

A Comparison of Oral Health Between Multiple Sclerosis Subjects with Dental Amalgams and Those with Amalgams Removed

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Abstract

The findings presented here suggest that mercury poisoning from dental amalgams may play a role in the etiology of oral health disorders in multiple sclerosis (MS) patients. Comparisons between MS subjects with dental amalgams and a control group of MS subjects without amalgams found significantly fewer oral cavity symptoms per subject in the amalgam-removal group during twelve months. They had fewer symptoms of metallic taste, foul breath, grinding teeth, and loss of taste. MS subjects with amalgam removal had significantly higher counts of total T-lymphocytes, T-8 suppressor cells, and a lower T-4 helper to T-8 suppressor ratio. The MS amalgam group had significantly lower levels of IgG, and the female MS amalgam subjects had significantly lower levels of IgM. The hair mercury levels of MS patients were significantly higher when compared to a control group of non-MS subjects.

Introduction

Evidence in the literature suggests a relationship between mercury from dental amalgams (which is comprised of approximately 50 percent mercury) and oral cavity health.¹⁻⁴ There is a continuous leaching of mercury from the dental amalgam. An age- and sex-controlled study⁴ at Colorado State University compared oral cavity health of a group of 51 subjects without amalgams to a group of 50 volunteers with amalgams. The amalgam group had a history of 255% more oral cavity health problems in eight categories when compared to the group

without amalgams. Significant differences were found in the incidence of the symptoms of foul breath, bleeding gums, grinding teeth, metallic taste, and periodontal disease. A noncontrolled study of 86 subjects with amalgams removed reported 86 percent of their oral health problems were improved or eliminated within an average of ten months after amalgam removal. The same eight symptom categories were studied.⁴ Both studies suggested that mercury from dental amalgams might be the etiology factor of these oral health disorders.

The present study compared the health and physiology of a group of multiple sclerosis (MS) subjects who had their amalgams removed to a group of MS subjects who retained their amalgams. Their oral cavity health history also was studied. This paper reports on the results of this comparison and presents hypotheses on how mercury might be causing oral cavity disorders. Evidence also shows how mercury may be related to MS; however, it is not the purpose of this paper to prove or disprove this hypothesis.

Mercury and Oral Cavity Health

Mercury, without considering amalgam mercury, is capable of causing oral cavity health disorders in both chronic and acute mercury poisoning. Bhaskar⁵ reports that mercury poisoning can lead to oral manifestations such as increased salivation, stomatitis, glossitis, and swelling of the salivary glands. Kerr and Ash⁶ give evidence that mercury can produce a generalized or localized allergic reaction in the mouth. The allergic response is characterized by redness, soreness, mucosal necrosis, and ulceration. Shafer, Hine, and Levy⁷ reveal that the oral cavity suffers seriously

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in mercurialism. Excretion of mercury in the saliva causes a remarkably increased flow of saliva and a metallic taste. The salivary glands may be swollen, and the tongue may be enlarged and painful. The oral mucosa is prone to ulcerations on the gingiva, palate, and tongue. These researchers also report that amalgam mercury may bring about allergic reactions in patients sensitive to mercury.

Acrodynia, a disease caused by mercury poisoning in young children, also exhibits oral manifestations.⁷ These children may exhibit profuse salivation and often much dribbling. The gingiva becomes extremely sensitive or painful and may exhibit ulceration. Teeth may loosen and shed prematurely. Because of the pain, mastication may be difficult. These children also exhibit severe grinding of the teeth.¹

Gorlin and Goldman¹ report on symptoms associated with mercury from amalgams. Symptoms may include glossodynia, refractory gingivitis, pharyngitis, sialorrhea, metallic taste, lip and facial edema, or even anaphylactic shock. With this evidence, the study compared oral health between MS subjects with amalgams and those with amalgams removed.

Dental Amalgams and Multiple Sclerosis

Evidence in the literature suggests there may be a relationship between mercury from dental amalgams and MS. Epidemiology studies have linked dental caries with MS.⁸ In Australia the rates of death due to MS are linearly related to the number of decayed, missing, and filled teeth: ($r=0.9, P=0.002$). In the United States a direct correlation also was found: ($r=0.55, P=0.001$). Another study involving 45 countries found a direct correlation with the incidence of MS and the frequency of decayed, missing, and filled teeth among children of school age: ($r=0.78, P=0.001$).

