ALASKA LEGISLATURE COMMITTEE FILES 1997-1998 8672
9606 SENATE LABOR & COMMERCE

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OBJECTIVES, SCOPE, AND METHODOLOGY

In accordance with the intent of Titles 24 and 44 of the Alaska Statutes (sunset legislation), we have reviewed the activities of the Board of Barbers and Hairdressers. As required by AS 44.66.050(a), the committee of reference shall consider this report during the legislative oversight process to determine whether the board should be reestablished. Currently, AS 08.03.010(c)(4) states that the board will terminate on June 30, 1997, and will have one year from that date to conclude its affairs.

Objectives

1. To determine if the termination date of the board should be extended.

2. To determine if the board is operating in the public's interest and determine if the board has exercised general control over the vocations of barbering, hairdressing and cosmetology.[1] The assessment of the operations and performance of the board, was based on criteria set out in AS 44.66.050(c). Criteria set out in this statute relate to the determination of a demonstrated public need for the board.

Scope and Methodology

Our audit reviewed the operations and activities of the Board of Barbers and Hairdressers for the period of FY 94, FY 95 and FY 96.

During the course of our examination, we reviewed and evaluated the following:

1. Applicable statutes and regulations.

2. Compliance with statutes and regulations related to the licensing of barbers, hairdressers and cosmetologists. Our evaluation addressed considerations of license applications and testing of candidates.

3. Minutes of meetings of the Board of Barbers and Hairdressers.

4. Annual reports issued by the board.

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[1] *AS 08.13.030 (b) states that the board shall*
(1) examine applicants and approve the issuance of licenses and permits to practice;
(2) authorize the issuance of licenses for schools of barbering, hairdressing, and cosmetology.
AS 08.13.030 (c) states that the board may
(1) suspend or revoke a license or permit;
(2) on its own motion or upon receipt of a written complaint, conduct hearings and request the Department of Commerce and Economic Development to investigate the practices of a person, shop, or school involved in the practice or teaching of barbering, hairdressing, or cosmetology;
(3) adopt regulations or do any act necessary to carry out the provisions of this chapter.

5. Complaints filed with the Division of Occupational Licensing and the Department of Law.

6. Office of the Ombudsman closed case file.

7. Reading files maintained at the Division of Occupational Licensing.

8. Other documents deemed pertinent.

We also conducted interviews with

1. Employees of the Department of Commerce and Economic Development, Division of Occupational Licensing.

2. Chairman of the Board of Barbers and Hairdressers.

3. Members of related national professional organizations.

4. Alaska Commission on Postsecondary Education personnel.

ORGANIZATION AND FUNCTION

Alaska Statute 08.13.010 establishes the Board of Barbers and Hairdressers. It was established in 1980 as a result of the legislature combining the Board of Barbers and the Board of Hairdressing and Beauty Culture Examiners.

Members of the board are appointed by the governor and serve four year staggered terms. The five member board includes two barbers, two hairdressers and one public member. Current vacancies include a barber member seat and the public member seat.

Department of Commerce and Economic Development, Division of Occupational Licensing

The Department of Commerce and Economic Development, Division of Occupational Licensing provides administrative and investigative assistance to the Board of Barbers and Hairdressers. Administrative assistance includes budgetary services and functions such as collecting fees, maintaining files, receiving and issuing application forms, and publishing notices of examinations and meetings.

Alaska Statute 08.01.065, mandates the department. with the concurrence of the board, adopt regulations to establish the amount and manner of payment of application fees, examination fees, license fees, registration fees, permit fees, investigation fees, and all other fees as appropriate for the occupations covered by the statute.

Alaska Statute 08.01.087 empowers the Division of Occupational Licensing with the authority to act on its own initiative or in response to a complaint. The division may: (1) conduct an investigation if it appears a person engaged or is about to engage in a prohibited professional practice: (2) bring an action in Superior Court to enjoin the act; (3) examine the books and records of an individual; (4) and issue subpoenas for the attendance of witnesses and records.

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REPORT CONCLUSIONS

In our opinion, the Board of Barbers and Hairdressers should be reestablished. The regulation and licensing of qualified barbers. hairdressers and cosmetologists is of benefit to the public's health, safety and welfare. The board benefits the public by establishing minimum educational and experience requirements that provide reasonable assurance that persons licensed are qualified. Assurances that those licensed act in a competent manner is also provided by active investigation of complaints conducted by the Division of Occupational Licensing's Investigative Unit within the Department of Economic Development.

Alaska Statute 08.03.010(c)(4) requires the Board of Barbers and Hairdressers be terminated on June 30, 1997. Under AS 08.03.020, the board has a one-year period to administratively conclude its affairs. We recommend the legislature extend the board's termination date to June 30, 2003.

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FINDINGS AND RECOMMENDATIONS

Recommendation No. 1

The legislature should consider reconfiguring the membership of the Board of Barbers and Hairdressers to include a cosmetologist.

The current membership of the Board of Barbers and Hairdressers requires two barbers, two hairdressers, and one public member. The board's responsibilities however, include regulating the field of cosmetology. Cosmetology licenses are currently held by the two hairdresser board members, however this is not required for membership on the board.

Cosmetologist practical examinations offered in Fairbanks, are proctored by the barber board member who is not a licensed cosmetologist. Although the Division of Occupational Licensing tries to find licensed cosmetologists to proctor the examination, such an arrangement is not required by statute or regulation. The chairman of the board indicated that with adequate training of the proctors, a license is not necessary. Training of the proctors, however is the responsibility of the board. We question whether adequate training can be ensured without a cosmetologist on the board.

To ensure board activities consider the profession of cosmetology and ensure the regulating body of the profession has the necessary expertise to fulfill their responsibilities, we recommend the legislature consider re-configuring the board membership to include a cosmetologist.

Recommendation No. 2

The Board of Barbers and Hairdressers should take steps to improve the structure and scoring procedures for professional licensing examinations.

Currently, applicants for most licenses are required to take a practical and a written examination. Current procedures require the practical examination be administered by three people (at least one of which must be a board member). Additional proctors (barbers and hairdressers) are recruited to assist board members in grading the examination. Proctors grade each of the disciplines tested. They are not required to be licensed in each of the disciplines they are grading.

A review of the examination scores indicated grades given applicants by the three proctors involved can fluctuate greatly. In one instance the scores given for one applicant varied by 38 out of a possible 100 total points. A review of the score sheets used did not provide insight on the fluctuation. When points were deducted, the proctors did not document the reasons why. The subjective nature of the examination and lack of information supporting a reduction in points given during the examination raise concerns whether the results of the examination would withstand a court challenge.

Further, proctors are to declare on their grading sheet any conflicts of interest they might have with the applicant. During our review we determined this does not always occur. On occasion, it was determined that an applicant's proctor had also been the individual's instructor. In one instance, this situation led to examination scores being challenged and allegations that the proctor involved was not free of a conflict of interest.

The scoring of examinations have also suffered from oversight and carelessness on the part of proctors. The applicants grade is based on the average of each of the proctor's scores. The Division of Occupational Licensing will provide each grader a score sheet which summarizes each subject to be tested by different categories. Each category has a point total assigned to it. The division will total each proctors scores and calculate the average to get the final grade. On several occasions a proctor would forget to score all of the categories. The division would then have to disregard the proctor's score in calculating the final grade.

To mitigate these problems many states are now contracting with national testing services to administer and grade the practical examination. By giving a nationally administered practical examination, the board could allow individual schools to offer the examination without requiring the presence of a board member. Additionally, by requiring a nationally accepted examination, the State's professional standards will remain on par with the rest of the nation.

An additional benefit of using a national testing service would be to provide applicants improved access to examinations. The examination could be offered in other locations which may be more convenient to the applicants. Currently, sites at which examinations are administered are determined by where the board member administering the examination resides. In the past year, examinations have only been available in Anchorage and Fairbanks.

If the board does not feel the use of a national testing service is justified or appropriate, it should take steps to improve the documentation of the rationale used in the scoring of examinations. The board should establish written standards for examination categories to insure uniform grading. For each point deducted, an explanation should be included on the score sheet to justify the reduction. However, we believe utilization of a national testing service is the best option and would provide for better licensing access to applicants with limited, if any, compromise of "public protection."

Recommendation No. 3

The Office of the Governor should replace vacancies on the board in a more timely manner.

Alaska Statute 08.13.010 states that the five member board includes two barbers, two hairdressers and one public member. Over the past three years the board has had to effectively operate without a public member. At the time of completion of fieldwork of this audit, the public member has attended only one meeting of the board since July, 1993. In February, 1995, the public member was terminated from the board by the governor. The position continues to be vacant as of the date of this report.

Additionally, one of the barber members of the board resigned during 1995 and the Governor has not appointed a replacement. As a result all three members of the board must be present in order to have a quorum. In April, 1996, a board meeting was scheduled to be held in Anchorage but, due to illness, a board member was unable to attend; therefore the meeting was canceled for lack of a quorum. Members of the public planning to attend the meeting (including at least one individual from Fairbanks) were disgruntled upon arriving and finding the meeting had been canceled.

The term of a third member of the board expired on July 1, 1995. This member is eligible for reappointment, however the governor has not taken action. As established by current statute, the member continues to serve on the board until a replacement is appointed.

The lack of board members clearly has impacted the effectiveness of the board. Without a public member, the general public is not represented on the board. With only three members, the board is continuously at risk of not having a quorum and if for any reason one of the current board members is unable to continue as a member, the board will not be able to carry out its responsibilities.

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ANALYSIS OF PUBLIC NEED

Limited Analysis

The following analyses of board activities relate to the public need factors defined in the "sunset" law, AS 44.66.050. These analyses are not intended to be comprehensive, but address those areas we were able to cover within the scope of our review.

The extent to which the board, commission, or program has operated in the public interest.

Each year the Board of Barbers and Hairdressers has administered the examination several more times than the semi-annual requirements of AS 08.13.040. These examinations are offered in both Anchorage and Fairbanks.

Regulations were amended to enable the issuance of most licenses by the Department of Commerce and Economic Development's Division of Occupational Licensing. An additional change enables schools of barbering, hairdressing and cosmetology to withhold reporting of a student's hours if the student is no longer attending the school and has not paid for the schooling.

Regulations were also amended to require individuals who have failed the written examination three times to provide documentation of additional training before the applicant will be scheduled for reexamination. An applicant applying to retake the practical section of the examination shall provide the board documentation of successful completion of 50 hours of training in each practical examination subject failed.

The extent to which the operations of the board has been impeded or enhanced by existing statutes, procedures, and practices which it has adopted, and any other matter, including budgetary, resource, and personnel matters.

Maintaining full membership on the board has been a recent problem. With the removal of the public member in February of 1995 (with no replacement appointed as of June 1996) and the lack of new appointment to replace the member whose term expired in July 1995, the board has been reduced to three members. As discussed in Recommendation No. 3 besides placing an additional workload on remaining members, this situation has resulted in the cancellation of a public meeting due to a lack of an operating quorum.

The composition of the present board, such as it is, does not statutorily provide for representation of all the professions regulated by the board. As discussed in Recommendation No. 1, we suggest that the legislature consider changing the statutory composition of the board to include a licensed cosmetologist.

Numerous problems hinder the effective administration of the board's licensing examinations. As discussed in Recommendation No. 2, there is evidence that the practical examination is at times subject to inconsistent, subjective scoring; at least perceived conflict-of-interests between examination proctors and individuals taking the examination; and, occasional oversight in how scores are summarized and tallied.

The extent to which the board has recommended statutory changes that are generally of benefit to the public interest.

The board supported legislation introduced in 1996 that would have expanded the mandate of the board to regulate and license manicurists. The legislation is consistent with the current statute for barbers and hairdressers allowing the board to regulate the profession consistently with the manner in which it currently oversees the other license-holders under its purview. The legislation was not adopted by the 1996 legislature.

The extent to which the board, commission or agency has encouraged interested persons to report to it concerning the effect of its regulations and decisions on the effectiveness of services, economy of service, and availability of services that it has provided.

The location, date, and time of upcoming board meetings and notices of proposed changes in regulations are published in **the Anchorage Daily News, the Fairbanks Daily News-Miner and Juneau Empire.** The board's meeting agenda set aside time for public comment. Meeting minutes reflect public participation throughout the meeting.

The extent to which the board has encouraged public participation in the making of its regulations and decisions.

Meetings were adequately advertised, and time was set aside for public testimony. Review of meeting minutes provided public comment throughout the meeting and is not limited to the public comment period. Proposed changes to regulation are subjected to the public participation process.

The efficiency with which public inquiries or complaints regarding the activities of the board, commission, or agency filed with it, with the department to which a board or commission is administratively assigned, or with the Office of the Ombudsman have been processed and resolved.

Between FY 93 and April 1, 1996, the investigative unit within the Department of Commerce and Economic Development's Division of Occupational Licensing is responding or has responded to 69 cases. Over 80% of the cases are related to licensing issues. We reviewed a sample of cases and determined investigative activities were sufficient and cases were resolved timely.

Three complaints were informally addressed by the Ombudsman. The three complaints essentially involved two central allegations, summarized as follows:

Allegation 1: *The Division of Occupational Licensing unfairly and unreasonably failed to give adequate notice of proposed license and permit fee increases.*

Allegation 2: *The division unfairly and unreasonably failed to notify licensees of the effective date for the new fee schedule.*

The Ombudsman found that the

> *notice of proposed regulation changes probably met minimal legal requirements, the conclusion that this process was unfair and unreasonable from the viewpoint of licensees seems inescapable. Small ads in one issue of each regional newspaper and notices mailed to a few dozen licensees out of the thousands who will be affected do not by any reasonable estimate constitute fair notice.*

The Division has since increased the mailing list for proposed regulation changes to include all schools and supply houses as well as a direct mailing to all licensees.

The extent to which the board or commission which regulates entry into an occupation or profession has presented qualified applicants to serve the public

New Permits Issued (Excluding Renewals)	FY 93	FY 94	FY 95	Total
Barber	20	17	21	58
Hairdresser	193	194	156	543
Cosmetology	16	26	19	61
Instructor	12	6	16	34
Shop Owner	21	48	72	141
School	1	0	2	3

In addition, 336 student permits and 53 temporary permits were issued during FY 95.

Applicants can apply for licensure by examination or by credentials. Applicants by examination are required to take a written and practical examination. The practical examination is scored by three people, with at least one being a board member. Division of Occupational Licensing (DOL) staff is responsible for totaling the points by category for each examiner and averaging the points for the three examiners to arrive at the applicant's final grade.

Letters from DOL to some of the proctors indicated there were inconsistencies in the scoring of the examinations. The graders did not give the applicant scores for certain categories of the examination. Rather than treating the scores for those candidates as zero, the examiner would not include the incomplete scores in determining the candidates final score.

The extent to which state personnel practices, including affirmative action requirements have been complied with by the board, commission, or agency to its own activities and the area of activity or interest.

We did not find any evidence that the board was not complying with the state personnel practices, including affirmative action in qualifying applicants. In no instances has the board denied an applicant a license based on personal attributes.

The extent to which statutory, regulatory, budgeting, or other changes are necessary to enable the agency, board or commission to better serve the interests of the public and to comply with the factors enumerated in this subsection.

Please refer to the Findings and Recommendations section of this report.

BARBERS AND HAIRDRESSERS

BOARD: Board of Barbers and Hairdressers

BOARD IDENTIFICATION NUMBER: 011

DEPARTMENT: DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT

AUTHORITY: AS 08.13.010

STATUS: Active

SUNSET DATE: June 30, 1997

REQUIREMENTS: Legislative Confirmation

PROHIBITIONS: Cannot serve more than all or part of two consecutive terms.

TERM: 4 years

DESCRIPTION: 5 members appointed by the Governor: 2 licensed barbers, 2 licensed hairdressers and 1 public member; serve at the pleasure of Governor.

FUNCTION: Regulates and controls applications, licenses, and permits of barbers, hairdressers, and cosmetologists; examines applicants.

CHAIR: Governor may select.

SPECIAL FACTS: Annual report to Governor. Members serve until a successor is appointed. An appointment to fill a vacancy is for the remainder of the unexpired term. A member who has served all or part of two successive terms may not reappointed unless four years have elapsed since the person has last served. Serve at the pleasure of the Governor.

COMPENSATION: Standard Travel and Per Diem. No additional compensation.

MEETINGS: As often as necessary to conduct its business.

FOR FURTHER INFORMATION CONTACT: Ms. Cindy Evans, Licensing Examiner, Division of Occupational Licensing, DCED, P.O. Box 110806 M/S 0800, Juneau, AK, 99811 0806, Phone: 907 465 2547 E-mail address: Cindy_Evans@commerce.state.ak.us

Membership Roster
BARBERS AND HAIRDRESSERS (011)

Member	Appointed	Reappointed	Term Exp.
Vacant Public			07/01/96
Lawrence R. Krupa Barber 3394 Badger Road North Pole, AK 99705	04/08/94		07/01/97
Mariann Stoffel Hairdresser 1352 Pioneer Peak Drive Wasilla, AK 99687	10/09/91	07/01/93	07/01/97
Sheryl L. Sutton Barber 205 Seward Street Juneau, AK 99801	07/30/96		07/01/00
Barbara Watkins Hairdresser 1017 San Fernando, Apt. 2 Anchorage, AK 99508	08/14/91		07/01/95

SB

90

FISCAL NOTE

STATE OF ALASKA
1997 LEGISLATIVE SESSION

BILL NO. SB 90

Revision Date:
Department: Commerce and Economic Development
Title: An Act relating to dental licensing; extending the
BRU: Occupational Licensing
termination date of the Board of Dental Examiners;....
Component: Operations
Sponsor: Senate Rules
Requestor: Senate Labor & Commerce
COMPONENT SERIAL NO. 1844

Expenditures/Revenues (Thousands of Dollars)

OPERATING EXPENDITURES	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	0.0	0.0	0.0	0.0	0.0	0.0
CAPITAL EXPENDITURES						
CHANGE IN REVENUES	0.0	0.0	0.0	0.0	0.0	0.0

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 General Fund						
1005 GF/Program Receipts						
1006 GF/MHTIA						
Other 1091 Designated PR						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Estimate of any current year (FY 97) cost: $ 163.2

POSITIONS

FULL-TIME						
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

SB 90 extends the Board of Dental Examiners to June 30, 2003 and makes other amendments to AS 08.36. Funding for continuation of the board in the amount of $163.2 is included in the department's FY 98 operatin budget request; therefore, new funds are not needed. The program is required to cover its costs with licensin fees under AS 08.01.065, and revenue generated by board fees are anticipated to cover its full operating cos

Prepared by: Jennifer Strickler, Administrative Manage
Phone: 465-2144
Division: Occupational Licensing
Date: 3/14/97
Approved by Commissioner: William L. Hensley
Date: 3-14-97
Agency: Commerce and Economic Development

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FISCAL NOTE

STATE OF ALASKA
1997 LEGISLATIVE SESSION

BILL NO. CSSB 90(L&C)

Revision Date:
Department: Commerce and Economic Development
Title: An Act relating to dental licensing; extending the termination date of the Board of Dental Examiners;....
BRU: Occupational Licensing
Component: Operations
Sponsor: Senate Rules
Requestor: Senate Labor & Commerce
COMPONENT SERIAL NO. 1844

Expenditures/Revenues (Thousands of Dollars)

OPERATING EXPENDITURES	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
PERSONAL SERVICES						
TRAVEL						
CONTRACTUAL						
SUPPLIES						
EQUIPMENT						
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	0.0	0.0	0.0	0.0	0.0	0.0
CAPITAL EXPENDITURES						
CHANGE IN REVENUES	0.0	0.0	0.0	0.0	0.0	0.0

FUND SOURCE (Thousands of Dollars)

1002 Federal Receipts						
1003 GF Match						
1004 General Fund						
1005 GF/Program Receipts						
1006 GF/MHTIA						
Other 1091 Designated PR						
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0

Estimate of any current year (FY 97) cost: $ 163.2

POSITIONS

FULL-TIME						
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

CSSB 90(L&C) extends the Board of Dental Examiners to June 30, 2001 and makes other amendments to AS 08.36. Funding for continuation of the board in the amount of $163.2 is included in the department's FY 98 operating budget request; therefore, new funds are not needed. The program is required to cover its costs with licensing fees under AS 08.01.065, and revenue generated by board fees are anticipated to cover its full operating costs.

