Psychometric Evidence that Dental Amalgam Mercury may be an Etiological Factor in Manic Depression

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Abstract

Before and after treatment scores on the Minnesota Multiphasic Personality Inventory-II (MMPI-II) were compared for 11 manic depression subjects who had their amalgams removed and for 9 subjects with amalgams who were told they were being given a placebo or sealant. Of the 87 scales, the amalgam removal group improved significantly more in 47 of them. Depression and hypomania scores improved significantly, as did anxiety, anger, schizophrenia, paranoia, and many others.

Scores on the Millon Clinical Multiaxial Inventory II found the scores in the amalgam removal group improved significantly more in the scales of avoidant, dependent, antisocial and borderline, compared to the sealant/placebo group. The scores in the categories of Clinical Personality pattern category and severe Personality Pathology category also improved significantly more in the amalgam removal group.

All scores of the nine dimensions tested in the Symptom Check List 90 improved significantly more in the group with amalgam removal. They included somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoia, and psychotism.

The amalgam removal group reported a 42% decrease in the number of somatic health problems after amalgam removal, compared to an 8% increase in somatic symptoms in the placebo/sealant group when comparing a before and after health questionnaire.

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Introduction

Recent studies have shown that people with silver dental fillings are depressed significantly more than people without fillings.[1,2,3] The silver dental filling, also known as an amalgam, contains approximately 50% mercury by weight.[4] The mercury leaches from the amalgam in the form of vapor and approximately 75%-80% of mercury vapor can be inhaled into the lungs, which then enters the blood stream and passes into the brain,[5,6] as well as other body tissue. Eggleston and Nylander[7] found a direct correlation between number of occlusal amalgams and mercury in the brain in postmortem studies. A study by Siblerud[3] comparing 51 subjects without amalgams to 50 subjects with amalgams found mercury levels in urine were 201% higher (P=0.0002) in the amalgam group and hair mercury levels were 26.5% higher.

It has been postulated that depression from amalgam mercury may result because mercury has the ability to affect certain neurotransmitters in the brain,[1] and mercury has been shown to affect the same neurotransmitters whose disruption causes manic depression (bipolar disorder)[8,9,10] The present study hypothesized that if dental amalgams containing mercury were removed, depression and mania might subside. This study also compared other mental health symptoms of bipolar patients before and after amalgam removal.

Previous research that compared subjects with and without amalgams found psychometric evidence that subjects with amalgams possessed significantly more emotional and mental symptoms, such as sudden anger, depression, irritability, obsession-compulsion, anxiety, hostility,

psychotism, disturbed sleep, trouble with decisions, inability to concentrate, forgetfulness, euphoria, and others.[1,2,3]

Method

Newspaper ads were placed in Denver and Fort Collins, Colorado newspapers, soliciting people who had been diagnosed with manic depression and who had silver dental fillings to participate in a research study.

The subjects were told of the hypothesis that mercury may be associated with manic depression. They were then given a choice of having their amalgams removed or having a sealant put on their amalgams to prevent the mercury from escaping. The sealant group was told they would be given either a sealant or a placebo.

The amalgam removal group consisted of five females whose mean age was 40.4 years and six males with a mean age of 41.2 years. The control group, who was given a sealant or placebo sealant, consisted of four females whose average age was 36.8 years and five males whose average age was 36.0 years. The amalgam removal group averaged 10.4 amalgams and the placebo/sealant group averaged 9.6 amalgams. To determine if the subjects had a bipolar disorder, the subjects were given the Decision Base™ computerized DSM3-R questionnaire administered by a psychiatrist. One subject in the amalgam group did not take this test, but her diagnosis of manic depression was confirmed by her psychiatrist.