The risk for dental caries has been found to be lower for the following groups: the lower income class in the United States; Chinese immigrants to England compared

with natives; blacks compared to whites; and males compared to females. Women during pregnancy and lactation are at higher risk for dental caries. The risk for MS follows the same trends.⁸ A study⁹ comparing dental caries of 51 MS subjects demonstrated an abnormally high rate of dental caries in MS sufferers compared to an age-matched group of epileptics. Investigators have found dental caries increase in locales with decreasing levels of sunlight.¹⁰ MS incidence also appears to increase with decreasing sunlight.

In the late 1940s, when mercury was determined to be the etiological factor in acrodynia, MS was suspected to be an adult form of acrodynia. However, investigators could not identify a widespread source of mercury. In 1966 Bassch.¹¹ a Swiss neurologist, suggested that amalgam fillings could be the mercury source. He believed MS was a neuroallergic reaction to mercury from dental amalgams. Ingallis⁸ theorized that the correlation between dental caries and MS might be related to mercury from dental amalgams. He described himself as having unilateral MS, and all his dental caries were ipsilateral. A study by Ahlrot-Westerlund et al.¹² also confirmed the relationship between mercury and MS. They found that mercury levels in MS patients' ($N = 12$) cerebral spinal fluid were eight times higher than in a control group ($N = 14$) of healthy subjects.

Eggleston and Nylander¹³ analyzed mercury levels in brain tissues from 83 cadavers. They found a positive correlation between the number of occlusal surfaces of dental amalgams and mercury levels in the brain. The results suggest that mercury from dental amalgam fillings may contribute to total brain mercury content.

Mercury and the Immune System

The T-8 suppressor (CD8) subclass of T-lymphocytes is reduced in MS patients.¹⁴ Eggleston¹⁵ found that amalgams sup-

pressed the T-lymphocytes. As amalgams were placed in the mouth, the T-lymphocyte count decreased. When the amalgams were removed, the T-lymphocytes increased. A sex- and age-controlled study¹⁶ at Colorado State University confirmed these findings. A control group of 20 females without amalgams had a significantly higher percentage of T-lymphocytes than an age-matched group of 20 females with amalgams (nonamalgam=55.55%, amalgam=53.00%, $P=0.045$). T-lymphocytes play a role in cellular immunity to viruses, bacteria, and yeast infections. Suppressed T-lymphocytes could play a role in oral cavity health as well.

One of the clinical findings in MS is an elevated IgG immunoglobulin in cerebral spinal fluid. IgG is an antibody that provides a defense against bacteria and toxins.¹⁷ The study¹⁶ at Colorado State University showed a direct correlation between urine mercury and IgG in 14 female volunteers with amalgams: ($r=0.614$, $P=0.010$). There also was a direct correlation between IgG ($r=0.463$, $P=0.048$) and urine mercury. It appears that mercury stimulates antibody production.

Koller¹⁷ found that mercury produced immunosuppression to viruses in rabbits. Mercury also produces an autoimmune reaction in the Brown-Norway rat.¹⁸ Leading theories on the etiology of MS focus on both viruses and autoimmunity.

Mercury and the Nervous System

Demyelination of nerve fibers is a hallmark pathological sign of MS. Studies have shown that mercury can cause demyelination of nerve fibers.¹⁹ A slower nerve conduction velocity is typical in MS patients. A study by Singer et al.²⁰ found that workers chemically exposed to inorganic mercury had a slower conduction velocity. A recently published study by the authors found that when amalgams were removed from MS patients, the nerve conduction velocity increased.²¹

Overview

Many MS patients had their dental amalgams removed after hearing about the possible relationship between multiple sclerosis and amalgam mercury. This study compared their health status after amalgam removal to a control group of MS subjects who retained their amalgams. Oral cavity health of the two groups also was compared. The investigators hypothesized that MS subjects who had amalgams removed would enjoy better oral health. The following findings support this hypothesis.