Prepared by: Jennifer Strickler, Administrative Manager — Phone: 465-2144
Division: Occupational Licensing — Date: 4/3/97
Approved by Commissioner: William L. Hensley — Date: 4-3-97
Agency: Commerce and Economic Development

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SENATE COMMITTEE REPORT
First Committee of Referral

DATE: 2/14/97

FURTHER: State Affairs

Date of 5-Day Notice: 3-13-97
(in accordance with Uniform Rule 23)

DATE TURNED IN TO OFFICE: 4-4-97

Labor and Commerce Committee considered

SENATE BILL NO. 90

"An Act relating to dental licensing; extending the termination date of the Board of Dental Examiners; and providing for an effective date."

and recommends:

[✓] be **replaced** with ____ CS SB 90 (L&C)

[ ] adopt **previous** ____ CS _____ (_____)

[ ] attached amendment(s)

[ ] adopt Letter of Intent by _____ Committee

[ ] further referral to the _____ Committee

Senate Bill:
[ ] same title
[✓] new title

House Bill:
[ ] same title
[ ] technical title
[ ] new: SCR#_____

SIGNING DO PASS	*DP*
CHAIR: Loren D. Leman	✓

OTHER RECOMMENDATIONS	*NR*	*DNP*	*AM*
Jim Kelly	✓		
	✓		
CHAIR:			

NEW FISCAL NOTE(S):

Department	Date	Zero	Fiscal
C+ED	3/14	✓	

to bill + CS

PREVIOUS FISCAL NOTE(S):*

Department	Date	Zero	Fiscal

[ ] **APPROPRIATION -- no fiscal note**

***include fiscal notes accompanying Governor's bill**

Alaska State Legislature

Senate

Official Business

State Capitol
Juneau, AK. 99801-1182

MEMO

TO: Legal Services
via fax: 2029 this page only

FROM: Annette Kreitzer, Aide to
Senate Labor and Commerce Committee

DATE: April 3, 1997

RE: FINAL CS for SB 90: Dental Licensing

Please make the following amendments for a Labor and Commerce Committee Substitute for Senate Bill 90, which passed out of Senate Labor and Commerce Committee today:

1) Page 1, Line 5:
DELETE [2003]
Insert 2001

2) Delete Sections 2 and 5

3) Insert Amendment LS0593A.2 by Lauterbach dated 4/3/97

There were no other changes to the bill. Please deliver to Senator Leman's office (Capitol Room 115).

4-4-97
Refax

Please give to Terri Lauterbach for her records.

AK

0-LS0593\A.2
Lauterbach
4/3/97

AMENDMENT #3

OFFERED IN THE SENATE

TO: SB 90

Page 1, line 1, following "**licensing**":

Insert "**and the practice of dentistry**"

Page 4, following line 19:

Insert new bill sections to read:

"*** Sec. 5.** AS 08.36.315 is amended by adding a new subsection to read:

(b) Notwithstanding other provisions of this section, the board may not impose a disciplinary sanction on a dentist based solely on the grounds that the dentist removed or placed, or recommended the removal or placement of, a professionally recognized restorative material for a patient in the absence of demonstrable physical harm to the patient.

*** Sec. 6.** AS 08.36 is amended by adding a new section to read:

Sec. 08.36.355. Patient's right to choice in restorative material. This chapter may not be construed to deprive a dental patient of the right to choose or replace a professionally recognized restorative material."

Renumber the following bill sections accordingly.

Mercury exposure from "silver" tooth fillings: emerging evidence questions a traditional dental paradigm

FRITZ L. LORSCHEIDER,*,[1] MURRAY J. VIMY,† and ANNE O. SUMMERS‡

*Department of Medical Physiology and †Department of Medicine, Faculty of Medicine, University of Calgary, Alberta, T2N 4N1, Canada; and ‡Department of Microbiology, University of Georgia, Athens, Georgia, 30602.

Abstract: For more than 160 years dentistry has used silver amalgam, which contains approximately 50% Hg metal, as the preferred tooth filling material. During the past decade medical research has demonstrated that this Hg is continuously released as vapor into mouth air; then it is inhaled, absorbed into body tissues, oxidized to ionic Hg, and finally covalently bound to cell proteins. Animal and human experiments demonstrate that the uptake, tissue distribution, and excretion of amalgam Hg is significant, and that dental amalgam is the major contributing source to Hg body burden in humans. Current research on the pathophysiological effects of amalgam Hg has focused upon the immune system, renal system, oral and intestinal bacteria, reproductive system, and the central nervous system. Research evidence does not support the notion of amalgam safety.—Lorscheider, F. L., Vimy, M. J., Summers, A. O. Mercury exposure from "silver" tooth fillings: emerging evidence questions a traditional dental paradigm. *FASEB J.* 9, 504–508 (1995)

Key Words: mercury toxicity • dental amalgam

HISTORICAL OVERVIEW OF MERCURY USE IN DENTISTRY

As early as the 7th century, the Chinese used a "silver paste" containing mercury (Hg) to fill decayed teeth. Throughout the Middle Ages, alchemists in China and Europe observed that this mysterious silvery liquid, extracted from cinnabar ore, was volatile and would quickly disappear as a vapor when mildly heated. Alchemists were fascinated that at room temperature Hg appeared to "dissolve" powders of other metals such as silver, tin, and copper. By the early 1800s, the use of a Hg/silver paste as a tooth filling material was being popularized in England and France and it was eventually introduced into North America in the 1830s. Some early dental practitioners expressed concerns that the Hg/silver mixture (amalgam) expanded after setting, frequently fracturing the tooth or protruding above the cavity preparation, and thereby prevented proper jaw closure. Other dentists were concerned about mercurial poisoning, because it was already widely recognized that Hg exposure resulted in many overt side effects, including dementia and loss of motor coordination. By 1845, as a reflection of these concerns, the American Society of Dental Surgeons and several affiliated regional dental societies adopted a resolution that members sign a pledge not to use amalgam. Consequently, during the next decade some members of the society were suspended for the malpractice of using amalgam. But the advocates of amalgam eventually prevailed and membership in the American Society of Dental Surgeons declined, forcing it to disband in 1856. In its place arose the American Dental Association, founded in 1859, based on the advocacy of amalgam as a safe and desirable tooth filling material. Shortly thereafter, tin was added to the Hg/silver paste to counteract the expansion properties of the previous amalgam formula (1–3).

There were compelling economic reasons for promoting dental amalgam as a replacement for the other common filling materials of the day such as cement, lead, gold, and tinfoil. Amalgam's introduction meant that dental care would now be within the financial means of a much wider sector of the population, and because amalgam was simple and easy to use, dentists could readily be trained to treat the anticipated large number of new patients. By 1895, the dental amalgam mixture of metals had been modified further to control for expansion and contraction, and the basic formula has remained essentially unchanged since then (2, 3). Scientific concerns about amalgam safety initially surfaced in Germany during the 1920s, but eventually subsided without a clear resolution. At the present time, based on 1992 dental manufacturer specifications, amalgam (at mixing) typically contains approximately 50% metallic Hg, 35% silver, 9% tin, 6% copper, and a trace of zinc. Estimates of annual Hg usage by U.S. dentists range from approximately 100,000 kg in the 1970s to 70,000 kg today. Hg fillings continue to remain the material preferred by 92% of U.S. dentists for restoring posterior teeth (4,5). More than 100 million Hg fillings are placed each year in the U.S. Presently, organized dentistry has countered the controversy surrounding the use of Hg fillings by claiming that Hg reacts with the other amalgam metals to form a "biologically inactive substance" and by observing that dentists have not reported any adverse side effects in patients. Long-term use and popularity also continue to be offered as evidence of amalgam safety (6).

In light of the medical research evidence that has accumulated primarily over the past decade, the purpose of this review is to examine the traditional dental paradigm that maintains that amalgam is a biologically safe and appropriate tooth restorative material.

MERCURY EXPOSURE FROM AMALGAM FILLINGS

During the early 1980s several laboratories established that Hg vapor (Hg^0) is continuously released from amalgam tooth fillings, and that the rate of release into human mouth air is increased immediately after chewing (7–9) or tooth brushing (10). Mouth air levels of Hg^0 correlate significantly with the number of occlusal (biting) amalgam surfaces in molar teeth. Continuous chewing for 10–30 min results in a sustained elevation of the mouth Hg^0 level, which eventually declines to a baseline level 90 min

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after chewing cessation (11). Blood Hg levels also display a positive correlation with the number and total surface area of amalgam fillings (12).

A single amalgam filling with an average surface area of only 0.4 cm^2 is estimated to release as much as 15 µg Hg/day primarily through mechanical wear and evaporation, but also through dissolution into saliva (13). Recent electron microscopy images and electrochemistry data show direct evidence of amalgam Hg corrosion and leakage into saliva as free ions (14). Thus, for an average individual with eight occlusal amalgam fillings (11), a total of 120 µg Hg could be released daily into the mouth and a portion of this amount would be inhaled or swallowed. These estimations are consistent with a recent report showing that human subjects with an average number of amalgam fillings excrete approximately 60 µg Hg/day in feces (15), a portion of which is microparticles of amalgam. Various laboratories have estimated that the average daily body absorption of amalgam Hg in humans ranges between 1.2 and 27 µg (16), with levels for some individual subjects being as high as 100 µg/day. At the present time the consensus average estimate is 10 µg of amalgam Hg (range 3–17 µg) absorbed per day (17), an uptake amount corroborated by a more recent daily estimate of 12 µg (15). By way of contrast, estimates of the daily absorption of all forms of Hg from fish and seafood is 2.3 µg, and from other foods, air, and water is 0.3 µg (17). Thus, it is now proposed that dental amalgam tooth fillings are the major source of Hg exposure for the general population (17, 18). This position has been clearly validated by a recent demonstration that at least 65% of excretable Hg in human urine is derived solely from dental amalgams, and that amounts of Hg excreted also correlate with total amalgam surface area (19).

BODY TISSUE UPTAKE OF AMALGAM MERCURY

The degree to which body tissues can sequester amalgam Hg after exposure has been demonstrated in a variety of human and animal experiments. Human autopsy studies reveal significantly higher Hg concentrations in brain and kidney of subjects with aged amalgam fillings than in subjects who had no amalgam tooth restorations (20). When amalgam fillings containing a radioactive Hg tracer were placed in sheep molar teeth, a whole-body image scan performed 4 wk later demonstrated several possible uptake sites for Hg including oral tissues, jaw bone, lung, and gastrointestinal tract, with major localization of Hg in the kidney and liver (21). A similar whole-body image study repeated in a monkey (whose teeth, diet, feeding regimen, and chewing pattern more closely resemble those of humans) clearly demonstrates high levels of amalgam Hg in kidney, intestinal tract, and other tissues. The brain/CSF Hg ratio had increased threefold by 4 wk after amalgam fillings had been installed (22). The primate kidney will continue to accumulate amalgam Hg for at least 1 year after installation of such fillings (23).

Repeated observations in adult sheep (21, 24) demonstrate that after placement of amalgam fillings the blood Hg levels remain relatively low even though the surrounding body tissue concentrations of Hg become many fold higher than blood. This suggests that tissues rapidly sequester amalgam Hg at a rate equivalent to its initial appearance in the circulation. Such a phenomenon may explain why monitoring blood levels of Hg in humans is a poor indicator of the actual tissue body burden directly attributable to continuous low-dose Hg exposure from amalgam.

In pregnant sheep, which received amalgam fillings containing a radioactive Hg tracer, it was demonstrated that both maternal and fetal tissues began to accumulate amalgam Hg within several days after such fillings were installed. Maternal-fetal transfer of amalgam Hg was progressive with advancing gestation, and amalgam Hg also transferred to breast milk postpartum (24). More recently, human fetal/neonatal studies have likewise demonstrated that Hg concentrations in fetal kidney and liver, and cerebral cortex of infants, correlate significantly with the number of amalgam filled teeth of their mothers (25). This latter finding is consistent with previous animal studies that show greater Hg concentration in rat fetal tissues (and less placental retention) when the source of exposure was Hg^0 rather than mercuric salts (26).

CELL METABOLISM OF MERCURY

Major metabolic pathways

Figure 1 illustrates the major metabolic pathways for the three species of Hg. The principal source of Hg^0 is vapor from dental amalgam tooth fillings, whereas organic Hg (Hg^+) is derived principally from fish and seafood, and inorganic Hg (Hg^{2+}) originates from other foods, water, and air. Approximately 80% of inhaled Hg^0 is absorbed across the lung and converted to Hg^{2+} intracellularly by catalase oxidation. In contrast to other Hg species, the high lipid solubility of Hg^0 permits it to cross cell membranes readily, including the blood-brain barrier, and easily enter the brain. However, the kidney eventually becomes the major site of Hg accumulation during compartmental redistribution after exposure to Hg^0. Some Hg^0 is also dissolved in saliva and swallowed, converted to Hg^{2+} by peroxidase oxidation, and the majority is eliminated by fecal excretion. Other Hg^{2+} that is ingested in the diet is poorly absorbed across the intestinal tract and most is excreted in the feces. Although the majority of Hg^+ from the diet is also eliminated in the feces, a substantial portion is absorbed intracellularly as methyl-Hg^+. Both intracellular Hg^{2+} and Hg^+ are ultimately bound covalently to glutathione (GSH) and protein cysteine groups. Hg^{2+} is the toxic product responsible for the adverse effects of inhaled Hg^0. Body tissues have various retention half-lives for Hg^+ and Hg^{2+} ranging from days to years (15, 17, 26–28). After Hg is released from tissues, fecal excretion becomes the predominant route for elimination of Hg from the body. Human fecal excretion of

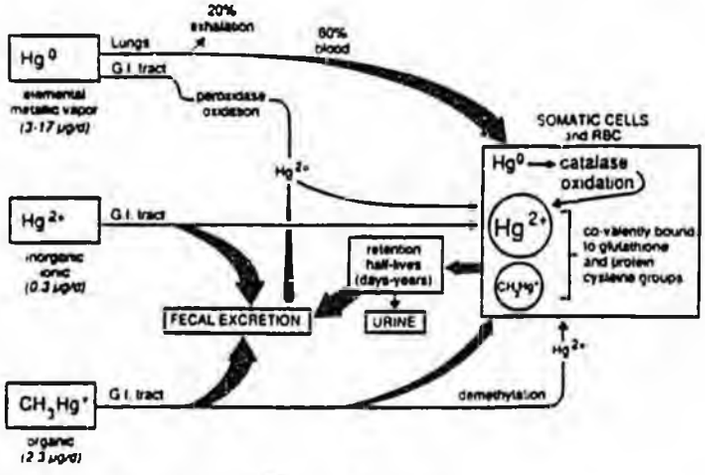

Figure 1. Metabolism of mercury species.

crease in the proportion of Hg-resistant bacteria in the floras of the intestine and oral cavity soon after installation of dental amalgam tooth fillings, an increase that persisted until the amalgam fillings were removed. The majority of these primate Hg resistant bacteria were also resistant to one or more commonly used antibiotics. Results show that Hg released from dental amalgam can enhance the prevalence of resistance to multiple antibiotics in the bacteria of the primate normal flora (40).

Reproductive system

The relationship of occupational exposure to Hg^0 and fertility of female dental assistants has recently been examined, because it is well established that long-term exposure to Hg^{2+} will alter reproductive cyclicity in rodents. Epidemiological screening by questionnaire of 7000 dental assistants showed that within an eligible subgroup of 418 women who were subsequently interviewed, fertility was reduced to only 63% that of control women not occupationally exposed to Hg^0. The study, while open to the criticism of all data that rely upon subject observation and opinion, concluded that dental assistants who prepared 30 or more amalgam fillings per week, and who also had poor Hg hygiene habits, were at risk of lowered fecundity (41).

Central nervous system

Initially suggestions occurred within medicine that neurodegenerative diseases could perhaps be linked to Hg from dental amalgam, but no experimental evidence was available at that time (42). However, it is now established that uptake and accumulation of amalgam Hg occur in monkey and human brain tissues (22, 27). Studies have demonstrated that Hg is selectively concentrated in human brain regions (medial basal nucleus, amygdala, and hippocampus) involved with memory function, and have suggested that Hg may be implicated (by mechanisms as yet unexplained) in the etiology of Alzheimer's disease (AD) (43, 44). Abnormal microtubule formation in AD brains has been associated with a defect in the tubulin polymerization cycle (45), which may increase the density of neurofibrillary tangles. A similar tubulin defect can be induced in the brain of $HgCl_2$-treated rats (46, 47), suggesting a connection between exposure to inorganic Hg and AD. $HgCl_2$ also markedly inhibits in vivo ADP-ribosylation of two rat brain cytoskeletal proteins, tubulin and actin, and thus alters a specific neurochemical reaction involved in maintaining brain neuron structure (48).

It is well established that Hg^+ will interact with tubulin resulting in disassembly of microtubules, and that microtubules function to maintain neurite structure (49). In a current investigation, recently reported, rats were exposed to Hg^0 4 h/day for as long as 14 consecutive days. Vapor exposure was maintained at 300 μg Hg/m^3 air, a level detectable in mouths of some human subjects with large numbers of amalgam fillings. Average brain Hg concentrations increased significantly with duration of Hg^0 exposure. Photoaffinity labeling of the β-subunit of the tubulin dimer with $[\alpha^{32}P]8N_3GTP$ in brain homogenates was diminished by 75% after 14 days of Hg^0 exposure. An identical neurochemical lesion of similar magnitude was seen in human AD brain homogenates, but no direct evidence exists to prove that this lesion is the result of human exposure specifically to amalgam Hg. Because the rate of tubulin polymerization is dependent on binding of tubulin dimers to GTP, it was concluded that chronic inhalation of low-level Hg^0 in rats can inhibit the polymerization of tubulin essential for formation of microtubules (50).

Another recent report demonstrates subclinical neuropsychological and motor control effects from an occupational exposure to Hg^0 over 1 year in a subpopulation of dentists with high urinary Hg levels (51). A more extensive report, evaluating dental technicians and dentists who received occupational exposure to Hg^0 and nondental personnel controls, demonstrated that after a chelation drug (DMPS) challenge test urinary Hg levels were 16-fold higher in technicians and 6-fold higher in dentists compared to control subjects. Baseline urinary porphyrin levels measured before DMPS treatment were associated with urinary Hg levels obtained after the DMPS challenge. Urinary Hg was also adversely associated with several neurobehavioral changes in Hg-exposed subjects including impairment of attention tasks and motor perceptual tasks. The utility of a DMPS challenge to assess renal Hg burden was established (52).

CONCLUSIONS

The collective results of numerous research investigations over the past decade clearly demonstrate that the continuous release of Hg^0 from dental amalgam tooth fillings provides the major contribution to Hg body burden. The experimental evidence indicates that amalgam Hg has the potential to induce cell or organ pathophysiology. At the very least, the traditional dental paradigm, that amalgam is a chemically stable tooth restorative material and that the release of Hg from this material is insignificant, is without foundation. One dental authority states that materials are presently available that are suitable alternatives to Hg fillings (4). Based on recent immunology investigations (35), electrochemical corrosion experiments (14), and human metabolic studies (15) it appears that the use of silver in amalgam may be almost as questionable as is Hg, and this evidence suggests that it may be inappropriate to alternatively use recently developed Hg-free silver-containing dental metals (53) to fill teeth. It would seem that now is the time for dentistry to use composite (polymeric and ceramic) alternatives (4) and discard the metal alchemy bestowed on its profession from a less enlightened era. Although human experimental evidence is incomplete at the present time, the recent medical research findings presented herein strongly contradict the unsubstantiated opinions pronounced by various dental associations and related trade organizations, who offer assurances of amalgam safety to dental personnel and their patients without providing hard scientific data, including animal, cellular and molecular evidence, to support their claims (54). FJ

The authors thank the Wallace Genetic Foundation, the International Academy of Oral Medicine and Toxicology, the University of Georgia Research Foundation, and the National Institutes of Health, whose support of research contained in a number of the citations herein made this review possible.