The subjects then completed three psychological tests, including the Minnesota Multiphasic Personality Inventory-II (MMPI-II), the Millon Clinical Multiaxial Inventory-II (MCMI-II), and the Symptom Check List 90 (SCL-90), in that order. The mercury vapor in the oral cavity was measured by a trained professional with a Jerome Mercury Vapor Analyzer before chewing gum and then again ten minutes after chewing. The same procedure was followed for each group with the probe moved in a figure eight pattern intraorally for twelve seconds. A health history questionnaire was also filled out by the subjects. Each of the eleven subjects in the treatment group had their amalgams removed by a different dentist in Colorado. A rubber dam and high velocity suction was utilized by all dentists. Seven subjects in the control group were given a placebo sealant in a dentist's office, while two subjects had a cavity retardant sealant put on their amalgams. There has been no evidence that this sealant retards the leaching of mercury vapor from the amalgams. The important factor was that the control group be established, believing that mercury vapor was not escaping from the amalgam. This controlled for the placebo effect.

Blood testing was done before treatment by Met Path Laboratories in Fort Collins and Denver. The blood testing included a complete blood count, blood chemistry, lithium levels, and evaluation of blood levels of metabolites of some neurotransmitters. The results of the blood tests are not presented in this paper, as there were no significant differences between the two groups. Blood mercury levels were not tested.

The amalgam removal group was given supplemental nutrients which included a multiple vitamin, vitamin C, zinc, vitamin E, garlic, and glutathione peroxidase. All these nutrients have been shown to help chelate mercury from the body or at least neutralize the effects of mercury[11-14] The control group was given one supplemental multiple vitamin and mineral tablet. Sola Ray provided the supplements.

All psychological testing and blood testing were again administered six to eight months after treatment. Statistical analysis was conducted by the statistics lab at Colorado State University, utilizing analysis of variance and the student "t" test. The level of significance for discussion purposes was 0.10 because of the low number of subjects and because the study purpose was to look for trends.

Results

The analysis of the data evaluated the difference of the results before treatment

compared to after treatment. These before and after differences were compared between the amalgam removal group and the sealant/placebo group.

MMPI

The MMPI (Minnesota Multiphasic Personality Inventory-II) consists of 567 questions which make up a total of 87 scales. (Table 1, below) The amalgam removal group showed a statistically significant improvement after amalgam removal in 47 of the scales when compared to the sealant/placebo control group. An improvement in another 20 of the scales was shown by the amalgam removal group, but not at a significant level. There was a statistically significant improvement in the control group of six scales.

Table 1: Significant means and standard deviations on the Minnesota Multiphasic Personality Inventory-II comparing subjects with amalgam removal and sealant/placebo amalgam group.