Method

Subjects

Approximately 25 dentists in Colorado who stopped using mercury amalgam restorations were asked to supply names of MS subjects who had their amalgams removed. Health surveys were sent to these subjects, and 50 subjects responded. A large number of MS subjects with amalgams responded to an ad placed in a Denver daily newspaper soliciting volunteers. An ad also was placed in the Northern Colorado Multiple Sclerosis Society newsletter asking for MS volunteers to participate in the study. A total of 47 MS subjects with amalgams served as the control group. The 40 females and 10 males with amalgam removal averaged 44.27 years in age. The amalgam MS group included 38 females and 9 males. They averaged 41.40 years. The amalgam-removal group averaged 2.75 years since the last amalgam was removed.

Health Questionnaire

Four health questionnaires were mailed to the subjects. They included (1) a general health questionnaire, (2) a before and after amalgam removal questionnaire, (3) a detailed MS health questionnaire, and (4) a standardized psychological questionnaire. (An earlier study²² by the author found significantly less mental health problems in a group of nonamalgam subjects compared to a group with amalgams.) On

the general health questionnaire, the subjects checked off the symptoms they had within the past twelve months. This questionnaire included the oral cavity health questions.

Laboratory

Only subjects living in Colorado participated in blood testing. A total of 24 MS subjects with amalgams (20 females, 4 males) had blood drawn at MetPath Labs throughout the state. The analysis was done at MetPath Labs in Denver, Colorado. The group of amalgam-removal MS volunteers numbered 24, including 20 females and 4 males. The average age of the MS group with amalgams was 42.91 years, and the amalgam-removal group averaged 41.83 years. Fifty-six attributes of the blood were compared. Eighteen of these significantly differed between the two groups. Many of these differences can be explained by mercury toxicity. The immune response will be discussed later in this paper. Not all subjects completed the additional blood tests; therefore, the number of participants in different tests varied.

The subjects supplied approximately 0.5 gram of hair from the nape of the neck, measuring one inch from the scalp. Thirty hair minerals were analyzed comparing 29 MS subjects to 27 non-MS subjects. Atomic absorption spectrophotometry analysis was done by Doctor's Data in West Chicago, Illinois, to analyze the hair minerals. Mercury levels were analyzed by cold vapor atomic absorption spectrophotometry on 40 MS subjects and 41 non-MS subjects. The control group of non-MS subjects consisted of 37 females and 4 males whose average age was 42.66 years. The MS group consisted of 36 females and 4 males whose average age was 42.35 years.

Data Analysis

These data were analyzed by chi-square for the health questionnaires and by analysis of variance for the numerical lab data. A student t test also was performed on the data.

The analysis was done by the Statistics Lab at Colorado State University. The probability value of $P = 0.10$ was chosen as the significant level for discussion because the study was looking for trends and because of the small sample size.

Results

Oral Cavity Health Questionnaire

The MS amalgam group reported 79.2% ($P = 0.003$) more dental symptoms per subject (Table 1, p.97) in the past twelve months than did the MS group without amalgams. The symptoms of metallic taste, foul breath, a loss of taste, and grinding teeth were significantly greater in the amalgam MS group, while increased salivation was greater but not at the significant level. Over 70% of the oral cavity symptoms were improved or eliminated after amalgam removal as reported by the subjects (Table 2, p.97). Metallic taste was eliminated or improved in all five patients. Periodontal disease was eliminated in two of six subjects and improved in one. Foul breath was eliminated or improved in all subjects, and 10 of 13 subjects reported that bleeding gums had improved. Teeth grinding was reported improved or eliminated by 62% of the subjects.

T-lymphocytes

The blood tests found that the total T-lymphocytes (CD2) (combined males and females, Table 3, p.98) were 30 percent higher in the amalgam-removal group than in the MS subjects with amalgams. The T-8 suppressor (CD8) levels were 24 percent higher, and the T-4 helper (CD4) to T-8 suppressor (CD8) ratio was 18 percent lower in the amalgam-removal group. Analysis of T-lymphocytes in the female MS patients (Table 4, p.98) found the amalgam-removal group had higher values of total T-lymphocytes, T-8 suppressor cells, a larger percentage of T-8 suppressor, and a significantly lower T-4 helper to T-8 suppressor ratio. The total T-lymphocyte level was significantly higher in the male amalgam removal group (Table 5, p.98) compared to

Table 1. Oral cavity symptom questionnaire (symptoms within past 12 months).