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Hg correlates significantly with the number of amalgam fillings, and the excretion rate for Hg in feces is 20 times higher than its corresponding excretion rate in urine. Even though fecal excretion of amalgam Hg predominates, this principal excretory route in humans shows a high correlation with urinary excretion of Hg. Fecal excretion rates for Hg in human subjects with amalgam tooth fillings can be as much as 100-fold higher than in subjects without such fillings (15).

Significance of glutathione and other sulfhydryl compounds

The major low molecular weight sulfhydryl compound in mammals is GSH, present at approximately 5 mM in cells, serum, and bile (29). Other low molecular weight sulfhydryls present at lower concentrations in cells include cysteine, biotin, lipoic acid, and coenzyme A. The major targets in proteins for binding of transition metals, including Hg, are the sulfhydryl group of cysteine and the imino nitrogen of histidine. The aromatic ring nitrogens of the nucleotide bases also form Hg complexes, with thymine and uracil being more reactive than cytosine, guanine, and adenine (30).

Whereas Hg^0 from amalgam is lipid soluble and freely passes through cell membranes, methyl and ionic Hg from food and other sources are both charged and therefore must be complexed with counter-ions or low molecular weight sulfur compounds in order to pass freely through the cell membrane.

The major cellular reaction potentiating the toxicity of Hg^0 is its oxidation by catalase, an enzyme found in all normal mammalian cells (31). This oxidation process can take place in any of the "barrier tissues" of the body as well as in the blood. Once generated within the cell by catalase, highly reactive Hg^{2+} will interact with a variety of nucleophilic ligands, the most abundant single nucleophile reactant being GSH. The sulfhydryl groups of proteins are next in abundance and avidity for Hg^{2+}, with the imino nitrogens of histidine and the nucleobases being substantially less reactive.

Despite the large molar excess of GSH, many proteins compete very effectively for binding of transition metals such as Zn, Ni, and Cu. The precise chemical basis for the high affinity of such metalloproteins is not understood; many of the currently well-defined members of this group, including important regulatory proteins, use cysteines and histidines as ligands to their respective metal cofactors (32). Thus, these proteins may exchange metals, including Hg, bound to GSH.

Once bound to GSH, Hg can leave the cell to circulate in serum or lymph and be deposited in other organs or tissues. GS-Hg-SG is eventually eliminated via either the kidney or downloaded via bile into the intestinal lumen and excreted in feces. After Hg leaves cells, its major route of elimination in any form (inorganic or organic) is via feces, with less than 10% of Hg normally exiting the body in urine (26). Experiments in sheep (21, 24) and monkey (22) indicate that 99% of amalgam Hg is excreted in feces, and in humans with 30 amalgam surfaces the average 24 h excretion rate for Hg in feces is 60 μg (95% of total daily excretable Hg) in contrast to 3 μg/24 h in urine (15). In mammals, half-lives from acute single doses of Hg^{2+} or methyl-Hg^+ range from months to years. Half-lives may differ with chronic Hg exposure as a result of compromised cellular function (e.g. kidney Hg turnover deceases with age and duration of exposure) (17, 26).

EFFECTS OF AMALGAM MERCURY ON CELL AND ORGAN SYSTEM FUNCTION

The overt clinical effects resulting from toxic exposure to the three species of Hg have been described (26, 28). Various animal and human experiments over the past several years have addressed the possibility of more subtle pathophysiological effects of amalgam Hg upon the function of several organ systems or cell types, including the immune system, renal system, oral and intestinal bacteria, reproductive system, and central nervous system.

Immune system

Ionic Hg has been shown to be antigenic and capable of inducing autoimmunity in rats (33, 34). In a very recent report, gelatin-encapsulated dental amalgam pieces were implanted intraperitoneally in an inbred strain of mice known to be genetically susceptible to Hg-induced immune pathology. Within 10 wk to 6 months the animals displayed hyperimmunoglobulinemia, serum autoantibodies that targeted nucleolar proteins, and systemic immune complex deposits. Similar changes were observed when only dental alloy (not containing Hg) was implanted, and these immune aberrations were attributed to the silver component of the alloy. This study concluded that both Hg and silver dissolution from dental amalgam can chronically stimulate the mouse immune system with subsequent induction of systemic autoimmunity (35). In humans, fecal excretion of silver is also correlated with the number of amalgam fillings (15). This would suggest that further investigation of the potential molecular effects of amalgam metals on the human immune system is warranted.

Renal system

Because human (20), monkey (22, 23), and sheep (21) kidney display significantly increased Hg concentrations after exposure to dental amalgam, some investigations have focused on what these concentrations may imply for renal function. Sheep with amalgam tooth filling implants show a reduced filtration rate of inulin, increased urinary excretion of sodium, and a decrease in urinary albumin (36). An increased sodium excretion has also been observed in monkeys similarly treated with amalgam fillings (unpublished data). Because Hg^{2+} accumulates primarily in the proximal tubule of rat (37) and rabbit (38) kidney and amalgam Hg in the proximal tubule of monkey kidney (23), where the majority of sodium is normally reabsorbed, increased excretion of sodium after placement of amalgam fillings in sheep (36) may reflect a reduced tubular capacity to conserve sodium selectively. Urinary albumin levels increased 1 year after removal of amalgam fillings in humans (12), whereas urine albumin levels fell in sheep after amalgam placement (36). It is uncertain whether these differences in albumin excretion patterns may reflect a Hg-induced reduction in renal blood flow due to the presence of amalgam fillings.

Oral and intestinal bacteria

It is well established that some human intestinal bacteria carry plasmids encoding resistance to both Hg and antibiotics (39). In a population subgroup of 356 persons who had no recent antibiotic exposure, those individuals with a high prevalence of Hg resistant bacteria in their intestinal flora were significantly more likely to display multiple antibiotic resistance in these same bacteria. A parallel investigation in monkeys demonstrated a marked in-

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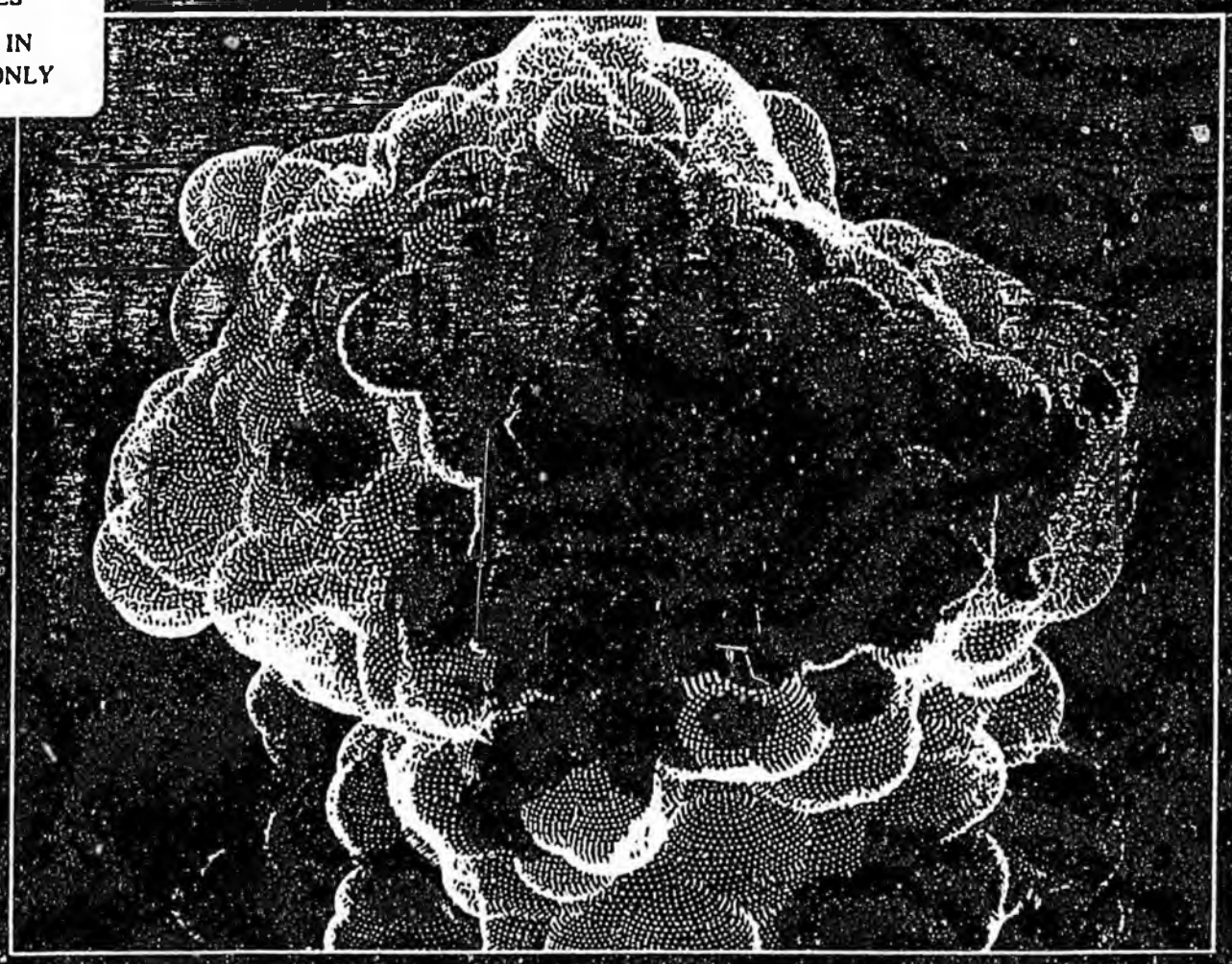

PARA-HYDROXYBENZOATE HYDROXYLASE

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April 1995, Volume 9, Number 7

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COVER: One subunit of p-hydroxybenzoate hydroxylase. The image highlights the surface of the protein, which is cut away in one segment to reveal the flavin, substrate, and key active-site residues inside. (Image generated by Domenico L. Gatti.) See Entsch and van Berkel, pages 476-483.

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Maternal-fetal distribution of mercury (^{203}Hg) released from dental amalgam fillings

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VIMY, M. J., Y. TAKAHASHI, AND F. L. LORSCHEIDER. *Maternal-fetal distribution of mercury (^{203}Hg) released from dental amalgam fillings.* Am. J. Physiol. 258 (Regulatory Integrative Comp. Physiol. 27): R939-R945, 1990.—In humans, the continuous release of Hg vapor from dental amalgam tooth restorations is markedly increased for prolonged periods after chewing. The present study establishes a time-course distribution for amalgam Hg in body tissues of adult and fetal sheep. Under general anesthesia, five pregnant ewes had twelve occlusal amalgam fillings containing radioactive ^{203}Hg placed in teeth at 112 days gestation. Blood, amniotic fluid, feces, and urine specimens were collected at 1- to 3-day intervals for 16 days. From *days 16–140* after amalgam placement (16–41 days for fetal lambs), tissue specimens were analyzed for radioactivity, and total Hg concentrations were calculated. Results demonstrate that Hg from dental amalgam will appear in maternal and fetal blood and amniotic fluid within 2 days after placement of amalgam tooth restorations. Excretion of some of this Hg will also commence within 2 days. All tissues examined displayed Hg accumulation. Highest concentrations of Hg from amalgam in the adult occurred in kidney and liver, whereas in the fetus the highest amalgam Hg concentrations appeared in liver and pituitary gland. The placenta progressively concentrated Hg as gestation advanced to term, and milk concentration of amalgam Hg postpartum provides a potential source of Hg exposure to the newborn. It is concluded that accumulation of amalgam Hg progresses in maternal and fetal tissues to a steady state with advancing gestation and is maintained. Dental amalgam usage as a tooth restorative material in pregnant women and children should be reconsidered.

mercury vapor; mercury exposure; fetal mercury exposure; tooth fillings

IT IS WELL established in humans that the continuous release of Hg vapor from in situ dental amalgam, "silver" tooth restorations, is markedly increased for prolonged periods after chewing or tooth brushing (13, 15, 17, 18). The weight composition of these Hg-silver tooth fillings is typically 50% elemental Hg metal (14), and the levels of Hg vapor in the mouth are correlated with the number of such fillings (17, 18).

A very recent study in sheep has demonstrated by whole body image scan that radioactive Hg vapor released from dental amalgam fillings is initially absorbed at lung, gastrointestinal, and jaw tissue sites (6). However, the pattern of tissue distribution of such Hg over time remains unknown. Therefore, the primary objective of the present study was to establish a time-course distribution for amalgam Hg in body tissues of adult sheep.

Although it has long been known that Hg from sources other than dental amalgam can cross the placental barrier and be taken up by the fetus (2, 3), no evidence exists that fetal exposure to Hg will occur because of the presence of dental amalgam in the mother. Therefore, another objective of this investigation was to determine the extent to which dental amalgam Hg will accumulate in fetal tissues during the latter one-third of pregnancy.

METHODS

Five adult ewes (Dorset/Suffolk cross) of 3–5 yr of age, with an average body weight of 68.4 ± 7 kg were bred, and the day of mating was considered to be *day 0* of gestation. At ~112 days gestation ewes were prepared for fetal and dental surgery. Halothane general anesthesia was administered through an endotracheal tube fitted to a Narkovet-2 gas anesthetic machine, and the maternal jugular vein, fetal femoral and jugular veins, and the amniotic sac were cannulated with Tygon catheters that were treated with 7% tridodecylmethylammonium chloride (TDMAC) heparin complex solution (Polysciences, Warrington, PA). Catheters were exteriorized using procedures that we have previously employed in sheep (8). These chronic indwelling catheters permitted serial sample collection throughout the course of gestation. Ewes were placed in individual metabolic cages 48 h after surgery so that fecal and urine specimens could be monitored intermittently over 2 wk for Hg excretion. Fetal venous blood gases were monitored for pH, Pco_2, and Po_2 at 2-day intervals after surgery to confirm viability and health of the fetus (Instrumentation Laboratory System, Lexington, MA, model 1301 pH blood gas analyzer). All animals were provided with water ad libitum and fed fresh hay twice daily throughout the course of the experiments.

At the time of fetal lamb surgery 12 radioactive occlusal amalgam fillings were placed in teeth of the ewe (three molars in each quadrant of the mouth). Dental procedures were as employed previously (6), and each trimmed and finished filling had a total alloy mass of ~850 mg of which 50% was pure elemental Hg. Before amalgam mixing, ^{203}Hg, which had a specific activity of 13 mCi/g (New England Nuclear, Boston, MA), was diluted 11-fold with nonradioactive elemental Hg. Each ewe received a total of ~7 mCi ^{203}Hg. After amalgam placement and trimming of the tooth fillings the oral

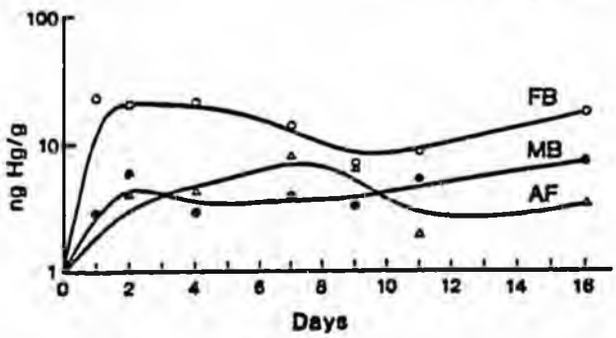

FIG. 1. Average concentration of Hg from dental amalgam in maternal blood (MB), fetal blood (FB), and amniotic fluid (AF) for 16 days after amalgam placement. Each point represents mean of 5 animals.

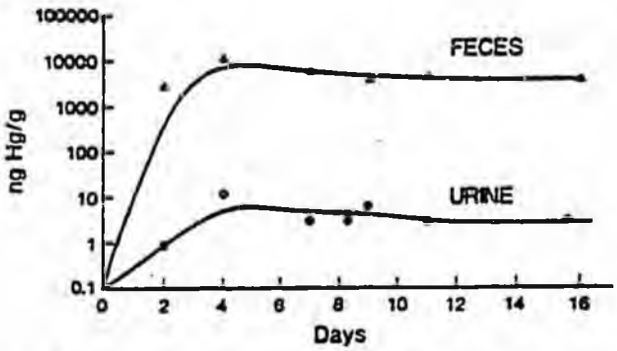

FIG. 2. Average concentration of Hg from dental amalgam excreted in maternal urine and feces for 16 days after amalgam placement. Each point represents mean of 5 pregnant animals.

cavity was flushed thoroughly with water and aspirated several times to remove amalgam particles.

Blood, amniotic fluid, feces, and urine specimens were collected at 1- to 3-day intervals, and the corresponding 24-h fecal mass and urine volume were recorded. Intraoral air Hg vapor was monitored intermittently in the ewe by procedures described previously (17). Animals were euthanized with pentobarbital sodium-saturated KCl on *days 16, 29, 73, 100,* and *140* (*days 16, 23, 25, 34,* and *41* for fetal lambs) after dental surgery, and tissue specimens were taken from a variety of maternal and fetal organs and weighed. Gastrointestinal tract samples were washed in isotonic saline to remove gut contents from the tissue specimens. Plasma was obtained by centrifugation, and separated red cells were washed with two volumes of saline. Total blood volume in the ewe was estimated to average 74 ml/kg (19). Within 48 h after parturition a 5-ml sample of milk was expressed from the breast of each ewe.

All tissue and fluid specimens were analyzed for radioactivity, and total Hg concentrations were calculated as previously described (6); corrections were made for isotopic decay ($t_{\frac{1}{2}} = 47$ days) and isotope specific activity; the dilution factor for nonradioactive Hg was added before mixing the amalgam. The final calculation value represented the total Hg from dental amalgam per gram (wet wt) of tissue or fluid. Data were plotted with average values as a function of days after amalgam placement using a best-fit-curve method to graphically depict patterns of Hg distribution (Harvard Graphics version 2.1, Software Publishing, Mountain View, CA).

RESULTS

The average intraoral air Hg vapor level in the five ewes during the present experiments was 44 μg Hg/m^3 (range 13–98) from 12 new amalgam restorations, which compares with average vapor levels in 10 human subjects after chewing of 43–45 μg Hg/m^3 from 12 occlusal amalgam restorations of variable age (18).

Figure 1 shows the average concentration of Hg (ng/g) from dental amalgam in maternal blood, fetal blood, and amniotic fluid during a 16-day period after amalgam placement for five pregnant ewes and their fetuses. Amalgam Hg was evident in all three fluids within 48 h when it reached a peak concentration. Elevated Hg levels were maintained for the 2-wk duration of specimen collection at ~4 ng/g in maternal blood (range 3–7) and amniotic fluid (range 2–8) and at ~16 ng/g (range 7–23) in fetal blood.

Figure 2 shows the average concentration of Hg (ng/g) from dental amalgam excreted in maternal urine and feces during a 16-day period after amalgam placement in

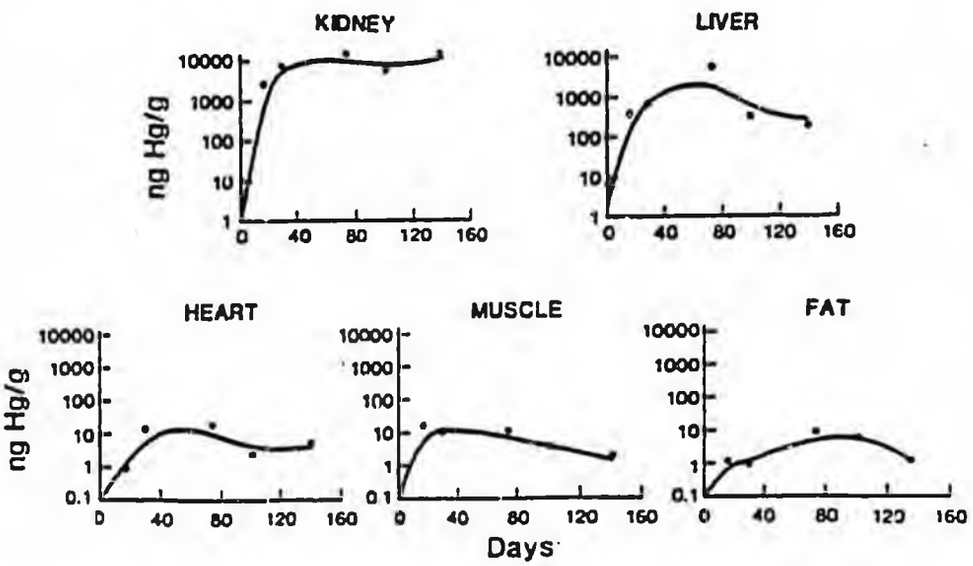

FIG. 3. Concentration of Hg from dental amalgam in kidney, liver, heart, muscle, and fat for each of 5 adult ewes autopsied at different times after amalgam placement.