	N=9 mean with seal./placebo pre treatment	S.D.	N-9 mean with seal./placebo post treatment	S.D.	N=11 mean amalgam removal pre treatment	S.D.	N=11 mean amalgam removal post treatment	S.D.	F value	P
infrequency	57.33	17.07	58.77	24.46	66.09	13.65	58.82	13.35	3.93	0.033
correction	48.44	7.13	50.33	10.11	43.09	9.62	50.91	10.21	6.90	0.009
hypochondria	54.78	14.92	58.11	18.27	68.73	10.38	61.55	13.76	3.96	0.032
depression	58.67	15.37	60.56	16.64	64.09	14.91	58.91	13.95	1.78	0.10
conversion hysteria	54.89	10.98	59.22	18.47	67.45	12.45	59.64	13.23	5.71	0.015
masc. fem.	53.11	13.87	55.33	13.86	56.00	11.11	51.36	11.84	5.54	0.016
paranoia	56.33	7.37	59.33	16.43	71.09	14.22	63.09	16.45	2.91	0.056
psychthemia	59.55	15.91	64.00	13.93	67.64	15.34	60.82	14.17	3.70	0.036
schizophrenia	58.67	16.55	62.67	20.86	70.82	13.30	61.09	15.27	7.34	0.008
hypomania	49.11	12.69	50.11	13.67	61.18	10.48	57.18	10.25	1.30	0.14
anxiety	57.44	10.31	57.67	12.38	64.00	13.08	56.27	10.95	7.20	0.008
repression	55.00	10.97	53.77	14.98	46.64	10.17	49.64	10.00	1.84	0.10
ego strength	42.67	9.21	43.22	9.67	40.55	9.42	46.55	7.66	3.71	0.036
college malady	55.22	13.15	56.67	12.61	66.82	13.78	58.27	11.37	6.47	0.01
gender role masculine	44.55	6.62	43.22	7.07	45.00	8.45	48.36	9.97	3.48	0.04
post traum. stress	58.11	15.35	57.00	15.48	67.00	15.62	56.73	11.57	3.69	0.035
anxiety	60.22	11.42	60.11	12.88	65.36	15.59	57.45	14.02	4.43	0.025
obsessiveness	51.78	9.69	51.89	11.22	59.18	14.69	52.77	13.39	4.11	0.03
depression	54.89	13.46	55.33	16.20	65.64	12.62	58.45	9.47	3.24	0.045
health concerns	57.56	11.93	57.56	17.95	70.18	13.32	61.72	11.16	2.76	0.06
bizarre mentaton	51.78	10.15	53.66	18.48	57.18	14.29	52.18	13.73	3.51	0.08
anger	47.11	5.80	48.67	11.01	59.73	10.02	53.36	9.47	3.95	0.03
cynicism	48.33	8.70	50.44	12.56	52.72	11.98	51.45	11.06	2.75	0.06
antisocial	46.11	9.17	48.33	12.26	50.45	8.70	51.45	7.97	2.01	0.09
low self esteem	55.00	12.82	58.89	14.05	55.27	7.89	51.54	7.13	12.09	0.002
family problems	52.44	10.79	51.89	11.05	62.00	13.92	57.00	12.28	1.88	0.095
negative treatment	52.44	11.90	55.33	14.89	60.55	11.44	55.09	13.56	7.61	0.007
subjective depression	56.55	15.20	59.78	15.20	67.18	12.91	59.36	14.32	6.25	0.012
brooding	50.89	12.32	55.67	15.36	68.45	10.89	58.72	10.47	8.72	0.005
need for affection	50.44	9.54	48.33	9.03	47.82	12.54	52.64	10.60	5.59	0.015
lass. molais	54.44	16.94	58.44	16.48	72.36	16.57	63.18	14.53	7.42	0.008
somatic comp.	52.44	10.89	57.56	19.27	68.64	17.00	55.91	15.53	6.82	0.009
social impert.	50.22	6.12	46.22	6.51	51.18	9.54	55.91	9.16	9.99	0.003
self alientation	58.44	17.05	57.89	13.66	70.64	11.42	62.27	10.45	2.01	0.09
persecut. ideas	54.88	21.59	50.89	22.53	66.27	11.62	60.29	7.37	3.37	0.043

cont'd

Table 1 continued: Significant means and standard deviations on the Minnesota Multiphasic Personality Inventory-II comparing subjects with amalgam removal and sealant/placebo amalgam group.

