (g)
Non-molars	3694	1847	0.51	941.97	423.88
Molars	3088	1544	1.10	1698.40	764.28
Total:	6782	3391		2640.37	1188.16



Results: Total Mercury Content Surfaces Amalgam + Amalgam Under Crowns

Most Reasonable Scenario

n=1000

Restoration Type	Number	Weight Amalgam (g)	Mercury Content @45% (g)
Surfaces Amalgam	7401	2387.30	1074.28
Crowns	3391	2640.37	1188.16
Total:		5027.67	2262.44

~ 5.0 g dental amalgam or 2.3 g **mercury** per person



Minnesota Statistics

2014

1) Deaths = **41,508**

2) Cremations = **23,643 (57%)**

3) Deaths aged 63 to 79 = **11,871 (29%)**

4) Cremations between 63-79 = **7,847 (33%)**



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Result of This Research Project:

New Estimate for Mercury Emissions from Cremation in Minnesota

- 2.3 grams of mercury per person
- age group 63-79 years
 - consider:
 - edentulous population
 - additional age groups
- New 2014 Minnesota estimate = 95 lb
(23,643 cremations @ 57% cremation rate)



Some Future Directions

Research:

- additional ages
- demographics
- socio-economic factors
- access to dental care
- dental insurance





Special Thank You to Partners & Collaborators on This Project

- Cremation Association of North America
- Minnesota Funeral Directors & Minnesota Funeral Directors Association
- Minnesota Department of Health
- University of Minnesota
 - Program of Mortuary Science
 - Anatomy Bequest Program
 - School of Dentistry
 - Clinical and Translational Science Institute
- Minnesota Pollution Control Agency