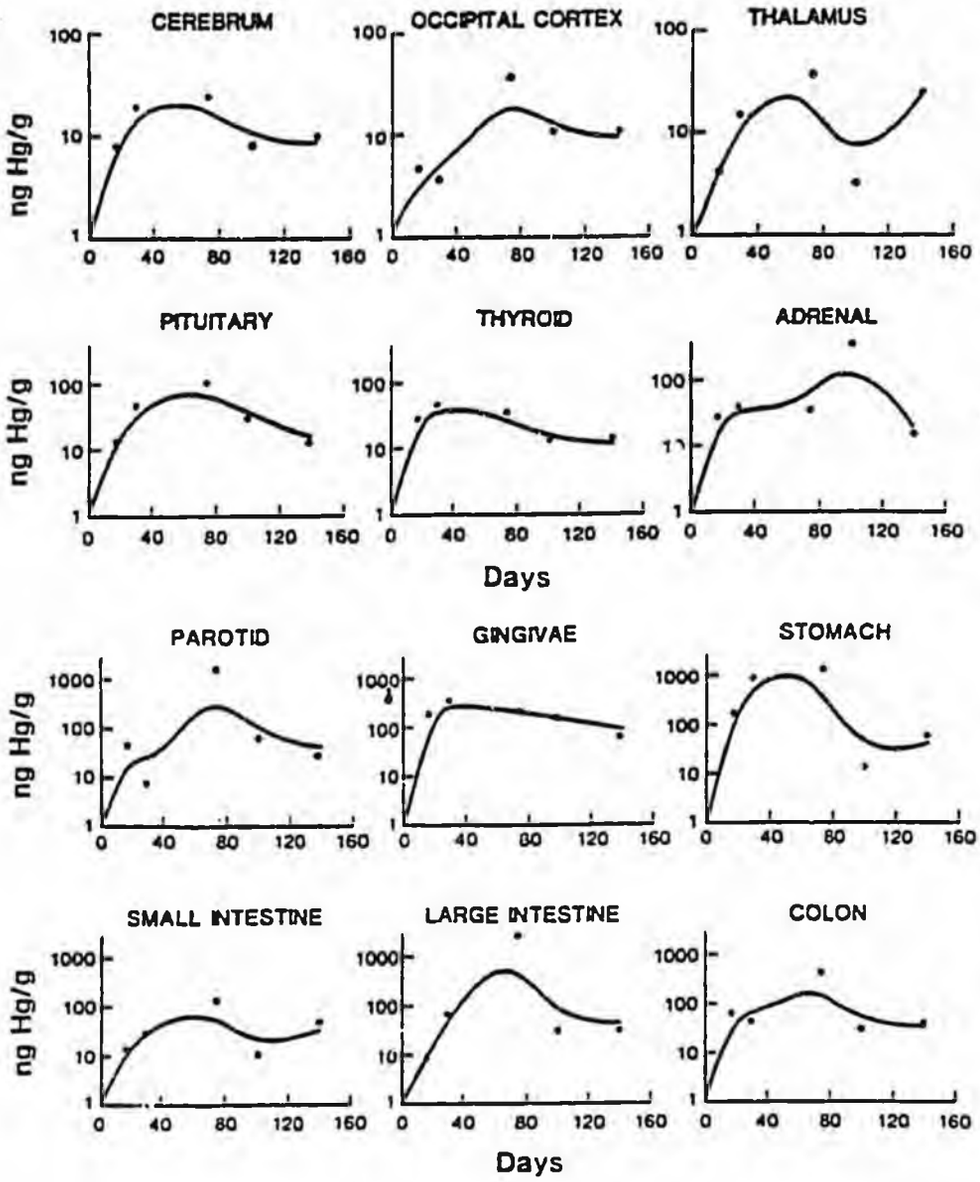

FIG. 4. Concentration of Hg from dental amalgam in brain cerebrum, occipital cortex, and thalamus and in pituitary, thyroid, and adrenal glands for each of 5 adult ewes autopsied at different times after amalgam placement.

FIG. 5. Concentration of Hg from dental amalgam in oral and gastrointestinal tissues: parotid gland, gingivae, stomach, small intestine, large intestine, and colon for each of 5 adult ewes autopsied at different times after amalgam placement.

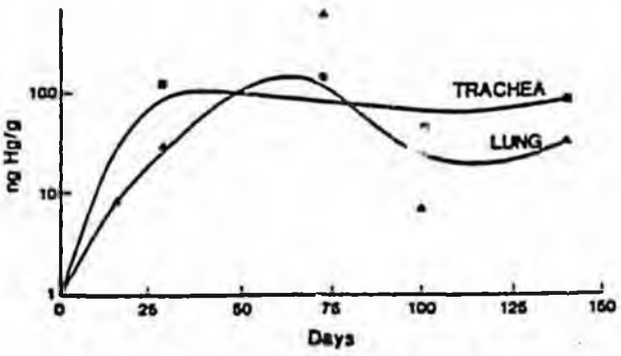

FIG. 6. Concentration of Hg from dental amalgam in lung and trachea for each of 5 adult ewes autopsied at different times after amalgam placement.

five pregnant ewes. Urinary levels rose rapidly and after *day 4* tended to plateau. The average urine value for this period was 5 ng/g (range 1–12) which, based on an average 24-h urine volume of 840 ml, would mean that as much as 10 μg Hg from amalgam was eliminated daily by the renal route. In contrast, the initial fecal Hg concentrations averaged 3,800 ng/g which, when corrected for an average fecal mass of 2,030 g/day, would mean that ~7.7 mg Hg from amalgam could be eliminated daily from the gastrointestinal tract during this 2-wk period. Thereafter, fecal Hg concentration measurements taken at time of autopsy showed a gradual decline such that by *day 73* after amalgam placement fecal Hg levels were less than one-half of the initial concentrations.

Figure 3 illustrates the concentration of Hg from dental amalgam in kidney, liver, heart (ventricle), gluteus muscle, and mesentery fat for each of five ewes autopsied at different times after amalgam placement. By 29 days, kidney Hg levels rose to ~9,000 ng Hg/g, and these levels were maintained throughout the 140-day duration of the study. A similar pattern of Hg concentration was observed in liver but with lower levels remaining at ~1,000 ng Hg/g until 140 days. This is in contrast to heart and muscle, which had Hg levels that plateaued at ~10 ng Hg/g, and fat, which had lower levels of Hg ranging from 1 to 5 ng/g.

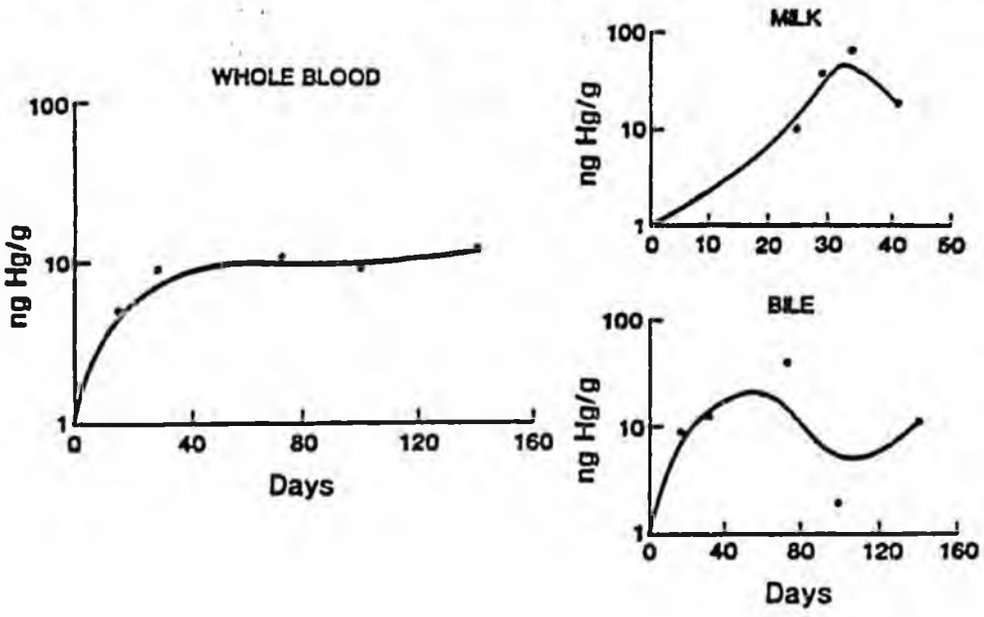

FIG. 7. Concentration of Hg from dental amalgam in whole blood, milk, and bile for each of 5 adult ewes autopsied at different times after amalgam placement.

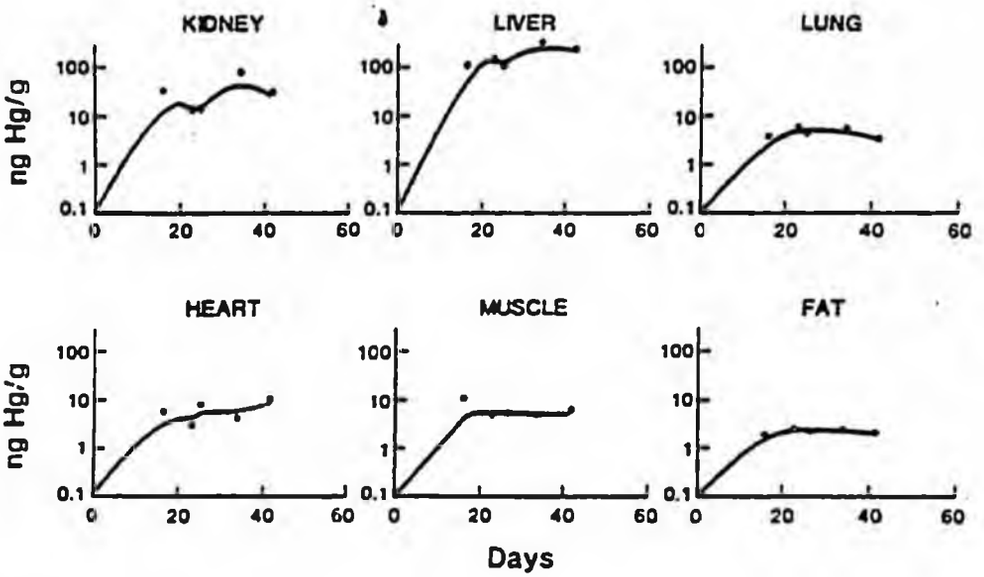

FIG. 8. Concentration of Hg from maternal dental amalgam in kidney, liver, lung, heart, muscle, and fat of 3–5 fetal lambs exposed in utero for various times after amalgam placement.

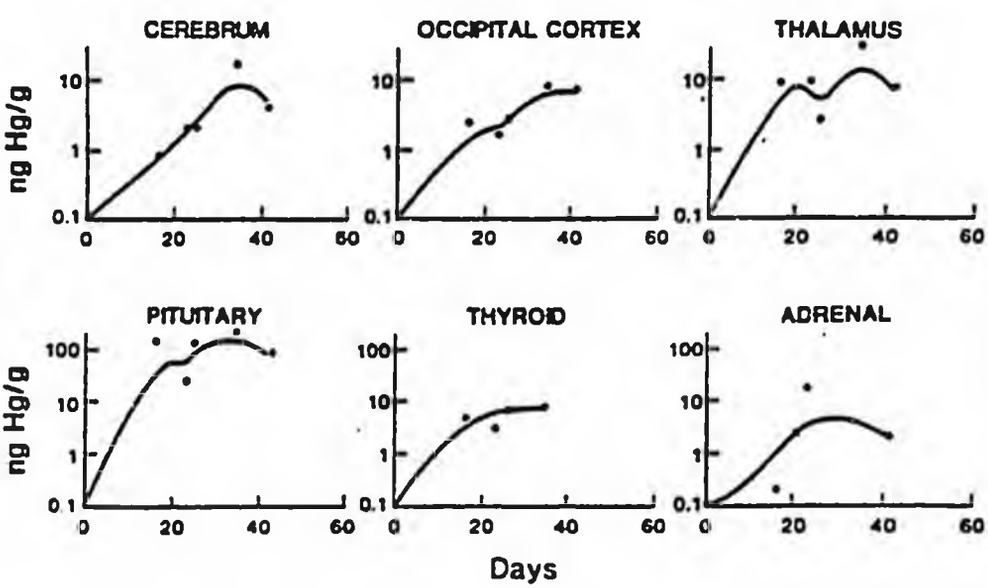

FIG. 9. Concentration of Hg from maternal dental amalgam in brain cerebrum, occipital cortex, and thalamus, and in pituitary, thyroid, and adrenal glands of 3–5 fetal lambs exposed in utero for various times after amalgam placement.

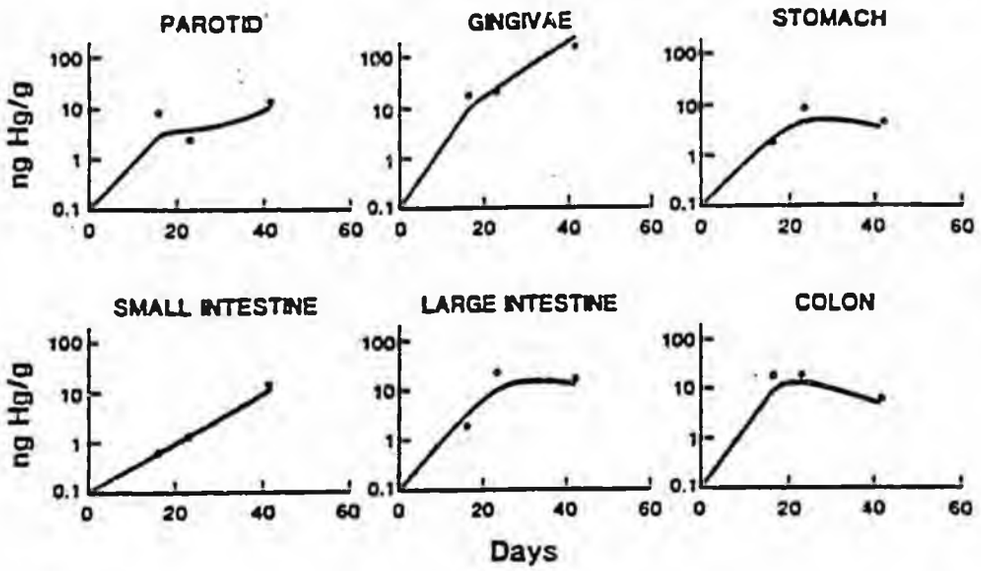

FIG. 10. Concentration of Hg from maternal dental amalgam in oral and gastrointestinal tissues: parotid gland, gingivae, stomach, small intestine, large intestine, and colon of 3–5 fetal lambs exposed in utero for various times after amalgam placement.

Figure 4 shows the concentration of Hg from dental amalgam in three regions of the brain and in three endocrine gland tissues in each of five ewes autopsied at different times after amalgam placement. Brain cerebrum, occipital lobe, and thalamus showed evidence of Hg concentration as early as 16 days, and from 29 to 140 days Hg levels ranged from 3 to 13 ng/g. After 29 days, pituitary, thyroid, and adrenal glands maintained somewhat higher Hg concentrations, ranging from ~10 to 100 ng/g.

Figure 5 depicts the concentration of Hg from dental amalgam in oral and gastrointestinal tissues from each of five ewes autopsied at different times after amalgam placement. Parotid gland had Hg levels ranging from 10 to 1,000 ng/g, whereas gingivae maintained a plateaued level of 200–300 ng Hg/g until 140 days. Stomach had Hg levels as high as 1,000 ng/g during the 140-day period, in contrast to small intestine, large intestine, and colon in which Hg levels ranged from ~10 to 200 ng/g.

Figure 6 shows the concentration of Hg from dental amalgam in respiratory tissues for each of five ewes autopsied at different times after amalgam placement. Lung had variable Hg levels ranging from 20 to 600 ng/g, and trachea cilial lining had Hg levels of between 50 and 120 ng/g throughout the 140-day period of the study.

Figure 7 illustrates that amalgam Hg levels in whole blood of five ewes averaged 10 ng/g and remained relatively constant during the 140-day period. Based on an average blood volume of 4,800 ml per ewe, this would mean that by 29 days after amalgam placement the total circulating pool of Hg in blood at any given time was at least 48 μg. Bile in these ewes at autopsy had levels of Hg that ranged from 3 to 40 ng/g during this same period. Milk obtained within 2 days after birth, at 25–41 days after amalgam placement, contained levels of Hg from dental amalgam that reached as high as 60 ng/g.

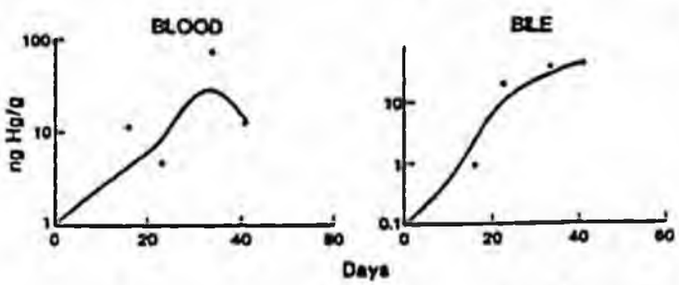

FIG. 11. Concentration of Hg from maternal dental amalgam in blood and bile of 3–5 fetal lambs exposed in utero for various times after amalgam placement.

Figure 8 demonstrates the concentration of amalgam Hg in kidney, liver, lung, heart, gluteus muscle, and mesentery fat of three to five fetal lambs exposed in utero to Hg from maternal dental amalgam for 16–41 days after amalgam placement. Fetal kidney had Hg levels of 10–14 ng/g in contrast to liver, which had higher levels of 100–130 ng Hg/g. Fetal lung, heart, and muscle had levels of Hg that were <10 ng/g, and fat had the lowest concentration at 1–2 ng Hg/g.

Figure 9 displays the concentration of amalgam Hg in regions of brain and in three endocrine glands of 3–5 fetal lambs exposed in utero to Hg from maternal dental amalgam for 16–41 days after amalgam placement. The highest Hg levels in cerebrum, occipital cortex, and thalamus were ~10 ng/g. This was in contrast to the fetal pituitary, which contained >100 ng Hg/g compared with thyroid and adrenal glands with <10 ng Hg/g.

Figure 10 shows the concentration of amalgam Hg in oral and gastrointestinal tissues of 3–5 fetal lambs exposed in utero to Hg from maternal dental amalgam for 16–41 days after amalgam placement. Fetal parotid gland had Hg levels that did not exceed 10 ng/g compared with levels in gingivae of 10–120 ng/g. Stomach, small intestine, large intestine, and colon had Hg levels of 10 ng/g or less.

Figure 11 demonstrates amalgam Hg concentration in blood and bile of 3–5 fetal lambs exposed in utero to Hg from maternal dental amalgam for 16–41 days after amalgam placement. Fetal blood Hg levels were variable and ranged from 3 to 75 ng/g, whereas bile Hg levels ranged from 1 to 47 ng/g.

Other data obtained in these experiments revealed that placental cotyledon concentration of amalgam Hg was 24, 161, and 289 ng/g after 16, 25, and 34 days, respec-

tively, of in utero exposure to maternal dental amalgam. The red blood cell-to-plasma ratio of amalgam Hg in the ewes from 16 to 140 days was 0.44 and in the fetal lambs was 0.97 after 16 to 41 days in utero exposure. Cerebrospinal fluid concentrations of amalgam Hg in the ewes averaged 4.6 ng/g and in the fetuses 5.1 ng/g.