	N=9 mean with seal./placebo pre treatment	S.D.	N-9 mean with seal./placebo post treatment	S.D.	N=11 mean amalgam removal pre treatment	S.D.	N=11 mean amalgam removal post treatment	S.D.	F value	P
poignancy	56.11	17.20	58.33	19.77	65.27	18.37	60.18	15.64	2.34	0.073
naivete	52.67	14.96	49.88	14.24	49.45	12.89	50.81	10.27	1.83	0.10
social alienation	52.11	9.10	54.55	22.53	66.73	15.06	55.64	15.49	9.54	0.004
emotional alienation	52.33	21.59	57.44	19.77	60.45	11.62	49.41	7.37	9.53	0.008
lack ego mast. cog.	65.22	17.20	62.67	14.24	69.91	18.33	57.73	15.63	3.53	0.04
lack ego mast. con.	59.11	14.96	59.44	14.87	67.36	12.89	52.55	10.27	14.95	0.007
lack ego mast. def.	56.22	17.92	58.44	20.49	62.55	15.31	53.00	13.22	4.01	0.03
bizarre sensory experience	59.67	15.72	61.00	20.92	72.36	20.75	60.91	17.62	4.56	0.025
imperturbability alienation	47.44	4.90	44.00	4.74	47.09	8.04	49.45	10.79	2.27	0.08
self/others	55.56	11.37	56.78	12.57	56.73	11.79	51.91	12.84	3.17	0.045
depression obvious	58.22	16.79	61.11	18.59	71.18	14.76	61.82	13.66	9.11	0.004
depression subtle	50.55	6.02	50.44	9.84	34.36	9.94	46.45	10.00	4.09	0.03
hysteria obvious	55.00	11.60	59.22	20.72	72.63	16.84	60.18	16.42	9.02	0.004
hysteria subtle	50.78	8.54	50.89	10.02	47.18	10.43	51.18	10.28	2.58	0.064
psychopathic deviat. obvious	54.33	11.78	56.44	13.59	69.55	13.91	63.18	12.63	4.12	0.03
psychopathic deviat. subtle	59.56	5.41	52.89	12.11	53.72	8.13	55.64	8.92	5.63	0.015
paranoia, obvious	51.56	6.56	57.37	16.00	67.73	16.57	60.72	14.83	6.04	0.013
hypomania, obvious	51.22	11.24	53.00	15.86	64.55	11.29	58.18	9.95	5.76	0.015
marital distress	56.00	6.84	54.55	8.49	67.18	15.00	59.36	14.65	2.16	0.08
addiction potential	52.66	9.50	53.55	9.66	61.09	7.52	58.91	6.83	2.92	0.054
addiction admission	51.88	6.88	53.88	10.36	60.27	9.74	57.00	12.06	2.42	0.07

Millon Clinical Multiaxial Inventory-II

The MCMI-II consists of 175 true and false questions that make up 20 scales (Table 2, p. 35). The amalgam removal group showed a statistically significant improvement in four of the scales, compared to the control group. The scales included avoidant (P=0.01), dependent (P=0.03), antisocial (P=0.07), and borderline (P=0.045).

The MCMI-II consists of four categories with each category determined by a combination of certain scales. The amalgam removal group showed a statistically significant improvement in the Clinical Personality Pattern category (P=0.049) and the Severe Personality Pathology (P=0.10) category.

Symptom Check List 90 (SCL-90)

The SCL 90 test consists of 90 questions that are utilized to evaluate a dimension. The amalgam removal group showed a significant improvement in all nine dimensions (Table 3, p.35) when compared to the control group. The changes in the SCL-90 were the most robust of all three psychometric instruments results. The nine dimensions included somatization (P=0.03), obsessive compulsive (P=0.008), interpersonal sensitivity (P=0.049), depression (P=0.007), anxiety (P=0.095), hostility (P=0.01), phobic anxiety (P=0.034), paranoia (P=0.061), and psychotism (P=0.011). The total scores of the dimensions were tabulated and the

Table 2. Significant means and standard deviations on the Millon Clinical Multiaxial Inventory - II comparing subjects with amalgam removal and sealant/placebo amalgam group.

	N=9 mean with seal./placebo pre treatment	S.D.	N-9 mean with seal./placebo post treatment	S.D.	N=11 mean amalgam removal pre treatment	S.D.	N=11 mean amalgam removal post treatment	S.D.	F value	P
avoidant	28.13	14.23	31.63	11.69	31.09	14.98	23.73	12.38	6.77	0.01
dependent	38.88	13.88	40.50	16.92	39.27	7.90	34.64	7.42	4.00	0.031
anitsocial	59.88	6.47	60.25	11.99	70.91	7.09	65.64	7.65	2.44	0.07
borderline clinical	74.88	8.01	76.75	11.12	82.73	9.03	77.73	9.34	3.33	0.045
personality pattern severe	516.38	66.48	517.38	91.48	556.18	29.23	525.82	35.74	3.11	0.049
personality pattern	213.50	18.52	213.00	21.30	229.00	15.85	218.93	20.17	1.83	0.10

Table 3. Means and standard deviations on the Sympton Check List 90 comparing subjects with amalgam removal and sealant/placebo amalgam group