Symptom	Without Amalgams N = 50	With Amalgams N = 47	Chi-Square	P
Metallic taste	5	10	2.357	0.063
Foul breath	4	9	2.595	0.054
Grinding teeth	7	15	4.476	0.017
Increased saliva	5	8	1.029	0.155
Bleeding gums	9	9	0.021	0.442
Burning sensation	2	1	0.283	0.297
Periodontal disease	4	4	0.008	0.464
Loss of taste	0	4	3.725	0.027
Total	36	60		

Total F value = 7.79 P = 0.0032
w/o = 0.72 symptoms/subject
w = 1.28 symptoms/subject
79.2 percent more dental symptoms/subject in amalgam group

Table 2. Dental questionnaire after amalgam removal.

	T	NC	E	I	W	E & I
Metallic taste	5	0	2	3	0	80%
Periodontal disease	6	2	2	1	1	50%
Foul breath	5	0	2	3	0	100%
Bleeding gums	13	1	5	5	2	77%
Grinding teeth	13	3	3	5	2	62%
Burning sensation	1	0	1	0	0	100%
Increased saliva	6	1	1	2	2	50%
Total	49	7	16	19	7	72%
		14%	33%	39%	14%	

Classification of symptoms: T = total symptoms before amalgam removal, NC = no change after removal, E = eliminated after removal, I = improved after removal, W = worsened after removal.

males with amalgams.

IgG and IgM

MS subjects with amalgams had significantly lower values of IgG (P=0.065) than the MS subjects with amalgams removed (Table 6 p.99). The IgM levels in the

females were significantly lower in the amalgam MS group.

Hair Minerals

MS subjects were found to have significantly higher levels of hair mercury compared to the control group (Table 7, p.99).

Table 3. T-lymphocytes (female & male).

Type	MS Amalgam Removal (N = 14)	S.D.	MS with Amalgam (N = 15)	S.D.	% Diff.	F Value	P Value
Total T-lymphocytes (CD2) per cu mm	1362	515	1044	499	30.4	2.97*	0.049*
	(N=15)		(N=19)			2.56	0.061
T-8 Suppressor (CD8) per cu mm	400	177	304	137	24.0	3.06	0.045*
T-4 Helper (CD4) per cu mm/ T-8 Suppressor Ratio	2.05	0.88	2.42	0.75	18.0	1.77	0.097*

*Not adjusted for sex
S.D. -standard deviation, p- probability

Table 4. T-lymphocytes (female).

Type	Amalgam Removal (N = 12)	S.D.	With Amalgam (N = 12)	S.D.	% Diff.	F Value	P Value
Total T-lymphocytes (CD2) per cu mm	1408	545	1146	495	22.8	1.51	0.116
	(N = 13)		(N=15)				
T-8 Suppressor (CD8) per cu mm	416	184	312	132	33.3	3.06	0.046
T-8 Suppressor %	24.2	9.4	19.9	6.2	17.8	2.09	0.080
T-4 Helper (CD4)per cu mm/ T-8 Suppressor Ratio	1.98	0.92	2.53	0.67	27.8	3.25	0.042

Table 5. T-lymphocytes (male).

	Amalgam Removal (N = 2)	S.D.	With Amalgam (N = 3)	S.D.	% Diff.	F Value	P Value
Total T-lymphocytes (CD2) per cu mm	1090	66	637	300	71.1	4.02	0.069

Table 5. IgG & IgM (female & male).

	MS Amalgam Removal (N = 12)	S.D.	MS with Amalgam (N = 16)	S.D.	F Value	P Value
IgG (Female & Male)						
IgG mg/dl	1091.9	160.12	1044.1	176.4	2.58	0.061
IgM (Female)	(N = 11)		(N = 13)			
IgM mg/dl	236.1	135.96	163.5	50.11	3.24	0.043

Table 7. Hair mineral levels.