DISCUSSION

The results of these experiments demonstrate that Hg from dental amalgam will appear in maternal and fetal blood and amniotic fluid within 2 days after placement of amalgam tooth restorations in the mother. Excretion of some of this Hg will also commence within 2 days through fecal and urinary elimination. Highest concentrations of Hg from amalgam in the adult occur in kidney and liver with substantial levels also present in endocrine glands, oral tissues, stomach, and the respiratory tract. In the fetus the highest amalgam Hg concentrations appear in liver and pituitary gland during the latter one-third of pregnancy when the placenta also progressively concentrates Hg as gestation advances to term. Finally, milk concentration of amalgam Hg postpartum can provide a potential source of Hg exposure to the newborn.

In the present study the average intraoral Hg vapor level released from 12 dental amalgam fillings in sheep was nearly identical to average vapor measurement levels obtained in humans with the same number of occlusal amalgam restorations (18). Justification for using the sheep as an experimental model to study the metabolism of dental amalgam Hg has been detailed in an earlier report (6). Although in vivo radioisotope experiments of this nature are perhaps more difficult to perform because of animal containment requirements than nonisotopic studies employing mass spectroscopy, neutron activation analysis, or autometallography analyses of Hg, our design has the distinct advantage that all of the Hg measured originates only from dental amalgam and cannot be attributed to food, water, or background environmental sources. Extension of these studies beyond 140 days would be limited by the physical half-life for ^{203}Hg of 47 days. All amalgam restorations remained intact during the 140-day duration of this study.

The general pattern of tissue concentration of Hg from dental amalgam reveals that, in the early phase from 16 to 29 days, a progressive increase in Hg uptake is at least partially dependent on the length of time elapsed after amalgam placement. After 29 days, concentration levels tended to remain in a plateau pattern suggesting that at least for the first 140 days after amalgam placement, tissue uptake of Hg will replace tissue turnover at a relatively constant steady-state rate.

The total circulating pool of amalgam Hg in blood was substantially higher than most tissue levels at any given time during the course of the experiment, implying that tissues have ready access to a regenerating Hg supply as it is continuously released from dental amalgam fillings. In this study the red blood cell-to-plasma ratios of Hg from amalgam in both the ewe and fetal lamb were less than one. This indicates that most of the amalgam Hg that is absorbed by several previously illustrated routes into sheep tissues (6) has remained in the elemental or inorganic form, since methyl Hg will preferentially accumulate in red blood cells with a resultant RBC-to-plasma ratio of 9:1 (1).

The large amount of amalgam Hg excreted daily in the feces may be caused by swallowing Hg with saliva or food and its subsequent concentration by the colon, and also by biliary concentration of blood Hg and secretion of Hg into the gut. It has been demonstrated in rats that inorganic Hg complexed to protein in bile is not readily reabsorbed and therefore is mostly excreted (10). Although by 140 days after amalgam placement we estimate as much as 13% of the amalgam Hg might be lost through the fecal route, the rate of loss rapidly declines. We would expect that the Hg loss would be much less than this amount over the next 140-day period if the present study had been extended. The placement and condensation of amalgam results in a tooth restoration that initially has a higher Hg concentration in the superficial biting surface area. Thus chewing forces on the new restorations would be expected to release greater amounts of elemental Hg vapor and amalgam microparticles containing proportionately higher amounts of Hg during the initial 2-wk phase.

The maternal tissue data suggest that chewing stimulation of the dental amalgams resulted in the release of Hg vapor, some of which was inhaled. Since ~80% of inhaled Hg vapor is absorbed across the lung and retained (9), this would explain the elevation in maternal blood levels of Hg and the resultant high concentration of amalgam Hg in maternal kidney and liver. Both kidney and liver were shown to be major sites of Hg deposition when human subjects inhaled radioactive Hg vapor from a nonamalgam source, and kidney and brain are considered to be critical target organs for Hg vapor effects (7). The data also suggest that some amalgam Hg may be absorbed across the lining of the maternal gastrointestinal tract, since Hg was found in high amounts in both the mucosal lining and contents of the tract. This Hg could have entered the tract as vapor swallowed with food and dissolved in saliva or as microparticles of amalgam and mercuric ions from the chewing and grinding action of the teeth. Although ~10% of Hg in the inorganic form (divalent and monovalent Hg) is absorbed across the gastrointestinal tract (16), the large amount of amalgam Hg present in the tract may, nevertheless, present a substantial challenge to the mother. Fetal colon concentration of amalgam Hg may indicate that meconium is the vehicle for transferring Hg to amniotic fluid.

In the adult ewe the high levels of Hg from amalgam that are concentrated in kidney are approximately ninefold greater than Hg levels found in adult liver. This is in marked contrast to the fetal lamb in which kidney concentration of Hg was ~0.1 times that of the liver. This may simply reflect the functional status of the adult kidney, whereas in the fetus the liver serves as a functional erythropoietic organ. Fetal liver erythropoiesis may also explain why Hg levels in fetal blood tended to be higher than levels in adult blood. Also, high Hg levels in fetal liver may be a consequence of most umbilical vein blood first passing directly to the fetal hepatic circulation. Sheep adult kidney levels of Hg from amal-

gam observed in this study are higher than levels reported in human kidney (12). However, our results were observed for only 140 days from 12 new amalgam fillings all placed in the mouth at the same time. This is in contrast to human data obtained in subjects in whom levels of Hg may have declined somewhat over an 8 to 10-yr duration from a variable number of amalgams of unknown age (12).

Maternal brain levels of Hg released from amalgam in this study were 3–13 ng Hg/g during a relatively brief duration of 16–140 days after amalgam placement. This agrees with net Hg levels found in autopsy specimens of human brain cortex of 7.2 ng/g from subjects with dental amalgams (4, 12), after subtraction of brain Hg levels in control (nonamalgam) subjects of 5.7 ng/g.

It is interesting to note that adult ewe pituitary gland concentration of Hg from amalgam was severalfold higher than brain concentration. This differential tendency was even more exacerbated in the fetal lamb. This finding is in agreement with Nylander (11), who reported relatively higher concentrations of Hg in pituitary compared with occipital brain of dentists. The endocrinological significance of amalgam Hg concentration in pituitary, thyroid, and adrenal glands in the present study should warrant further attention in future studies.

The present demonstration of selective concentration of amalgam Hg in cotyledon tissue with advancing gestational age is consistent with earlier evidence that elemental Hg from a nonamalgam source will traverse the placenta (2). This observation is supported by fetal blood Hg levels that are fourfold higher than maternal levels during the initial 2-wk phase after amalgam placement in this study. The sheep epitheliochorial placenta has six tissue layers separating fetal and maternal blood compared with the human hemochorial placenta with only three tissue layers, the latter placental barrier having transfer properties that can enhance its permeability (5). On this histological basis alone one might expect a human fetus to receive a greater proportion of a given dose of dental amalgam Hg than would a sheep fetus.

We conclude that Hg released from dental amalgam tooth fillings will begin to selectively accumulate in maternal and fetal tissues soon after amalgam placement. Accumulation of amalgam Hg progresses in tissues to a steady state with advancing gestation and is maintained for as long as 20 wk. Amalgam restorations are a source of continuous Hg exposure to both the mother and fetus. In view of the experimental evidence presented herein, continued employment of dental amalgam as a tooth restorative material in pregnant women and children should be reconsidered.

The authors thank Dr. J. E. Fewell, Director of the Reproductive Medicine Research Group, and the Christie Unit for the Study of Human Reproduction for provision of facilities and assistance with materials to conduct this investigation. The authors also are grateful to S. Nastz and M. Satchwell for assistance with the dental surgery and S. Kelly for assistance with animal management.

Partial support was provided by grants from the Wallace Genetic Foundation and the International Academy of Oral Medicine and Toxicology.

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Received 18 Sept. 1989; accepted in final form 4 December 1989.

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ORIGINAL PAPER

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Mercury burden of human fetal and infant tissues

Received: 18 November 1993
Accepted: 28 March 1994

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Abstract The total mercury concentrations in the liver (Hg-L), the kidney cortex (Hg-K) and the cerebral cortex (Hg-C) of 108 children aged 1 day–5 years, and the Hg-K and Hg-L of 46 fetuses were determined. As far as possible, the mothers were interviewed and their dental status was recorded. The results were compared to mercury concentrations in the tissues of adults from the same geographical area. The Hg-K ($n = 38$) and Hg-L ($n = 40$) of fetuses and Hg-K ($n = 35$) and Hg-C ($n = 35$) of older infants (11–50 weeks of life) correlated significantly with the number of dental amalgam fillings of the mother. The toxicological relevance of the unexpected high Hg-K of older infants from mothers with higher numbers of dental amalgam fillings is discussed.

Conclusion Future discussion on the pros and cons of dental amlagam should not be limited to adults or children with their own amalgam fillings, but also include fetal exposure. The unrestricted application of amalgam for dental restorations in women before and during the childbearing age should be reconsidered.

Key words Mercury · Fetuses
Newborns · Infants · Dental amalgam

Abbreviations *Hg-C* total mercury concentration in the cerebral cortex (ng/g wet weight) · *Hg-K* total mercury concentration in the renal cortex (ng/g wet weight) · *Hg-L* total mercury concentration in the liver (ng/g wet weight)

Introduction

Recent investigations [1, 5] have shown in humans that dental amalgam fillings are the principal source of the mercury burden of adults, at least in geographic areas with a moderate consumption of fish and seafood. There is now widespread international focus on the pathophysiological significance of mercury that is continuously released from amalgam tooth fillings [6]. A result of one of these studies [5] was that some of the few infants investigated at that time showed relatively high mercury concentrations in their kidneys. To expand upon this finding, the objective of the present study was to determine the mercury concentration in tissues from a much larger population of infants and also from older children and fetuses. As far as possible the mothers were interviewed and their dental status determined.

Materials and methods

Liver and kidney specimens from 46 fetuses and liver, renal cortex and cerebral cortex from 108 children aged 1 day–5 years were collected during 1990–1992 from autopsies performed at the Pathological Institute and the Institute of Forensic Medicine of the University of Munich.

Abortions had mainly been induced for medical reasons. All infants had died suddenly and most were diagnosed as sudden infant death syndrome.

From 40 mothers of fetuses and 65 mothers of children, information on occupational, domestic or medical mercury burden were

available and the dental status of these mothers was recorded. In no case was an occupational exposure to mercury of the parents or an extreme fish consumption of the mother or the child reported. There was no case of an unusual mercury burden of the child (e.g. by a broken thermometer or the application of mercury containing pharmaceuticals).

Tissue samples of approximately 1 g were digested with 2 ml nitric acid (min. 65%, Supra pure grade, E. Merck, Darmstadt, FRG) for 6 h at 140°C in sealed Teflon lined pressure vessels (Parr Acid Digestion Bomb, H. Kürner, Rosenheim, FRG). After cooling the solutions were diluted with water to 10 ml and the concentrations of total mercury were determined by cold-vapour atomic absorption spectrometry after enrichment on a gold-platinum-net [19]. The accuracy of the method was established by standard reference materials (BCR reference material # 145, bovine liver and IAEA fish homogenate MA-A-2).

Total mercury concentrations were calculated as ng mercury per g tissue wet weight. Because the distribution of the values was nonparametric, medians were calculated. Subgroups were compared by the Mann-Whitney test. Correlations were determined by Spearman rank correlation.

In order to combine the results of fetuses and children into a single figure, the gestational age of the fetuses was converted to "negative weeks of life", i.e. 40 weeks minus gestation.

The group under investigation was classified in 4 subgroups according to the age:

1. Fetuses: from gestation until birth
2. Newborns and young infants: 0–10 weeks
3. Older infants: 11–50 weeks
4. Young children: 1–5 years

Table 1 Spearman rank correlation of the mercury concentrations in human tissues to the number of teeth with amalgam fillings of the mother

		Fetuses	Newborns and younger infants (0–10 weeks)	Older infants (11–50 weeks)	Younger children (1–5 years)
Liver	*n*	40	19	35	11
	r	+0.366	±0.000	+0.254	−0.163
	sig.	b	a	a	a
Renal cortex	*n*	38	19	35	11
	r	+0.537	+0.212	+0.454	+0.273
	sig.	d	a	c	a
Cerebral cortex	*n*	0	18	35	11
	r		+0.213	+0.372	−0.181
	sig.		a	b	a

Significance: a = < 95%; b = > 95%; c = > 99%; d = > 99.9%

All results were compared parallel to those of 34 adults in the same age range as the mothers (16–45 years) having at least two teeth with dental amalgam [5, 19].

Results

Statistical correlations between the mercury concentration in various organs and the number of maternal teeth with dental amalgam fillings are shown in Table 1.

In fetuses the mercury concentration in the liver (Hg-L) was significantly correlated with the number of maternal teeth with amalgam fillings. No such correlation was found for Hg-L in the other age groups.

The mercury concentration in the renal cortex (Hg-K) and maternal teeth with amalgam fillings were significantly correlated in fetuses and older infants but not in the other age groups.

The mercury concentration in the cerebral cortex (Hg-C) was significantly correlated with the number of maternal teeth with amalgam fillings in older infants only.

In fetuses and older infants significantly higher mean mercury concentrations in the liver and the renal cortex were found, if the mothers had ten or more teeth with dental amalgam in comparison to fetuses or older infants from mothers with a maximum of two teeth with amalgam fillings (Table 2). Figures 1–3 illustrate the range of individual mercury concentrations in liver, kidney cortex and cerebral cortex, respectively, of all fetuses and children, compared to the range of adults without dental amalgams. Many older infants have rapidly acquired a tissue burden of mercury in the kidney that is equivalent to or which exceeds the range of mercury in adults who do not have amalgam fillings.

Discussion

The mercury concentration in different tissues of fetuses and infants has been rarely studied and has never been related to maternal amalgam fillings. Suzuki et al. [20] reported the mercury concentrations in five brain and four liver specimens of fetuses and Markesbery et al. [14] in two fetal, one term and three infant brains. Their results lie within the same range of concentrations that we found.

Table 2 Comparison (Mann-Whitney-Test) of the mercury concentrations (ng Hg/g, medians) in tissues of human fetuses and older infants (age: 11–50 weeks) from mothers with either 0–2 or 10 or more teeth with amalgam fillings to age-matched adults (age: 16–45 years) with the same number of amalgam fillings as the mothers [5, 19]

		0–2 Teeth with amalgam	>10 Teeth with amalgam	Significance of difference
Liver	Fetuses	12.68 (*n* = 10)	25.85 (*n* = 14)	b
	Older infants	19.2 (*n* = 10)	34.4 (*n* = 8)	b
	Younger adults	18.7 (*n* = 41)	67.2 (*n* = 19)	d
Renal cortex	Fetuses	5.95 (*n* = 10)	10.3 (*n* = 11)	d
	Older infants	20.75 (*n* = 10)	115.6 (*n* = 8)	c
	Younger adults	47.3 (*n* = 41)	409.25 (*n* = 18)	d
Cerebral cortex	Older infants	2.05 (*n* = 10)	3.95 (*n* = 8)	a
	Younger adults	14.7 (*n* = 39)	25.7 (*n* = 19)	b

Significance: a = < 95%; b = > 95%; c = > 99%; d = > 99.9%

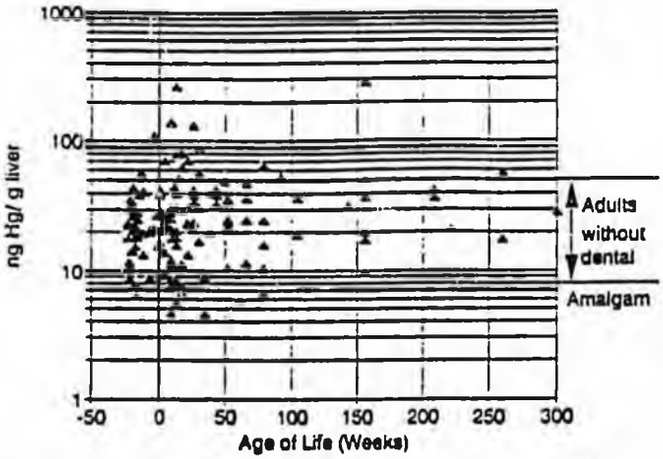

Fig. 1 Total mercury concentration in the liver of human fetuses and infants related to age of life

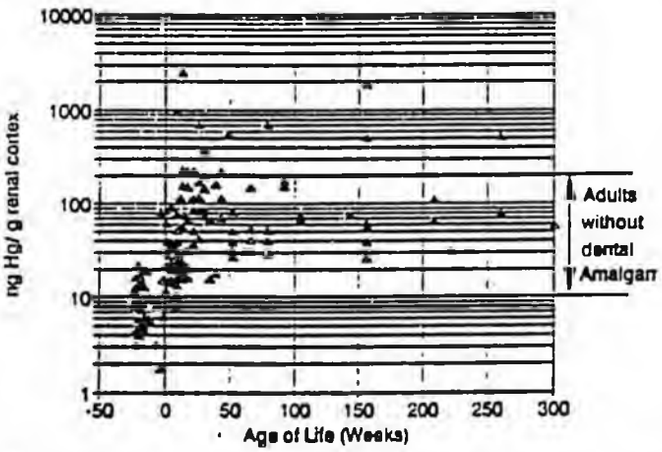

Fig. 2 Total mercury concentration in the renal cortex of human fetuses and infants related to age of life

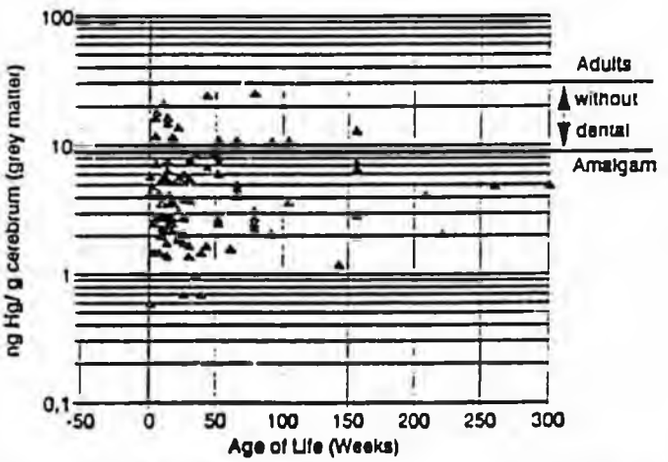

Fig. 3 Total mercury concentration in the cerebral cortex of human infants related to age of life

Data from earlier investigations [15, 16] are less reliable due to the limitations of analytical methods at that time.

Exposure of pregnant guinea pigs to mercury vapour [25, 26] or pregnant ewes to amalgam fillings (containing radioactive ^{203}Hg) [22] resulted in an increase of the mercury concentrations of the fetuses and the newborn. The placental transfer of mercury from the mother to the fetus depends on the maternal mercury burden [7, 10, 12, 21]. Since the number of dental amalgam fillings is significantly related to the mercury concentration in the maternal tissues of animals [22] and humans [5] the number of maternal amalgam fillings should also influence the mercury concentration in human fetal tissues. We were able to confirm this relationship with respect to the fetal liver and kidney. The avidity of maternal kidneys for mercury documented in Table 2 can be explained by the storage function of the maternal kidney for mercury. It can be assumed that the "mobile" mercury, available for a transfer through the placenta, derives predominantly from the maternal liver (and comparable compartments) and not from the maternal kidney. Moreover, the fetal liver seems to trap the transferred mercury to some extent [8, 12, 25, 26] and thus prevents a higher accumulation in the fetal kidney. The present findings in humans compare favourably with similar results reported earlier in sheep [22].

The mercury concentrations in the tissues of newborns and young infants were not well correlated with the number of maternal teeth with amalgam fillings. This may be explained by a superposition of the initial influence of the maternal dental amalgam on the mercury concentration in the infant tissues during pregnancy by a redistribution of mercury from the infant liver to the infant kidney and other tissues in the first months of life and a simultaneous new intake of mercury in this transient period of life [12, 26].

Maternal amalgam fillings appears to influence the Hg-C in older infants approximately as much as they influence Hg-C in adults. The influence on the Hg-K in older infants is approximately half so great as that of own fillings of adults (see Table 2).