	N=9 mean with seal./placebo pre treatment	S.D.	N-9 mean with seal./placebo post treatment	S.D.	N=11 mean amalgam removal pre treatment	S.D.	N=11 mean amalgam removal post treatment	S.D.	F value	P
somatization	5.89	4.83	6.11	4.34	14.10	8.08	9.2	7.19	4.27	0.029
obssesive/ compulsive	9.67	8.97	8.56	10.28	14.4	6.70	6.2	5.37	7.44	0.008
Interpersonal sensitivity	8.78	8.79	7.11	7.67	12.3	6.95	5.0	3.59	3.36	0.049
depression	9.78	10.46	10.44	11.83	19.2	8.19	10.8	7.98	7.85	0.007
anxiety	8.00	9.22	6.22	9.92	10.6	6.80	6.4	7.32	1.90	0.095
hostility	3.00	3.12	2.44	2.74	5.10	3.31	1.80	1.81	3.51	0.041
phobic anxiety	2.00	4.90	2.66	6.80	4.70	3.70	2.10	3.54	3.87	0.034
paranoid	4.11	8.20	2.78	3.50	8.20	6.14	3.50	5.08	2.68	0.061
psychotism	4.89	6.90	5.33	2.90	6.90	5.86	2.90	3.07	6.53	0.011
additional	5.22	5.19	5.0	6.14	10.6	5.17	7.00	4.37	5.08	0.020
Totals	61.33	58.86	56.67	72.13	106.10	47.96	54.90	40.51	7.44	0.008

amalgam removal group improved significantly more (P=0.008). All nine categories improved after treatment in the amalgam removal group, and five of nine improved in the control group.

Oral Cavity Mercury Vapor

Oral cavity mercury vapor was measured before treatment, and it increased by 290% after chewing gum for ten minutes with both groups combined. (This compares to a 351% increase found in 24 women with amalgams in a previous study[1]). The amalgam removal group increased by 329% and the placebo/sealant group by 106%. (Table 4, p. 36)

Somatic Health History

The amalgam removal group averaged 36.5 symptoms/subject before treatment

Table 4. Mean mercury vapor (mcg/m^3) in the oral cavity before chewing gum and ten minutes after chewing.

N=19* Before chewing mean	N=19 After chewing mean	percent increase
0.024	0.070	290%
N=11 Amalgam Removal Before Chewing Mean 0.017	N=11 Amalgam Removal After Chewing Mean 0.073	390%
N=8 Placebo/Sealant Before Chewing Mean 0.032	N=8 Placebo/Sealant After Chewing Mean 0.066	106%

*Both groups combined. Testing was done before amalgam removal.

and 21.2 symptoms/subject after amalgam removal, a 42% decline. The placebo/sealant group averaged 18.8 symptoms/subject before treatment and 20.2 symptoms/subject after treatment. (Table 5, p. 37)

Discussion

The mental health status of the amalgam removal group showed significant improvement after the removal of amalgams when compared to the placebo/sealant control group. Several of the individuals in the amalgam removal group discontinued their lithium medication entirely under their psychiatrist's direction and functioned well without it.

Hypotheses on the Etiology of Bipolar Disorders

Most psychotherapists believe that manic depressive illness is a result of a neurochemical imbalance in the brain. A number of neurotransmitters have been implicated in manic depression.

The catecholamine hypothesis states that some, if not all, depressions are associated with an absolute or relative deficiency of catecholamines, particularly noradrenaline, at functionally important receptor sites in the brain.[15] Elation, conversely, may be associated with an excess of such amines.[16] Much of the evidence for this hypothesis is supported by the action of drugs affecting moods. Lithium, which was believed to be a specific antimanic agent, was thought to potentiate the reuptake of synaptic noradrenaline.[17] Acetylcholine acts as an excitatory neurotransmitter in most areas of the brain.[17]

Acetylcholine, however, generally produces behavior inhibiting or depressant effects. It is known that there is an extensive cholinergic innervation of limbic and hypothalamic systems thought to be functionally important in the regulation of affective states such as manic depression .[17]

Janowsky and colleagues[18] expanded the catecholamine hypothesis and pro-

Table 5. Somatic health history before and after treatment.