	MS Subjects (N = 40)	S.D.	Non-MS (N = 41)	S.D.	F Value	P Value
Mercury (ppm)	2.08	3.03	1.32	0.76	2.98	0.044

Discussion

The evidence presented here supports the hypothesis that mercury from dental amalgams may be an etiological factor of oral cavity disease. These data also demonstrate that mercury from dental amalgams appears to suppress the immune system. A mercury-sup-

pressed immune system could explain why the MS group with amalgams had poorer oral cavity health than those without amalgams.

Oral Cavity Health

An earlier study by the author⁴ found that subjects with amalgams had signifi-

cantly more dental health problems than a control group without dental amalgams. The amalgam-bearing subjects had more incidents of foul breath, bleeding gums, teeth grinding, metallic taste, and periodontal disease. Most of these symptoms have been associated with mercury toxicity.^{1-3,5-7,23} The present study supports the hypothesis linking mercury to dental disease. The study found that MS subjects with amalgams reported more symptoms of metallic taste, teeth grinding, loss of taste, foul breath, and increased salivation during the past 12 months compared with an MS group with their amalgams removed. The first four symptoms were reported at the significant level. This study also supports an earlier noncontrolled investigation documenting that subjects perceived their oral health improved after amalgam removal. In this study the MS subjects reported that 33% of their oral cavity symptoms were eliminated after amalgam removal and that another 39% improved. This aspect of the study was not controlled for placebo effect.

One of the characteristic symptoms of MS is loss of taste. There were four MS subjects with amalgams who had lost their sense of taste within the previous twelve months. No MS subjects with amalgams removed reported a loss of taste. This finding suggests that mercury could affect the sense of taste by causing demyelination of the sensory nerves from taste receptors.

In two studies, subjects without amalgams experienced significantly fewer symptoms of foul breath. Gorlin and Goldman¹ may have the answer to why this occurs. Because mercury can enter the bloodstream, the circulating mercury comes in contact with the hydrogen sulfide formed during decomposition of the detritus present in periodontal pockets, forming an insoluble sulfide. Eventually there is thrombosis of the capillaries, and the surrounding tissue becomes irritated. (Another avenue of mercury entry may be directly from mercury vapor of the amalgam.)

It is known that diseased gums and

poor oral cavity health can cause bad breath. Pleva² and Raue³ both report that metallic taste disappeared after amalgam removal. Siblingud confirmed this in an earlier study⁴ where 14 of 32 subjects reported the metallic taste disappeared after amalgam removal, and 16 of the 32 said that the symptom had improved. In this study, twice as many subjects with amalgams in this study reported having a metallic taste compared to MS subjects without amalgams. It may be the mercury in the saliva that creates the metallic taste as reported by Shafer.⁷

Of the 13 MS subjects who reported bleeding gums before amalgam removal, 77% felt their gums did not bleed as much or not at all after amalgam removal. This supports an earlier study⁴ when 83 percent of 23 subjects revealed their bleeding-gum condition improved after amalgam removal. A controlled study⁴ supported this finding when amalgam subjects reported a greater history of bleeding gums than did nonamalgam subjects (non-amalgam = 3, amalgam=8, $P=0.113$). Mercury's ability to cause ulceration of the gingiva⁷ may help explain why subjects report less bleeding after amalgam removal.

Grinding teeth is another symptom of mercury toxicity.¹ The amalgam-bearing MS subjects reported significantly more symptoms ($P=0.017$) of grinding teeth than did the amalgam-removal MS group. Tremors are another common symptom found in mercury toxicity. Siblingud⁴ found that 50 subjects with amalgams had a history of significantly more tremor symptoms when compared to a control group of subjects without amalgams (nonamalgam=4, amalgam=17, $P=0.002$). They also had more symptoms of grinding teeth (nonamalgam=4, amalgam=7, $P=0.135$). The study hypothesized that grinding of the teeth may be an involuntary muscle movement caused by mercury. This study found no difference in reported periodontal disease between the two MS groups.