Most of the babies under investigation were not nursed or nursed only for a few weeks. Hence it follows that the higher Hg-K and Hg-C of offspring from mothers with amalgam fillings is due at least partly to an exposure derived in utero and not from breastmilk. If and to what extent nursing by mothers with multiple amalgam fillings contributes to the mercury burden of the baby should be further investigated. Dental amalgam mercury does concentrate in sheep milk [22], however, Klemann et al. [9] found no statistically significant correlation between the mercury concentration in human breastmilk and the number of amalgam fillings of the mothers.

At the present time, the toxicity of mercury vapour from dental amalgams is being assessed through a variety of investigations [1]; however, the toxicological consequence of the relatively high mercury concentrations in the renal cortex of infants, as found in the present study, has not been determined. In contrast to the well-known vulnerability of the developing brain to an exposure to mercury vapour (most of the mercury from dental amalgam is released in this form) or methyl-mercury, there are

no reports that the infant kidney is more sensitive to inorganic mercury than the adult kidney [6, 10, 11, 13, 21, 23, 24, 27]. On the other hand, current evidence suggests that the nephrotic syndrome following absorption of mercury compounds results from an immunotoxic response [24]. Amalgam mercury has also been shown to alter several indices of kidney function in sheep [2]. Possible differences in the binding form of the mercury in the kidney of fetuses, infants and adults, e.g. to metallothionein or selenium, are presently not known [4, 17, 18].

The present findings clearly demonstrate that further discussion on the pros and cons of dental amalgam should not be focused exclusively on adults or children with their own amalgam fillings [3, 27], but also on the offspring.

From our results it can be concluded that infants can accumulate mercury, apparently derived from maternal amalgam fillings, in their kidneys to a similar extent as older children or adults do from their own fillings. Therefore the unrestricted application of amalgam for dental restorations in women before and during the child-bearing age should be reconsidered in analogy to the recommendation of the German Health Authorities from 1992 [3], which argued that because of a higher vulnerability of infants to mercury, amalgam cannot be further recommended for dental restorations for children up to 6 years and notably not during the first 3 years of life. At the very least, high numbers of amalgam fillings should be avoided for women before and during child-bearing age. In 1991, the WHO confirmed an earlier statement from 1980: "The exposure of women of child-bearing age to mercury vapour should be as low as possible" [24].

Acknowledgements The authors wish to acknowledge the financial support of this investigation by the Degussa AG, Frankfurt/Main and the generous assistance in the collecting of the fetal samples by the I. Gynaecological Clinic and the Institute of Pathology of the Ludwig-Maximilians-University, Munich.

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Pediatrics

Volume 153
Number 8
August 1994

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4. **Is this preferred procedure a .....?** ____ Product _XXX_ Procedure ____ Equipment ____ Publication

5. **Briefly describe the preferred procedure:** Two basic clinical techniques are described to decrease the risk of mercury vapor exposure to the patient during mercury amalgam removal: A) With a Rubber Dam B) Without a Rubber Dam

6. **Technique of preferred procedure:**
   - A) With a Rubber Dam
     1) Place rubber dam in the usual way
     2) Provide alternative source of air (Oxygen, Nitrous oxide, Room air)
     3) Place saliva ejector under dam to remove mercury vapor that penetrates latex
        IAOMT Data: 0-20 mcg/m^3
     4) Use high volume evacuation with isolate attachment (enhance with 2 evacuation pumps and/or auxiliary evacuation)
        IAOMT Data:
     5) Use copious amount of water in spray
     6) Section amalgams and remove in as large pieces as possible
     7) Remove and dispose of rubber dam immediately after amalgam removal
     8) Rinse and evacuate mouth immediately after removal of dam (use mercury vapor analyzer to guide length and thoroughness of oral cleansing)
     9) Rinse all instruments of mercury vapor used during removal (mirror, handpieces, etc.)

10) Immediately change patients protective wear and clean their face
11) Consider appropriate nutritional support before, during and after removal
12) Install room air purifiers or ionizers for everyone's well being

B) Without a Rubber Dam

1) Provide alternative source of air (Oxygen, Nitrous oxide, Room air)
2) Use high volume evacuation with isolate attachment (enhance with 2 evacuation pumps and/or auxiliary evacuation)
3) Use copious amounts of water in spray
4) Section amalgams and remove in as large pieces as possible
   IAOMT data: 4 quadrants amalgam removal, one at a time, 3 fillings/quad, without rubber dam, with HVE & Isolate attachment. In mcg/m^3 (Allen 9/8/92)

High Vol Evac	= 0
Stop HVE	= 10-50
10 second rinse	= 5-30
30 second rinse	= 0-15
50 second rinse	= 0

5) Rinse and evacuate mouth immediately after amalgam removal to remove vapor and chunks of amalgam (use mercury vapor analyzer to guide length and thoroughness of oral cleansing)
6) Immediately change patients protective wear and clean their face
7) Consider appropriate nutritional support before, during and after removal
8) Install room air purifiers or ionizers for everyone's well being

7. Manufacturer(s):

1) Ionizer: American Environmental Systems, Colorado Springs, Co., (303) 530-7077
2) Jerome 411 Mercury Vapor Analyzer

8. Scientific Literature: Ochoa,1983; Gronka,1970; Roydhous,1985; Mantyla, 1976; Gordon, 1978; Schulein, 1984

9. Legal Aspects: 1990 USEPA Chronic Inhalation Concentration for Mercury: 0.3 micrograms / cubic meters of air

10. Historical Background: Common sense from scientific literature on mercury vapor and IAOMT data

AGPTHYG.1

IAOMT
Standards of Care

Preferred Procedure

Reducing Mercury Vapor Exposure for Doctor & Staff During Amalgam Removal

Preferred Procedure Code	DRSTHYG.1
Received	9/4/92
Scientific Review	9/4/92
Standard of Care Review	9/6/92
IAOMT Board Review	9/27/92
Provisional Approval	
Approval	9/27/92
No Opinion	
No Approval	

Your Name: Phillip P. Sukel, D.D.S., F.I.A.O.M.T. **Home Phone:** (708) 837-1301

Office Address: 1640 N. Arlington Heights Rd. Suite 201 **Office Phone:** (708) 253-0240

City: Arlington Heights **State:** Il. **Zip:** 60004 **Country:** USA

Are you a member of IAOMT? _XX_ Yes ____ No **Non-member Application Fee: $25.00.**

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1. Name of preferred procedure: Reducing Mercury Vapor Exposure for Doctor and Staff During Amalgam Removal

2. Alternative name(s) of preferred procedure:

3. What is this preferred procedure related to? ____ Medicine _XX_ Dentistry

4. Is this preferred procedure a .....? ____ Product _XXX_ Procedure ____ Equipment ____ Publication

5. Briefly describe the preferred procedure: Various clinical techniques are described to decrease the risk of mercury vapor exposure to Doctor & Staff during mercury amalgam removal.

6. Technique of preferred procedure:

1) Use high volume evacuation with isolate attachment (enhance with 2 evacuation pumps and/or auxiliary evacuation)
2) Wear protective mask during removal (see below for mask manufacturers)
3) Use copious amounts of water in spray
4) Section amalgams and remove in as large pieces as possible

IAOMT data: 4 quadrants amalgam removal, one at a time, 3 fillings/quad, without rubber dam, with HVE & isolate attachment. In mcg/m^3 (Allen 9/8/92)

High Vol Evac	= 0
Stop HVE	= 10-50
10 second rinse	= 5-30
30 second rinse	= 0-15
50 second rinse	= 0

5) Rinse and evacuate mouth immediately after amalgam removal (use mercury vapor analyzer to guide length and thoroughness of oral area cleansing)
6) Immediately remove Doctor's gloves and at least rinse hands, face, glasses, etc. thoroughly before proceeding .... then take off your mask
   IAOMT Data: Under gloves measurement, immediately after removal, HVE, without isolate attachment, without rubber dam, from 1 to 16 amalgams. 30-50 mcg/m^3 (1992)
7) Change and/or clean patients protective wear and clean their face
8) Rinse mercury vapor from instruments exposed to mercury vapor (mirrors, hand pieces, etc.)
9) Consider appropriate nutritional support for Doctor & Staff before, during and after removals
10) Install room air purifiers or ionizers for everyone's well being

7. Manufacturer(s):
1) Ionizer: American Environmental Systems, Colorado Springs, Co., (303) 530-7077
2) 3M Mask: Special industrial mercury vapor mask. When not using place inside down, do not put into plastic bag
3) MSA Respirator: Mercury Vapor Respirator by Mine Safety Appliances, Pittsburgh, Pa.
4) Jerome 411 Mercury Vapor Analyzer

8. Scientific Literature: Ochoa,1983; Gronka,1970; Roydhous,1985; Mantyla, 1976; Gordon, 1978; Schulein, 1984

9. Legal Aspects: 1990 USEPA Chronic Inhalation Concentration for Mercury: 0.3 micrograms / cubic meters of air and OSHA Work Place Exposure Limits

10. Historical Background: Common sense from the scientific literature on mercury vapor and IAOMT data

DRSTHYG.1

IAOMT
Standards of Care

Preferred Procedure

Reducing Mercury Vapor Exposure During Hygiene Procedures

Preferred Procedure Code MVEHYG.1

Received	9/15/91
Scientific Review	8/24/92
Standard of Care Review	8/24/92
IAOMT Board Review	9/27/92

Provisional Approval
Approval 9/27/92
No Opinion
No Approval

Your Name: Wayne King, D.M.D. **Home Phone:** (404) 426-8847

Office Address: 1200 Roseweli Road, Suite 4 **Office Phone:** (404) 426-0288

City: Marietta **State:** Ga. **Zip:** USA **Country:**

Are you a member of IAOMT? Yes **Non-member Application Fee $25.00.**

---

1. **Name of preferred procedure:** Reducing Mercury Vapor Exposure During Hygiene Procedures

2. **Alternative name(s) of preferred procedure:**

3. **What is this preferred procedure related to?** ____ Medicine _xx_ Dentistry

4. **Is this preferred procedure a .....?** ____ Product _xxx_ Procedure ____ Equipment ____ Publication

5. **Briefly describe the preferred procedure:** Various clinical methods are described to decrease the risk of mercury vapor exposure from mercury dental amalgams during various hygiene procedures.

6. **Technique of preferred procedure:**
   1. Avoid touching amalgam fillings with a rubber prophy cup or prophy brush while polishing teeth.
      IAOMT Data:
   2. Avoid touching amalgam fillings with the ultrasonic scaler during scaling.
      IAOMT Data:
   3. Avoid direct spray of air/baking soda polishers onto amalgam surfaces.
      IAOMT Data:
   4. Avoid polishing (finishing) amalgam fillings unless absolutely necessary such as proximal surfaces when preparing adjacent tooth for a crown. If you must polish use lots of water spray and high volume evacuation and any other room air precautions.
      IAOMT Data: during polishing interproximals with 3M disks
      without water spray and high volume evacuation -- 500-900 mcg/m^3
      with water spray and high volume evacuation -- 15-40 mcg/m^3
      upon stopping and after rinsing for 30 seconds -- 0-5 mcg/m^3
      So rinse mouth thoroughly when finished with HVE.
   5. Use alternative source of air (O_2 or mask with room air) for patient for any procedure that may generate mercury vapors from existing dental amalgams.
   6. Use high volume evacuation and saliva ejector during procedures (patient may hold HVE near mouth and/or auxiliary evacuation system).
   7. Doctor/Hygienist/Staff should wear protective mask (see below) to minimize inhalation of mercury vapors.
   8. Patient should wear appropriate protection.

7. **Manufacturer(s):**
    1. 3M - Special industrial mercury vapor mask. When not using place inside down, do not put into plastic bag
    2. MSA - Mercury Vapor Respirator by Mine Safety Appliances, Pittsburgh, Pa.
    3. Jerome 411 Mercury Vapor Analyzer

8. **Scientific Literature:** Ochoa, 1983; Gronka, 1970; Roydhous, 1985; Mantyla, 1976; Gordon, 1978; Schulein, 1984; Skinner, Science of Dental Materials.

9. **Legal Aspects:** 1990 USEPA Chronic Inhalation Concentration: 0.3 micrograms / cubic meter of air

10. **Historical Background:** Common sense from the scientific literature on mercury vapor and IAOMT data.

MVEHYG.1

0-LS0593\A.1
Lauterbach
3/17/97

AMENDMENT

OFFERED IN THE SENATE

TO: SB 90

AS 08.64.326 8(A)
SB 278

Page 1, line 1, following "**licensing**":

Insert "**and the practice of dentistry**"

Page 4, following line 19:

Insert new bill sections to read:

"* **Sec. 5.** AS 08.36.315 is amended to read:

Sec. 08.36.315. Grounds for discipline, suspension, or revocation of license. The board may revoke or suspend the license of a dentist, or may reprimand, censure, or discipline a dentist, or both, if the board finds after a hearing that the dentist

(1) used or knowingly cooperated in deceit, fraud, or intentional misrepresentation to obtain a license;

(2) engaged in deceit, fraud, or intentional misrepresentation in the course of providing or billing for professional dental services or engaging in professional activities;

(3) advertised professional dental services in a false or misleading manner;

(4) received compensation for referring a person to another dentist or dental practice;

(5) has been convicted of a felony or other crime that affects the dentist's ability to continue to practice dentistry competently and safely;

(6) engaged in the performance of patient care, or permitted the performance of patient care by persons under the dentist's supervision, that does not conform to minimum professional standards of dentistry regardless of whether actual injury to the patient occurred; **the board may not base a finding of failure to**

conform to minimum professional standards of dentistry solely on the grounds that a dentist's practice is unconventional or experimental in the absence of demonstrable physical harm to a patient;

(7) failed to comply with this chapter, with a regulation adopted under this chapter, or with an order of the board;

(8) continued to practice after becoming unfit due to

(A) professional incompetence; **the board may not base a finding of professional incompetence solely on the grounds that a dentist's practice is unconventional or experimental in the absence of demonstrable physical harm to a patient;**

(B) failure to keep informed of or use current professional theories or practices;

(C) addiction or dependence on alcohol or other drugs that impairs the dentist's ability to practice safely;

(D) physical or mental disability;

(9) engaged in lewd or immoral conduct in connection with the delivery of professional service to patients;

(10) permitted a dental hygienist or dental assistant who is employed by the dentist or working under the dentist's supervision to perform a dental procedure in violation of AS 08.32.110 or AS 08.36.070(a)(11);

(11) failed to report to the board a death that occurred on the premises used for the practice of dentistry within 48 hours.

* **Sec. 6.** AS 08.36.315 is amended by adding a new subsection to read:

(b) Notwithstanding other provisions of this section, the board may not impose a disciplinary sanction on a dentist based solely on the grounds that the dentist removed or placed a professionally recognized restorative material for a patient in the absence of demonstrable physical harm to the patient.

* **Sec. 7.** AS 08.36 is amended by adding a new section to read:

Sec. 08.36.355. Patient's right to choice in restorative material. This chapter may not be construed to deprive a dental patient of the right to choose or replace a professionally recognized restorative material."

Renumber the following bill sections accordingly.

LEGAL SERVICES

DIVISION OF LEGAL AND RESEARCH SERVICES
LEGISLATIVE AFFAIRS AGENCY
STATE OF ALASKA

(907) 465-3867 or 465-2450
FAX (907) 465-2029
Mail Stop 3101

130 Seward Street, Suite 409
Juneau, Alaska 99801-2105

MEMORANDUM March 18, 1997

SUBJECT: Dentistry (SB 90)

TO: Senator Loren Leman
Attn: Annette Kreitzer

FROM: Terri Lauterbach
Legislative Counsel

Enclosed is your requested amendment.

Because of your instruction to use language similar to other statutes that authorize "alternative medicine," I have added general language to AS 08.36.315 in sec. 5 of the attached amendment. It is based on AS 08.64.326(a)(8)(A), relating to physicians. If you don't want your amendment to be this general, and want to address only restorative materials, you could just use secs. 6 and 7 of the attached amendment.

Please let me know if I can be of further assistance.

TML:glc
97-185.glc

Enclosure

SENATOR LOREN LEMAN

Northwest Anchorage

716 W 4th Ave, Suite 520, Anchorage, AK 99501 (907) 258-8189 Session: State Capitol, Juneau, AK 99801 (907) 465-2095

MEMO

TO: Legal Services
via fax: 2029 two pages total

FROM: Annette Kreitzer, Aide to
Senator Loren Leman

DATE: March 17, 1997

RE: Amendment to SB90: Dental Licensing

Please draft an amendment to SB 90 incorporating the following language:

a) Nothing in this section shall be construed to deprive any dental patient of the right to choose or replace any professionally recognized restorative material, nor to permit disciplinary action against a dentist solely for removing or placing any professionally recognized restorative material.

b) Nothing in paragraph (a) shall be construed to prevent disciplinary action against a dentist for practicing dentistry in violation of AS 08.36.

The intent of the amendment is to allow dentists to remove dental amalgam if a patient requests. Language should be consistent with other state statutes allowing "alternative medicine".

SB 90 is up in Senate Labor & Commerce tomorrow at 1:30 p.m..

Am#2:

SENATE BILL NO. 90

IN THE LEGISLATURE OF THE STATE OF ALASKA

TWENTIETH LEGISLATURE - FIRST SESSION

BY THE SENATE RULES COMMITTEE BY REQUEST OF THE LEGISLATIVE BUDGET AND AUDIT COMMITTEE

Introduced: 2/14/97
Referred: L&C, State Affairs

A BILL

FOR AN ACT ENTITLED

"An Act relating to dental licensing; extending the termination date of the Board of Dental Examiners; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

*** Section 1.** AS 08.03.010(c)(7) is amended to read: Am #1 - made no objection 2-0

(7) Board of Dental Examiners (AS 08.36.010) -- June 30, 2003 [1997];

*** Sec. 2.** AS 08.36.010 is amended to read: Am 2   Delete sec. 5 (public board members)

Sec. 08.36.010. Creation and membership of board. There is created the Board of Dental Examiners consisting of nine members. Five [SIX] members shall be licensed dentists who have been engaged in the practice of dentistry in the state for five years immediately preceding appointment, two members shall be dental hygienists licensed under AS 08.32 who have been engaged in the practice of dental hygiene in the state for five years immediately preceding appointment, and two members [ONE MEMBER] shall be [A] public **members. The terms of public members shall be**

New Text Underlined [DELETED TEXT BRACKETED]

staggered [MEMBER].

* **Sec. 3.** AS 08.36.120 is amended to read:

Sec. 08.36.120. Signing, photograph, and filing date of application. Each applicant shall submit a recent unmounted [, AUTOGRAPHED] photograph of the applicant. Applications shall be signed by the applicant and filed at least 45 days before the date scheduled for an examination.