Amalgam Removal Group (N=11)

Categories of Symptoms	Before number of symptoms	After number of symptoms	percent change
Skin (11)*	22	13	- 41%
Cardivascular (9)	9	4	- 55%
Neurological (9)	14	11	- 21%
Digestive (12)	30	19	- 37%
Blood (5)	2	3	+50%
Glandular (19)	22	19	-14%
Sleep and Fatigue (9)	54	32	- 41%
Allergies (11)	20	18	-10%
Disease (6)	6	9	+50%
Eyes (17)	47	24	- 47%
Dental Symptoms (14)	42	12	- 71%
Other (44)	133	69	- 48%
Total	401	233	- 42%
Symptoms per subject	36.5	21.2	

*Number of specific symptom classifications in each category.

Placebo/Sealant Amalgam Group (N=9)

Categories of Symptoms	Before number of symptoms	After number of symptoms	percent change
Skin (11)*	12	21	+75%
Cardiovascular (9)	4	7	+75%
Neurological (9)	3	11	+266%
Digestive (12)	24	23	- 4%
Blood (5)	1	1	0%
Glandular(19)	8	6	- 25%
Sleep and Fatigue (9)	17	20	+18%
Allergies (11)	7	8	+14%
Disease (6)	1	5	+400%
Eyes (17)	20	22	+107%
Dental Symptoms (14)	26	14	- 46%
Other (44)	46	44	+4%
Total	169	182	+ 8%
Symptoms per subject	18.8	20.2	

*Number of specific symptom classifications in each category.

posed an adrenergic-cholinergic hypothesis of manic depression. This hypothesis postulated that "affect" may represent a balance between cholinergic and adrenergic neurotransmitters activity in those areas of the brain that regulate mood. Depressive illness may reflect a disease of relative cholinergic predominance, while manic could result from relative adrenergic predominance. Current standard psychiatric drug treatment also supports this hypothesis.

Prange, Wilson, Lynn, Alltop and Stikeleather[19] developed "the permissive hypothesis" of affective disorders. They postulated that a deficit in central 5HT (serotonin) transmission permits the emergence of affective disorder. A serotonin deficit, coupled with decreased noradrenergic transmission would lead to clinical depression, while decreased serotonin activity, coupled with increased nor-adrenergic transmission, would lead to mania, according to this hypothesis. Anti-depressant drugs, such as tricyclic compounds and MAO inhibitors, increase the availability of 5HT in the brain, while reserpine, which reduces serotonin, may produce depressive episodes in some individuals.

In 1975[20] it was proposed that dopaminergic dysfunction might be a component of depression and mania as well. It was thought that mania is associated with increased dopaminergic neuronal activity, while depression was associated with a decrease in dopaminergic activity. A number of animal studies have given evidence that mania is related to an increase in dopamine.[21] The literature also reports that dopa, which increases brain dopamine synthesis, can induce mania in some depressed bipolar patients.[22] Stern and Langston have correlated the presence of depressive symptoms in Parkinson patients with decreased forebrain dopamine.[23] Pharmacological studies also suggest an association between depression and decreased dopaminergic activity.[10]

In summary, the literature suggests that bipolar disorders may result from disregulation of the secretion and reception of noradrenaline, acetylcholine, serotonin, and dopamine. If one could determine what causes this dysfunction, it might explain the etiology factor for some manic depressive patients. One possible etiological factor may be mercury. Research has shown that mercury can affect norepinephrine,[9] acetylcholine,[10] serotonin,[8] and dopamine.[9] Perhaps this may explain why the mental health status of subjects who had their mercury amalgams removed improved significantly.

Mercury and Neurotransmitters

Animal studies have shown that mercury affects the uptake of dopamine by synaptosomes in rats.[9] It can also inhibit the binding of serotonin (3H7-5HT) to its high affinity synaptic receptor in the rat brain.[8] Cooper and Manalis[10] have demonstrated that mercury can cause a sudden release of acetylcholine and then a sudden and complete blockage on the sciatic nerve and sartorius muscle of the frog. It has also been shown to inhibit the uptake of norepinephrine in brain synaptosomes.[9] The dysfunction of all these neurotransmitters is suggested as a possible cause of manic depression. Previous studies[1] have hypothesized that mercury's ability to affect the secretion and uptake of neurotransmitters may be an etiological factor in depression and other mental health problems.