An earlier noncontrolled study⁴ found that 86% of seven subjects reported peri-

odontal conditions improved or were eliminated after amalgam removal, while this study found 50 percent of six subjects reported improvement or elimination. Lesions of the mouth can lead to periodontal disease. As mentioned earlier, one of the common oral symptoms of mercury toxicity is increased ulceration of the gingiva. This might be why so many subjects report their periodontal condition improved after amalgam removal. Other factors that play a role in periodontal disease and oral cavity health include the immune system and its ability to produce antibody resistance to bacteria and viral microbes. If the immune system is affected, one would expect poorer oral cavity health.

T-lymphocytes

This study gives evidence that the immune system is affected in MS subjects with amalgams, a finding that may be attributed to mercury toxicity. In multiple sclerosis, T-8 suppressor cells are suppressed significantly more during exacerbation of symptoms. Their normal function is to help suppress the immune system, and without them, the immune system becomes overactive. An overactive immune system is one hypothesis of the etiology of MS pathology. The picture is much clearer when looking at only the females. Their total T-lymphocytes was 22.8 percent higher in the amalgam-removal group, which probably is accounted for by the 33 percent higher level of T-8 suppressor cells. This would account for the higher percentage of T-8 suppressor cells found in the amalgam-removal group and the significantly lower T-4 helper to T-8 suppressor ratio. These findings support earlier studies by the authors and Eggleston.¹⁵

Immunoglobulins

An interesting dichotomy arises regarding the immunoglobulin IgG. An earlier study found a direct correlation between IgG with urine mercury, and the number of amalgams. However, an overall comparison between the same groups found the group with amalgams had lower levels of IgG compared to the group

without amalgams (nonamalgam=1096.7 mg/dl, amalgam=1011.7 mg/dl, P=0.13). A similar finding occurred in this study. The MS group with amalgams had significantly lower levels of serum IgG compared to the MS amalgam-removal group. Perhaps Moszcynski's²⁴ study could help explain this. He found reduced IgG levels in people exposed to long-term mercury vapor when compared to a control group. However, IgG is elevated when exposed to toxins.²⁵ This could explain the correlation between IgG with urine mercury and the number of amalgams. It also may help explain the higher levels of IgG in the cerebral spinal fluid of MS patients. Ahlrot-Westerlund et al.¹² found mercury levels eight times higher in MS subjects than in a control group without MS. These findings may represent an acute form of mercury toxicity. Likewise, the lower values of IgG found in subjects with amalgams may represent chronic exposure as Moszcynski²⁴ found. The immunoglobulins IgG and IgM are the body's main defense against bacteria.²⁵ If these are suppressed, subjects with amalgams may suffer from more oral cavity health disorders. Both IgG and IgM have disulfide bonds, essential in normal functioning of the antibody. It is well known that mercury has a strong affinity to sulfhydryl groups.

Hair Mercury

The significantly higher hair mercury levels in the MS subjects when compared to the control group of non MS subjects substantiates the possible role that mercury plays in MS. One possible source of the mercury may be dental amalgams. An earlier study⁴ found significantly higher levels of mercury in the hair of amalgam-bearing subjects when compared to a control group of nonamalgam subjects.

Conclusion

These findings raise concern about the role of mercury from dental amalgams in causing oral cavity health problems. T-lymphocytes play an integral role in main-

taining optimum health. When they are overactive, a variety of health problems occur. Mercury from dental amalgams may play a role in the suppression of T-8 suppressor cells in MS subjects with amalgams. Mercury also may be responsible for the lower levels of the serum antibodies IgG and IgM found in the MS amalgam subjects. This disruption of the immune system may be a factor in MS and to its associated oral cavity disease. A study by Hahn et al.²⁶ found that radioactive mercury placed in amalgam fillings of monkeys appeared in high concentrations in the tooth alveolar bone, gingiva, tongue, and oral mucosa within four weeks after amalgam insertion. This may help explain why people who have dental amalgams suffer from more symptoms of metallic taste, foul breath, loss of taste, teeth grinding, and increased salivation when compared to a control group without amalgams. The study also found that the MS subjects who had amalgams removed suffered significantly fewer exacerbations of symptoms than MS subjects with amalgams. The data is reported in another scientific paper.²⁷

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