* **Sec. 4.** AS 08.36.234(a) is amended to read:

(a) The board shall provide for the licensing without examination, except as provided in (2) of this subsection, of a dentist who

(1) provides certification to the board that the dentist

(A) is a graduate of a dental school accredited by the Commission on Accreditation of the American Dental Association, or its successor agency, and holds a certificate from the American Dental Association Joint Commission on National Dental Examinations that the dentist has passed the written examination given by the commission;

(B) has passed clinical and written examinations required for licensure in another state, territory, or region of the United States and has been licensed to practice dentistry in that state, territory, or region of the United States; the state, territory, or region must have licensing requirements at least generally equivalent to those of this state at the time of application; **if the board does not consider the licensing requirements of the other jurisdiction to be generally equivalent to those of this state at the time of application because certain areas of subject matter were not included in the other jurisdiction's examinations, the board may find compliance with the requirements of this subparagraph if the dentist demonstrates completion of continuing education in the omitted subject areas, holds a specialty certification in the omitted subject areas, or provides proof satisfactory to the board of a history of successful practice involving the omitted subject areas;**

(C) is in good standing with the licensing entity in the jurisdiction where the dentist is currently licensed and in all jurisdictions in

which the dentist was previously licensed while practicing in those jurisdictions; if the dentist is employed by the federal government, the dentist must be in good standing with the employing federal agency;

(D) has been engaged in continuous active clinical practice averaging at least 20 hours a [PER] week for each of the five years immediately preceding the application

(i) in a jurisdiction in which the dentist was licensed and in good standing; or

(ii) working for the federal government while in good standing with the employing federal agency and after having been licensed by a jurisdiction;

(E) is not the subject of an adverse decision based upon a complaint, investigation, review procedure, or other disciplinary proceeding within the five years immediately preceding application, or of an unresolved complaint, investigation, review procedure, or other disciplinary proceeding, undertaken by a state, territorial, local, or federal dental licensing jurisdiction or a dental society;

(F) is not the subject of an unresolved or an adverse decision based upon a complaint, investigation, review procedure, or other disciplinary proceeding undertaken by a state, territorial, local, or federal dental licensing jurisdiction, dental society, or law enforcement agency that relates to criminal or fraudulent activity, dental malpractice, or negligent dental care and that adversely reflects on the applicant's ability or competence to practice dentistry or on the safety or well-being of patients;

(G) has not previously had a license to practice dentistry suspended for grounds similar to those specified under AS 08.36.315, revoked, or voluntarily surrendered;

(H) has completed at least 42 hours of continuing education related to clinical dentistry in the three years preceding application for a license in this state; the continuing education must have been approved by the American Dental Association, the Academy of General Dentistry, or the

appropriate specialty board;

(I) has not within the previous three years failed the clinical exam given by the Western Regional Examining Board;

(J) is not the subject of an adverse report from the National Practitioner Data Bank or the American Association of Dental Examiners Clearinghouse for Disciplinary Information that relates to criminal or fraudulent activity, negligent dental care, or malpractice;

(2) has passed, to the satisfaction of the board, a written examination that consists of the portion of the written examination given under AS 08.36.160(b) that pertains to the state's laws on the practice of dentistry; the board may not require a higher passing score for applicants under this section than the board requires for applicants under AS 08.36.110;

(3) is personally interviewed by the board for purposes of verifying credentials;

(4) pays all required fees;

(5) provides the board with an affidavit that the dentist is not an impaired practitioner;

(6) provides to the board an authorization for release of records in a form prescribed by the board.

*** Sec. 5.** TRANSITIONAL PROVISION. Notwithstanding AS 08.36.010, as amended by sec. 2 of this Act, a dentist who holds a position on the Board of Dental Examiners on the effective date of this Act is not prohibited by this Act from serving the remainder of the member's unexpired term. The governor shall appoint the new public member required under this Act when a vacancy occurs in a position previously held by a dentist and set the number of years in the term of the public member appointed under this section so that the new public member's term is staggered with the term of the other public member.

*** Sec. 6.** This Act takes effect July 1, 1997.

Braces & Faces

John M. Sparaga, DMD
Diplomate, American Board of Orthodontics
Orthodontics
Orthognathic Surgery

April 10, 1993

Senator Loren Leman

Dear Senator Leman,

The amendment being acted upon today, Section 4 of CS SB 90, wherein the Dental Board would be unable to impose sanctions on a dentist who replaced or proposed to replace dental restorations in absence of demonstrable harm, Should be eliminated from this bill.

This amendment is being pushed by dentists who believe that amalgam/mercury restorations are harmful and should be replaced, a theory that has been well refuted by every credible scientific body or government agency involved. Dr. Hal Huggins, the dentist who popularized this notion over ten years ago, and personally brought his message to Anchorage, has recently been found by the Dental Board if Examiners of the state of Colorado to have perpetrated fraud and misrepresentation upon their citizens with this message, and has had his license to practice dentistry there revoked by the state. This amendment allows the same fraud to be exercised upon our citizenry by similarly unscrupulous dentists.

It should appear obvious that dentistry per se would profit handsomely if it routinely replaced dental restorations at the will of the provider, rather than if there was a sound health reason to do so. It should also appear obvious that any profession so interested in the welfare of the patient that it would hamper its own profitability, must be acting in good faith. A great public criticism of medicine is that of not policing their own. Yet, here is a perfect example of dentistry trying to maintain a high level of professionalism and honest care for its patients, with a few individuals who stand to profit able to thwart that effort through the legislative process.

9500 Independence Drive #1000, Anchorage, Alaska 99507
907-522-5000 FAX 907-522-5001

As in the eighties, when the state of Alaska passed legislation allowing the administration of the much touted anti-cancer drug Laetrile to be pandered upon the public by the naturo-pathic side of medicine, we now stand likely to suffer similar egg-in-the-face results with this amendment to hamper the efforts of sound dentistry.

Please exercise mature, sound judgment in the best interest of the public's welfare, and remove this onerous amendment from SB 90, or defeat this bill as written if necessary.

Sincerely,

John M. Sparaga, D.M.D.

John M. Sparaga, D.M.D.

cc:Mail for: Annette Kreitzer

Subject: Re: SB 90
From: Senator Loren Leman 4/07/97 10:12 PM
To: rsklc1@aurora.alaska.edu at CC2MHS1
cc: Annette Kreitzer

Dr. Crooks,

Thank you for your input. I share some of your concerns about unsubstantiated claims--however, I also want to protect the rights of patients to have alternative restorative materials placed, and the rights of dentists to advise patients appropriately. I will pass on your suggestions to the State Afairs Committee.

Loren Leman

Subject: SB 90
From: rsklc1@aurora.alaska.edu at CC2MHS1
Date: 4/7/97 7:23 PM

Senator Leman,

Hello, I am Ken Crooks, DDS, Chairman of the Alaska Board of Dental Examiners, and I would like to enter discussion of SB 90. I have not been directed by fellow board members to address you, but I will speak as the board representative for issues which we have specifically addressed unless otherwise indicated.

Sir, I have received copies of email correspondence between yourself and Dr. Cook via the ADS and am very interested in joining the discussion. This message is set up addressed to yourself, Dr. Cook, and the ADS Executive Director Martha Reinbold. It is my desire that this serve as a vehicle to deal with concerns from a portion of the professional dental community regarding SB 90.

I have testified in the House L&C Committee hearing on HB 135. I wish to provide you with the position of the Board of Examiners regarding SB 90. The board met on April 4 and 5 and had access to SB 90 as amended in the 4/3/97 Senate Labor and Commerce Committee meeting. We also had a chance to discuss the language and implications with the Dpt of Licencing administrators and Mr. Ken Truitt of the Attorney General's office.

The Board of Dental Examiners is supportive of its own renewal. The board is also supportive of all provisions of the current SB 90 up to Section 4.
The board considers section 5 to be unnecessary, but not threatening to our function in any way.

The language of Section 4 is considered by the Board of Dental Examiners

to be a threat to the health and safety of Alaska citizens because it imposes limitations on the power of the board to regulate unethical or incompetent dental practice. We presented the language of the existing SB 90 bill to State Assistant Attorney General Truitt with the question: Under this proposed statute, can the board sanction a dentist who makes wild, unsubstantiated, claims about any kind of treatment involving filling replacement? Mr Truitt responded that it was an unclear situation which could go either way; that the words "may not" within section 4 were an attorney's grounds for counter-argument.

Senator Leman, the board does not care if a dentist adequately replaces any kind of restoration with the informed consent of a patient. What the board IS concerned about is the possibility of being forced to tolerate unjustifiable removal and replacement of fillings (unneeded treatment) on the basis of unproven claims presented by a dentist to a patient. The Board of Dental Examiners voted on April 4, 97, not to support Section 4 of SB 90, for the above reasons, and would prefer to see the section deleted.

If section (4) must survive - - I propose changes to the language of SB 90 as follows, the language from the first addition has been adapted from the American Dental Association Code of Ethics, (since I do not know how to underline on email, please accept capitalization as indication of new language) :

(b) Notwithstanding other provisions of this section, AND PROVIDING THAT A DENTIST HAS NOT REPRESENTED THAT DENTAL TREATMENT RECOMMENDED OR PERFORMED HAS THE CAPACITY TO CURE OR ALLEVIATE DISEASES, INFECTIONS OR OTHER CONDITIONS, WHEN SUCH REPRESENTATIONS ARE NOT BASED UPON ACCEPTED SCIENTIFIC KNOWLEDGE OR RESEARCH, the board may not impose a disciplinary sanction on a dentist based solely on the grounds that the dentist removed or placed, or recommended the removal or placement of, a professionally recognized restorative material for a patient in the absence of demonstrable physical harm OR DEMONSTRABLE EVIDENCE OF TREATMENT PROVIDED UPON THE RECOMMENDATION OF THE DENTIST WHICH DOES NOT ADDRESS A PROFESSIONALLY RECOGNIZED ORAL HEALTH PATHOLOGY OR COSMETIC CONDITION OF THE PATIENT.

DENNIS L. ANDERSON D.D.S.
04/02/97

State of Alaska
Senate Labor and Commerce Committee
Attention Mike Pauley - Senate Aide

Dear Senators,

I am writing to address the proposed amendment to AS0.8.36.010. I understand the proposed amendment would make it possible for dentists to recommend the removal and replacement of dental amalgam restorations with other approved dental materials done in accordance with standard protocols. These replacements could be done without facing disciplinary sanction.

As a former dental board member and past chairman of that board, I want to go on record as strongly supporting the proposed amendment. Further, dentists should secure a patient's informed consent before ever placing such a potentially toxic material in any patient's teeth. Most patients have no idea that amalgam is approximately 50% mercury. When given this information, it has been my experience that seldom would they allow it to be placed in their teeth.

I will be out of Alaska on Thursday April 3rd through April 6th. If there will be another opportunity to testify, I would appreciate being informed. Thank you for your consideration and, hopefully, your approval of this amendment.

Sincerely,

Dennis L. Anderson D.D.S.

17638 KASILOFF DRIVE, EAGLE RIVER, AK 99577-8261 907-696-1000 (HOME & FAX)

Dental Examiners/2

Ann Harter McCoy
P.O. Box 211453
Anchorage, AK 99521-1453
Voice and Fax (907) 337-4486

FAX TRANSMISSION

DATE: December 2, 1996

TO: Marla Huss, Boards and Commissions
Office of the Governor

CC: Catherine A. Reardon, Director
Division of Occupational Licensing

RE: Resignation from Board of Dental Examiners

Please accept my resignation from the Board of Dental Examiners.

Thank you for the opportunity to serve as the public member on the Board of Dental Examiners. There have been recommendations that there be at least 2 public members on this board. I am in favor of this. If you have questions, please give me a call.

Ann H McCoy

Resume File / Dental Bd.

Ann Harter McCoy
7749 Old Harbor Road
Anchorage, AK 99504
(907) 337-6138

EDUCATION

Master of Arts in Teaching (Adult and Community Education), 1993, Alaska Pacific University
Graduate assistant 1991-93: Murdock Science Grant–developed and produced newsletters, brochures, other training materials, and graphics; collaborated on development of training component; acted as computer consultant

Bachelor of Arts (Art), 1968, Humboldt State College, Arcata, California

EXPERIENCE

Alaska Pacific University, Adjunct Faculty, 1993-present
Develop and teach ED 463/663 Computer Literacy for Teachers. The course focuses on providing information and skills for use of current technologies including computers.

Ann H. McCoy Consulting Service, Owner, 1991-present
Conduct research and program evaluations. Write reports and articles. Utilize desktop publishing skills to create documents (including newsletters, brochures, and reports) and generate graphics. Organize and coordinate conferences. Develop and present educational workshops and training seminars for adults, and produce supporting materials. Facilitate meetings and workshops.

National PTA Region 7, Vice President, 1990-1992
Supervised and provided support for seven state PTA presidents. Organized, prepared, and taught state board leadership education seminars. Designed and implemented region conferences. Developed, produced, and disseminated leadership materials, newsletters and correspondence.

Office of the Governor, Project Coordinator, 1989-1990
Managed projects. Made public presentations and personal contacts. Drafted correspondence. Researched and developed information. Organized and coordinated statewide parent involvement conference. Distributed information about parent involvement in education. Wrote and produced follow up conference report.

Alaska PTA, Treasurer, 1989-1991
Restructured financial accounting system. Implemented accountability measures. Designed budget development process. Developed yearly budget. Maintained financial transactions of organization. Processed payroll and related reports. Prepared financial reports.

Alaska PTA, President, 1985-1989
Developed, implemented and evaluated goals, activities, timelines. Coordinated work of volunteers. Prepared budgets. Established an office. Wrote and published reports, training handbooks, newsletters, and other leadership materials. Coordinated conventions. Developed and conducted training workshops for adult volunteers. Presided at meetings and conventions. Communicated and built coalitions with State Department of Education, State Board of Education, and other statewide organizations. Participated in conferences and supplied testimony. Served on numerous task forces and committees related to a variety of topics, including health and education issues.

Community Organizations, Volunteer, 1974-1985
Involvement included positions with: Creekside Park PTA, 1979- present (president 1981-1983, 1989-1990); Northeast Anchorage Community Council, 1975-1982 (organizing committee and president); Anchorage School District Art Curriculum Committee, 1981-1991; and Anchorage Council of PTAs, 1982-1985, 1989-90 (president 1983-1985)

Alaska State-Operated School System, Teacher, Nooiak, 1970-1974
Supplied individualized education experiences for 2nd and 3rd grade students. Developed and taught 7th and 8th grade art program. Established school library. Conducted parent conferences. Participated in community activities.

COMMUNITY INVOLVEMENT

Alaska Department of Education Skills for Healthy Life Standards and Assessment Committee, 1993-present
Action for Alaska's Children, 1989-present, board of directors, treasurer
Alaska PTA Board of Managers, 1984-present
National PTA Board of Directors, 1985-1992
Alaska Department of Education Alternative Teacher Certification Advisory Task Force, 1991-92
Anchorage School District Art Curriculum Committee, 1981-1991
Alaska Arts in Education,1988-1991, Advisory Board member
Alaska State Teacher Certification Advisory Committee, 1988-1989
Alaska Department of Education Youth at Risk Planning Committee, 1989
Alaska Commissioner of Education's Task Force on Education, 1987-1989
Alaska Department of Education Student Assessment Task Force, 1987-1989
Anchorage School District Parent Involvement Task Force, 1988-1989
Anchorage School District Curriculum Review Council, 1988-1989

HONORS AND SPECIAL ACHIEVEMENTS

Graduate Student Speaker, Alaska Pacific University Commencement, 1993
Distinguished Service Award-Outside the Profession (1st awarded), National Art Education Association, 1990
Legislative Commendation Honoring Service as Alaska State PTA President, Alaska State Legislature, 1989
Contributions to Quality Education Award, Anchorage Chamber of Commerce, 1987
Outstanding Volunteer Award, Anchorage School District, 1987, 1984, 1983
Honorary Life Member, National PTA, 1984; Honorary Life Member, 7 state PTAs
Green and Gold Key, Senior Men & Women's Honorary of Humboldt State, 1967
Who's Who Among Students in American Universities and Colleges, 1967

PUBLICATIONS

Breaking Down Barriers to Parent Involvement in Education: An Analysis of Responses from Participants at the 1991 Alaska Parent Involvement Conference; research report
Numerous articles for PTA newsletters and other publications

CONFERENCES AND COURSES TAUGHT

Developed and presented numerous short term workshops and seminars over the past ten years.
Guest lecturer for classes in curriculum, multicultural education, foundations, special needs
Assisted with teaching course on equity and diversity

PROFESSIONAL ORGANIZATIONS

Kappa Delta Pi, Rho Zeta Chapter, Charter member, 1986-present
Association for Supervision and Curriculum Development
American Association of University Women

GRADUATE COURSES

Professional writing, research, leadership, adult & community education, education, curriculum, multicultural education, Alaska Native history and culture; Alaska Pacific University, 1973 to 1993
Education, art, computers; University of Alaska Anchorage, 1974, 1980, 1984
Leadership in education; University of Denver, 1985
Education, curriculum; California State University, Hayward, 1969-1970

CERTIFICATE

Alaska Teacher Certificate, Type A, 1970-present

Audit Report

DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT
BOARD OF DENTAL EXAMINERS

October 14, 1996

Audit Control Number:
08-1443-96

Division of Legislative Audit
P.O. Box 113300, Juneau, Alaska 99811-3300

ALASKA STATE LEGISLATURE

LEGISLATIVE BUDGET AND AUDIT COMMITTEE
Division of Legislative Audit

P. O. Box 113300
Juneau, AK 99811-3300
(907) 465-3830
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October 14, 1996

Members of the Legislative Budget
and Audit Committee:

In accordance with the provisions of Title 24 of the Alaska Statutes, the attached report is submitted for your review.

DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT
BOARD OF DENTAL EXAMINERS

October 14, 1996

Audit Control Number

08-1443-96

The objective of the audit was to determine whether the Board of Dental Examiners should continue in existence. Alaska Statute 08.03.010(c)(10) terminates the board on June 30, 1997. As of July 1, 1997, the board will begin its one-year "wrap up" period and, if no action is taken by the legislature, the board will be dissolved at June 30, 1998. We recommend that the legislature extend the board until June 30, 2002.

The audit was conducted in accordance with generally accepted government auditing standards. Fieldwork procedures utilized in the course of developing the findings and discussion presented in this report are discussed in the Objectives, Scope, and Methodology section of this report.

Randy S. Welker, CPA
Legislative Auditor

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OBJECTIVES, SCOPE, AND METHODOLOGY

In accordance with the intent of Titles 24 and 44 of the Alaska Statutes (sunset legislation), we have reviewed the activities of the Board of Dental Examiners (the board) to determine if it should continue in existence.

As required by statute, the legislative committee of reference is to consider this report as part of the oversight process in determining whether this board should be reestablished. The law currently specifies that the board will terminate on June 30, 1997 and will have one year from that date to conclude its affairs.

During the course of our examination, we reviewed and evaluated the following:

- Applicable statutes and regulations.
- Interviews with Department of Commerce and Economic Development, Division of Occupational Licensing personnel.
- Interviews with the board's legal representative.
- Licensing files.
- Investigation files.
- Annual reports of the board's activities.
- Minutes of the board's meetings.
- Office of the Ombudsman on-line closed case files.
- Division of Occupational Licensing Policy and Procedures Manual.
- Contents of the board's correspondence files.
- Other relevant documents.

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ORGANIZATION AND FUNCTION

The Board of Dental Examiners was established in 1955. This regulatory board (see inset at right) is comprised of six licensed dentists, two licensed dental hygienists, and one public member. The dentists and dental hygienists must have been practicing in Alaska for five years immediately preceding their appointment to the board. Alaska Statute also requires that the public member of the board have no direct financial interest in the occupation the board regulates. Board members are appointed by the governor and serve staggered terms of four years.

Board of Dental Examiners
Board Members

James A. Clark, Dentist, Chairman
James R. Arneson, Dentist
Kenneth L. Crooks, Dentist
Raymond L. Lang, Dentist
Phyliis L. Pendergrast, Dentist
Carol L. Ross, Dentist
Susan L. Seater, Dental Hygienist
Connie Stewart, Dental Hygienist
Ann H. McCoy, Public Member

Alaska Statute 08.36.070 establishes the powers of the board. They include:

1. Examining and issuing licenses to qualified applicants.

2. Holding hearings and ordering the disciplinary sanction of a person who violates the provisions of Alaska Statute 08.32, Alaska Statute 08.36, or a regulation of the board.

3. Adopting regulations ensuring that renewal of licenses is contingent upon proof of continued competency.

4. Issuing permits to licensed dentists and dental hygienists who meet standards determined by the board for specific procedures that require specific education and training.

The board is organized under the Department of Commerce and Economic Development, Division of Occupational Licensing. The department is statutorily responsible for performing administrative duties such as receiving applications and fees, issuing licenses as authorized by the board, and providing enforcement and investigative services to the board.

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REPORT CONCLUSIONS

Alaska Statute 08.03.010(c)(7) terminates the Board of Dental Examiners on June 30, 1997. Alaska Statute 08.03.020 provides the board one year in which to conclude its affairs if the legislature does not enact legislation for its continuance. We recommend that the legislature extend the board's termination date until June 30, 2003.

Audits since 1985 have reported that board action or inaction has restricted entry into the dental profession by not allowing licensure by credentials as permitted by Alaska law. Although the board has made significant strides in permitting such licensure, this continues to remain an issue for the board (see Recommendation No. 1). As a result, the legislature may wish to revise the board's statute with regard to licensure by credential and the board's composition to include more public members. The main purpose for public membership on boards is to add a more objective viewpoint which is not inhibited by personal financial interests.