Somatic Health History

The subjects were asked to check all somatic symptoms in the health questionnaire during the past six months before and after treatment (Table 5, p. 37). There were 12 categories and a total of 166 symptoms comprising the 12 categories. The subjects who had their amalgams removed reported more symptoms before treatment, compared to subjects in the placebo/sealant group (36.5 symptoms/subject, compared to 18.8 symptoms/subject). This was an

unusually higher difference, and part of the reason may be that the amalgam removal group had more dental amalgams. However, after amalgam removal, the subjects reported a 42% decrease in health problems, compared to an 8% increase in symptoms in the placebo/sealant group. Each group had about the same number of symptoms per subject after treatment (21.2 symptoms/subject in amalgam removal, compared to 20.2 in placebo/sealant group).

This supports an earlier study[24] that found subjects reported a decrease in health problems after amalgam removal. None of the subjects were told that physical health problems may improve after amalgam removal. Of the eleven amalgam removal subjects, ten reported fewer symptoms after amalgam removal, and one reported the same number. In the placebo/sealant group, four of the nine reported more symptoms after treatment. This evidence helps support the hypothesis that amalgam mercury may be causing physical health problems.

Other Factors

The amalgam group was given a greater number of supplemental nutrients, compared to the control group. These were given to help neutralize and chelate the mercury from the body. Perhaps the excess nutrients may have had an effect on the improvement of mental health status in the amalgam removal group. Further studies will have to delineate this effect.

It is impossible to control perfectly for the placebo effect when removing amalgams. This would involve removing the amalgam in the control group and replacing it with another amalgam. The patient would be able to open his/her mouth and look into a mirror and see that the filling was still silver. It would also be unethical to do such a procedure. The purpose of the placebo/sealant was to have the subject think that he/she was not being exposed to the mercury vapor.

The health history of the amalgam removal group indicated that group was unhealthier before amalgam removal, compared to the control group. The psychological tests also found that the mental health status was also poorer, compared to the control group before treatment. Whether these differences played a role in the greater mental health improvement should be investigated in future studies.

Another factor may have been an age difference between the two groups. The amalgam removal group averaged 40.8 years in age, compared to 36.3 years in the amalgam group. The amalgam also contains approximately 35% silver, 13% tin, and 2% copper.[4] These elements may also have an effect on the brain.

Mercury and Mental Health Disorders

The literature describes a multitude of mental health problems that mercury can cause. The "mad hatter" was a term used to describe workers in the felt hat industry during the last century because of the emotional problems they developed. These workers were exposed to mercuric nitrate and developed symptoms such as sudden anger, drowsiness, depression, loss of memory, timidity, insomnia, hallucinations, delusions, and mania. It was not until 1941 that brain damage resulting from mercury poisoning was identified as the cause of "mad hatter" syndrome.[25] An organic mercury pesticide sent over 6,000 Iraqi people to the hospital. Symptoms reported were depression, a lack of interest, visual hallucinations, deficient concentration, and poor short term memory.[26]

Other mental health symptoms reported from exposure to mercury vapor include forgetfulness, headaches, irritability, poor concentration, insomnia, excitability, fearfulness, restlessness, melancholy, depression, timidity, fatigue, indecisiveness, and hopelessness.[27] The results from this study demonstrate many of these symptoms improved significantly after amal-

gam removal, suggesting that amalgam mercury may be an etiological factor in this illness.

Conclusion

This research was a pilot study, involving a small number of manic depressive patients, which was looking for trends. Statistical analysis supports the hypothesis that removal of mercury amalgams from the oral cavity may have resulted in the improvement of mental health status, including depression and mania. Somatic health also improved. The measurements of the psychological profiles are highly validated parameters which indicate mental health improvement. Further studies with larger numbers and a longer time period between testings are needed to validate these initial findings and to help elucidate amalgam mercury's role as an etiological factor.

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