The Findings and Recommendations section of this letter describes areas where weaknesses or conflicts exist. We have made recommendations which, if implemented, will improve the efficiency and effectiveness of the board.

Exhibit 1

Court Orders Board to Allow Licensure by Credentials of Qualified Applicants

In 1984, the board issued an emergency regulation, 12 AAC 28.951, which suspended licensure by credentials after concern was expressed by the Attorney General about the board's procedures. The Attorney General found that the board was conducting an "oral test" instead of an "oral interview" as allowed by statute. In the late 1980's the board refused to permit licensure by credentials of qualified applicants. This was despite specific intent language attached to 1986 legislation which extended the board under the State's sunset statute. This intent directed the board and the division of occupational licensing (OL) to develop new procedures for credentialling. In August 1990, twenty-three applicants applying for licenses by credentials filed a civil suit protesting the board's refusal to consider their applications. The court found for the plaintiffs and ordered the board *"to receive and consider all applications submitted by plaintiffs for admission by credentials on or before 60 days from January 28, 1991."* According to the Department of Law (Law), this suit cost the state approximately $40,000 with less than half of this amount being paid with dental licensing fees.

The following table summarizes the total applications for licensure by credentials from FY 90 through FY 93. We believe the sharp upswing of licenses issued in FY 92 represents pent up demand for licensure by credentials.

DENTISTS LICENSED BY CREDENTIALS

DESCRIPTION	FY 86 - FY 90[1]	FY 91[2]	FY 92	FY 93	FY 94	FY 95	FY 96
Dentists	Unknown	20	55	11	13	16	4[3]
Applications Denied[4]	Unknown	2	4	6	9	18	10

License by credentials statute revised effective June 1992

Alaska Statute 08.36.234 was revised in 1992 to mandate licensure by credentials. In addition, changes were made to the requirement that an applicant for licensure be "*licensed to practice dentistry in another state, territory, or region with licensing requirements at least equivalent in scope, quality and difficulty to those of this state at the time of licensure.*" The revised statute required that applicants have

> *passed clinical and written examinations required for licensure in another state, territory, or region of the United States and has been licensed to practice dentistry in that state, territory, or region of the United States; the state, territory, or region must have licensing requirements at least generally equivalent to those of this state at the time of application.* [Emphasis added.]

According to the Department of Law,

> *Current law thus appears to direct the board to be more flexible in accepting, as generally equivalent, out-of-state exams that are not identical to Alaska's exam.*

Applicants denied licensure by credentials in FY 91 through FY 96 appeal board's decisions

Alaska Statute 08.36.234, relating to dental licensure by credentials, requires an applicant to meet a variety of qualifications (see page 10). Of the fifteen applicants for licensure by credentials that were denied licensure between FY 91 and FY 96, six were because the state or regional clinical examination required by the state in which they were licensed was not considered by the board to be generally equivalent to the clinical examination required in Alaska for licensure by examination. Two of the six appealed the board's decision. The appeals went to a hearing officer as part of the administrative adjudication process provided for in Alaska Statute 44.62. The appellants' contention was that the clinical examinations were generally equivalent.

The hearing officer recommended that one applicant's licensing decision be reconsidered and that the other applicant be licensed by the board. The board rejected the hearing officer's proposed decision and pursuant to Alaska Statute 44.62.500(c) called for the record and heard additional evidence on whether the examinations were generally equivalent.

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[1] There were no dental licenses by credentials issued during FY 86 through FY 90. We did not compile records of any applications for licensure by credentials for this time period.

[2] Of the twenty-three dentists who filed suit to force the board to license dentists by credentials, sixteen were issued licenses in FY 91 and four in FY 92. The remaining three apparently did not continue to pursue licensure in Alaska.

[3] The 1996 class of dentists has not yet graduated, the bulk of FY 96's licensing had not occurred as of the end of our fieldwork.

[4] Count of denied applications is based on the fiscal year the board makes the decision to reject/deny the application for licensure.

FINDINGS AND RECOMMENDATIONS

Recommendation No. 1

The legislature should revise the board's statutes for more flexibility in licensing by credentials.

Issuing a license based on past performance records in place of an examination is termed licensure by credentials. In prior audits, we have criticized the board for not providing a means for licensure by credentials for dentists. Although significant efforts have been made by the board to license dentists by credentials, this method of licensing remains at issue with the board.

Exhibit 2

Board Rejects Examination Requirement of 27 Jurisdictions.[5]

The Western Regional Examining Board (WREB) examination is the clinical examination selected by the board for licensure by examination of dentists. The board's policy since they began licensing by credentials has been to use the "same subject" rule to define general equivalency of examinations.

The board reviews the subjects on the clinical examination that the state in which the applicant has been licensed requires for licensure to ensure that they are the same subjects on the WREB examination. As a result of this rule, in the past some applicants were rejected. They were not licensed, although they had passed either of the two other regional exams, the Northeast Regional Examining Board (NERB) and the Central Regional Dental Testing Service (CRDTS), and the exam given by the State of California. All of these exams were rejected as being generally equivalent because they did not test on endodontics, the branch of dentistry that deals with diseases of the tooth root, dental pulp, and surrounding tissue.

After the court decision discussed in Exhibit 1, the standards adopted by the board for general equivalency still resulted, until recently, in the rejection of other regional examinations as being generally equivalent to the WREB examination (see Exhibit 2). The board attempted to compensate for this by instituting a policy of allowing a credential applicant to substitute continuing education to compensate for an out-of-state licensure examination that is not equivalent to Alaska's examination. This appears to be a reasonable policy, however, in a Memorandum of Advice dated November 6, 1992 the Attorney General's office indicated that they did not

> *believe that the 1992 amendments allowed the Board to adopt such policy because the policy means that the board would be accepting out-of-state licensing requirements which at the time of the person's application were not generally equivalent to Alaska's requirements at the time of application, and allowing the applicant to supplement his or her qualifications after the fact.*

The board, therefore, ceased allowing continuing education to compensate for an out-of-state licensure examination that is found not to be generally equivalent to Alaska's examination.

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[5] Northeast Regional Examining Board (NERB) fifteen member states are: Connecticut, Maine, New Hampshire, Ohio, District of Columbia, Maryland, New Jersey, New York, Illinois, Massachusetts, Michigan, Pennsylvania, Vermont, Rhode Island, and West Virginia. Central Regional Dental Testing Service (CRDTS) eleven member states are: Colorado, Minnesota, North Dakota, Wyoming, Iowa, Missouri, South Dakota, Kansas, Nebraska, Wisconsin, and Illinois.

Exhibit 3

Alaska Statute 08.36.234. Licensure by credentials.

(a) The board shall provide for the licensing without examination, except as provided in (2) of this subsection, of a dentist who

(1) provides certification to the board that the dentist

(A) is a graduate of a dental school accredited by the Commission on Accreditation of the American Dental Association, or its successor agency, and holds a certificate from the American Dental Association Joint Commission on National Dental Examinations that the dentist has passed the written examination given by the commission;

(B) has passed clinical and written examinations required for licensure in another state, territory, or region of the United States and has been licensed to practice dentistry in that state, territory, or region of the United States; the state, territory, or region must have licensing requirements at least generally equivalent to those of this state at the time of application;

(C) is in good standing with the licensing entity in the jurisdiction where the dentist is currently licensed and in all jurisdictions in which the dentist was previously licensed while practicing in those jurisdictions; if the dentist is employed by the federal government, the dentist must be in good standing with the employing federal agency;

(D) has been engaged in continuous active clinical practice averaging at least 20 hours per week for each of the five years immediately preceding the application

(i) in a jurisdiction in which the dentist was licensed and in good standing; or

(ii) working for the federal government while in good standing with the employing federal agency and after having been licensed by a jurisdiction;

(E) is not the subject of an adverse decision based upon a complaint, investigation, review procedure, or other disciplinary proceeding within the five years immediately preceding application, or of an unresolved complaint, investigation, review procedure, or other disciplinary proceeding, undertaken by a state, territorial, local, or federal dental licensing jurisdiction or a dental society;

(F) is not the subject of an unresolved or an adverse decision based upon a complaint, investigation, review procedure, or other disciplinary proceeding undertaken by a state, territorial, local, or federal dental licensing jurisdiction, dental society, or law enforcement agency that relates to criminal or fraudulent activity, dental malpractice, or negligent dental care and that adversely reflects on the applicant's ability or competence to practice dentistry or on the safety or well-being of patients;

(G) has not previously had a license to practice dentistry suspended for grounds similar to those specified under AS 08.36.315, revoked, or voluntarily surrendered;

(H) has completed at least 42 hours of continuing education related to clinical dentistry in the three years preceding application for a license in this state; the continuing education must have been approved by the American Dental Association, the Academy of General Dentistry, or the appropriate specialty board;

(I) has not within the previous three years failed the clinical exam given by the Western Regional Examining Board;

(J) is not the subject of an adverse report from the National Practitioner Data Bank or the American Association of Dental Examiners Clearinghouse for Disciplinary Information that relates to criminal or fraudulent activity, negligent dental care, or malpractice;

(2) has passed, to the satisfaction of the board, a written examination that consists of the portion of the written examination given under AS 08.36.160(b) that pertains to the state's laws on the practice of dentistry; the board may not require a higher passing score for applicants under this section than the board requires for applicants under AS 08.36.110;

(3) is personally interviewed by the board for purposes of verifying credentials;

(4) pays all required fees;

(5) provides the board with an affidavit that the dentist is not an impaired practitioner;

(6) provides to the board an authorization for release of records in a form prescribed by the board.

(b) A dentist applying for licensure without clinical examination is responsible for providing to the board all materials required by this section or by the board to implement this section to establish eligibility for a license without clinical examination. In addition to the grounds for revocation of a license under AS 08.36.315, the board may revoke a license issued without a clinical examination upon evidence of misinformation or substantial omission.

(c) The board shall adopt regulations necessary to implement this section including the form and manner of certification of qualifications under this section.

During this time, the board also proposed a policy to

> *accept an applicant's certification in a dental specialty as substitute proof to show that the applicant is qualified for an examination topic that is not included on the out of state licensure exam required in the jurisdiction in which the applicant is currently licensed.*

However, the Attorney General's office indicated that, for the same reasons cited in the November 1992 memorandum, the board's statute regarding licensure by credentials did not give them the authority to implement this policy (see opposite page for statutes regarding licensure by credential).

Recently, the board has given more consideration to regional examinations when licensing applicants by credential. Since November 1992, both the Central Regional Dental Testing Service (CRDTS) and the Northeast Regional Examining Board (NERB) examinations have been modified, and the CRDTS exam was considered to be generally equivalent. This past spring, the board licensed an applicant who had passed the NERB examination. Additionally, there are eleven other states and territories that do not belong to the regional examination boards, but give their own individual exams. It is unclear how many of these states give exams that would be considered generally equivalent as the board only evaluates exams for equivalence when an application is received from a licensee in that jurisdiction.

The licensing by credential statute is currently being interpreted to require the comparison of the current exam offered in the jurisdiction in which the applicant is licensed, to the exam offered in Alaska at the time of application. Since exams have changed over the years, it is possible that jurisdictions which currently do not test endodontics, resulting in licensees from those jurisdictions being denied based on general equivalency, actually tested this subject at the time the applicant took the exam. Additionally, an individual may also be a specialist in this field of dentistry, or have extensive continuing education in the subject and still be unable to be licensed in Alaska. Thus it seems that the current interpretation of the statute is unduly restrictive, and appears to have resulted in the denial of licensure to qualified dental practitioners.

Some board members appear to be working toward a proposal to make licensing by credentials more flexible. An examination under review would have to meet, for example, six out of eight criteria in order to be considered generally equivalent. These members, however, do not appear to be in the majority. We, therefore recommend that the legislature consider further revising the statute to provide additional flexibility in the examination requirements for licensure by credential. Currently the statute requires that an applicant have

> *passed clinical and written examinations required for licensure in another state, territory, or region of the United States and has been licensed to practice dentistry in that state, territory, or region of the United States; the state, territory, or region must have licensing requirements at least generally equivalent to those of this state at the time of application.*

We suggest the legislature expand this statute to alternatively allow substitution of:

1. Proof of certification in a dental specialty. Applicants should be allowed to demonstrate they are qualified for an examination topic that is not included on the out-of-state licensure exam required in the jurisdiction in which the applicant is currently licensed by providing proof that they maintain a current specialty license in that field.

2. Continuing education. Continuing education credits, as determined to be adequate by regulation to be developed by the board, should be sufficient to demonstrate that the applicant is qualified for a examination topic that is not included on the out-of-state licensure exam required in the jurisdiction in which the applicant is currently licensed.

3. Successful practice history. Proof of continuing practice, for a number of years as determined by the board to be adequate in area of dentistry that is not included on the out-of-state licensure examination required in the jurisdiction in which the applicant is currently licensed, should be sufficient to demonstrate the applicant's qualifications in this area.

In our view, this statutory change will result in increased licensing for qualified dental practitioners that are not currently eligible for licensure.

Recommendation No. 2

The legislature should consider revising the board's composition to include more public members.

The regulation and licensing of qualified professionals is necessary to protect the public's health, safety, and welfare. The board is to provide this service by establishing minimum educational and experience requirements that provide reasonable assurance that persons licensed are qualified. Assurance that licensed professionals act in a competent manner is provided by investigation of complaints and revocation or suspension of licenses when appropriate.

Audits since 1985 have found that board action or inaction has restricted entry into the dental profession by not allowing licensure by credentials as permitted by Alaska law. Such licensure continues to remain an issue for the board (see Recommendation No. 1). The board is currently composed of six dentists, two dental hygienists, and a single public member. Our review, however, indicated that the board's public member was not present for 45% of the meetings and teleconferences held by the board. As there is currently only one public member assigned to the board, the absence of this member leaves the board without a representative from the public.

The main purpose for public membership on professional licensing boards is to add an objective viewpoint which is not inhibited by personal financial interests. We recommend the legislature consider revising the board's composition to include an additional public member to provide better representation of individuals without a direct financial interest in the board's decision making process.

Recommendation No. 3

The legislature should revise the statute requiring submission of a signed photograph by dental applicants.

AS 08.36.120 currently requires that applicants for dental licenses submit an autographed photograph with their application. The Division of Occupational Licensing is not currently requiring that the photograph submitted be signed as it is submitted attached to a signed and notarized application. Additionally, the notary's seal is required to partially cover the photograph on the application. The existing requirement is redundant and we recommend that the legislature delete the word autographed within this statute.

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ANALYSIS OF PUBLIC NEED

Limited Analysis

The following analyses of board activities relate to the public need factors defined in the "sunset" law, Alaska Statute 44.66.050. These analyses are not intended to be comprehensive, but address those areas we were able to cover within the scope of our review.

The extent to which the board, commission, or program has operated in the public interest.

The board, through their administration of the licensure of dentists and dental hygienists, has endeavored to present competent dental professionals to the public. Continuing professional education is required for dentists and dental hygienists renewing their licenses. Licensees are required to post and publicly display their licenses. This notifies the public that their practitioner has met the minimum standards for the issuance and renewal of their licenses.

Applicants can be licensed through examination or credentials. Issuing a license by using a performance record in place of an examination is termed licensure by credentials. Prior audits have noted that the board has restricted entry by making it difficult to obtain a license by credentials. Although the board has considerably increased their efforts to provide for licensure by credential, this issue continues to consume resources of the board (see Recommendation No. 1).

The extent to which the operation of the board, commission, or agency program has been impeded or enhanced by existing statutes, procedures, and practices that it has adopted, and any other matter, including budgetary, resource, and personnel matters.

During FY 94, FY 95, and FY 96, the board achieved their statutory requirement of meeting at least four times during the year. Relatively frequent teleconferences were also held to permit applicants to be licensed between the regularly scheduled quarterly board meetings.

Board members are appointed by the governor, and the creation and composition of boards are defined within Alaska statutes. According to our review of FY 94 through FY 96 board appointments, the current composition of the board raises some concern. In our view, public interests would be better served by the addition of a second public member to the board (see Recommendation No. 2).

Since the last sunset audit, changes to the Alaska Administrative Code include:

A. The addition of regulations requiring all non-metal full base dentures to be identified with the owner's first initial and last name at the time of processing.

B. The addition of regulations requiring that acceptable cardiopulmonary resuscitation techniques for licensure be based on training equivalent to that required by the American Heart Association or American Red Cross.

C. The addition of regulations requiring applicants for licensure by credentials take a clinical examination on the subjects of periodontics, endodontics, amalgam and cast gold, and either a clinical or written examination on prosthetics.

As indicated in Recommendation No. 1, we believe that this interpretation of the general equivalency standard has resulted in the denial of licensure for qualified individuals, impeding the board's efforts to license qualified individuals by credential. We, therefore, recommend that changes be made to this statute to provide more flexibility to the board to allow dentists interested in relocating to Alaska from other jurisdictions to be licensed.

Annual reports for FY 94, and FY 95 were submitted by the board to OL. As of the end of fieldwork, the deadline for submission of the FY 96 report had not yet passed.

The extent to which the board, commission, or agency has recommended statutory changes that are generally of benefit to the public interest.

The board is primarily composed of relatively new members. The new board has not yet recommended any statutory changes be made to the dental hygienists' or dentists' statutes.

There has been only one statutory change to the dental hygienists' statutes (Title 8, Chapter 32) since our previous audit. Effective September 1995, Alaska Statute 08.32.110(d) was added as follows:

> *This section does not prohibit a dental assistant from applying topical preventive or prophylactic agents or pit and fissure sealants when those duties have been delegated to the assistant by a dentist licensed under AS 08.36 or by a dentist exempt from licensure under AS 08.36.350(a)(2).*

Few statutory changes have been made to the dentistry statutes (Title 8, Chapter 36) since our previous audit. Effective September 1995, however, the legislature revised the board's statutes to include the following:

A. Alaska Statute 08.36.070(13) was added to require applicants to have, and maintain throughout the period of a license, current certification in cardiopulmonary resuscitation techniques.

B. Alaska Statute 08.36.315(4) was added to include receipt of compensation for referrals as grounds for discipline, suspension, or revocation of license.

The extent to which the board, commission, or agency has encouraged interested persons to report to it concerning the effect of its regulations and decisions on the effectiveness of service, economy of service, and availability of service that it has provided.

The location, date and time of board meetings and examinations are published in newspapers around the State so that those interested can attend. During our review, however, we noted that for 27% of the regularly scheduled meetings reviewed, a public comment period was neither included in the board meeting agenda nor provided during the meeting itself.

The board also publishes a summary of disciplinary actions, in a newspaper of general circulation, at least annually as required by Alaska Statute 08.36.070(10).

The extent to which the board, commission, or agency has encouraged public participation in the making of its regulations and decisions.

As discussed above, a public comment period was not consistently made available at board meetings. However, a public comment period is made available in the process of adopting new regulations.

The efficiency with which public inquiries or complaints regarding the activities of the board, commission, or agency filed with it, with the department to which a board or commission is administratively assigned, or with the Office of the Ombudsman have been processed and resolved.

The Office of the Ombudsman closed eight files relating to the board during FY 94 through FY 96. Six of these complaints were closed the date of their receipt with the complainant referred to occupational licensing (OL). Three of these six complaints alleged that OL was not reviewing applications in a timely manner. This appeared to be the result of a policy change requiring the entire board to review new applications. Additional audioconferences are now scheduled to accommodate new applicants in a timely manner.

The remaining three complaints were resolved within two weeks of receipt as follows: 1) The complaint alleged that a probation monitor's reports were not presented to the board, resulting in termination of the monitor on an erroneous basis. This complaint was investigated, and it was found that the licensing staff did not act improperly, the board chose not to have a full hearing on the issue; 2) The complaint alleged that the board unreasonably would not provide information regarding policies and procedures for investigating complaints. this complaint was resolved by providing complainant with a copy of procedures obtained from OL; and 3) The complaint alleged that the board ignored relevant facts in license restriction hearing. This complaint was made over one year after the incident occurred. Since the complainant did not wish to appeal, he was informed that the complaint was not timely for review.