Psychometric Evidence that Dental Amalgam Mercury May be an Etiological Factor in Schizophrenia

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Abstract

Scores on the Minnesota Multiphasic Personality Inventory-2 (MMPI-2), the Millon Clinical Multiaxial Inventory-II (MCMI-II), and Symptom Check List-90 (SCL-90) were compared before dental amalgam removal of eight schizophrenia patients to scores six months after amalgam removal. Significant improvement was found in forty-one of the sixty-one component scales of the MMPI-2 and twelve of the twenty subscales including schizophrenia, hysteria, paranoia, and anger. Sixteen of the twenty-five diagnostic scales improved significantly in the MCMI-II including schizoid, anxiety disorders, thought disorders, and bipolar symptoms. Four of nine dimensions improved significantly in the SCL-90 including depression, psychoticism, and obsessive-compulsive. Because dental amalgam mercury can enter the brain and affect neurotransmitters, the authors hypothesize that removal of the mercury-laden fillings may have contributed to the improved mental health.

Introduction

In a recent study[1] researchers examined the mental health of eleven manic depression (bipolar) patients before removing their dental amalgams (silver dental fillings). Six months after amalgam removal, the patient's mental health status was again tested. These results were compared with a control group who retained dental amalgams and who were given a placebo. The mental health of the amalgam removal group improved significantly, and no improvement was seen in the control group. A very significant improvement was seen in the schizophrenia subscale of the Minnesota Multiphasic Personality Inventory.[2]

Other studies[2,3,4] by the authors found significant differences in mental health between subjects with dental amalgam to those without. Those without suffered significantly less depression, anger, and anxiety.

The dental amalgam consists of approximately 50 percent mercury by weight.[5] Studies[6,7] have shown that mercury vapor constantly leaches from the amalgam. Approximately 75 to 80 percent of the mercury vapor enters the lungs after inhalation and then enters the bloodstream. At this stage the mercury is not ionized, allowing it to readily cross the blood-brain barrier. A study by Eggleston and Nylander[8] found a direct correlation between the number of occlusal amalgams and the amount of mercury in the brain of postmortem subjects.

The cause of schizophrenia is unknown, but evidence suggests a dysfunction with the neurotransmitters.[9] Neurotransmitters such as dopamine,[10] monoamine oxidase,[11] and serotonin[12] have all been implicated in schizophrenia, and all these are known to be affected by mercury.[13,14,15]

The authors hypothesized that by removing dental amalgams, the source of mercury that may be affecting neurotransmitters, the mental health of schizophrenia patients would improve. Indeed, the study found a very significant improvement in mental health.

Method

Recruits were found by placing advertisements in Colorado newspapers in

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Denver, Colorado Springs, Fort Collins, and Boulder. The ads solicited people under the age of fifty who had been diagnosed with schizophrenia and who had at least five silver dental fillings.

Investigators informed each subject about the hypothesis that mercury is associated with schizophrenia. Eight subjects completed the study, and twelve subjects opted to drop out after the preliminary testing.

The subjects consisted of five males whose mean age was 39.4 years and three females averaging 43.3 years in age. The mean number of amalgam surfaces was 23.5. To confirm the diagnosis of schizophrenia, the subjects were given the Decision Base™ computerized questionnaires also referred to as DSM-III-R. Their personal psychiatrist also confirmed the diagnosis.

The subjects underwent three psychological tests. Tests included the Minnesota Multiphasic Personality Inventory-2 (MMPI-2), the Millon Clinical Multiaxial Inventory-II, and the Symptom Check List 90 (SCL-90). They also completed a questionnaire regarding their health history during the past six months. Blood testing on each subject consisted of a complete blood count, a blood chemistry, and fractionated plasma catecholamines.

Each subject had all dental amalgams removed by a Colorado dentist, who used a rubber dam and high-velocity suction during the procedure to prevent contamination by mercury. Each subject received supplemental nutrients including a high potency multiple vitamin, vitamin C (1000 mg), vitamin E (400 IU), zinc (50 mg), garlic, L-glutamine (500 mg), and L-glutathione (50 mg). All these supplemental nutrients have been shown to chelate or neutralize the effects of mercury.[16,17,18]

Psychological testing and blood testing were administered again six to nine months after amalgam removal. Data Service Center, Inc. of Fort Collins, Colorado, entered the findings into the computer and the Statistics Laboratory at Colorado State University performed statistical analysis. Analysis of variance and the Student's t Test were used in the statistical analysis. The level of significance for discussion purposes is P (probability) = 0.10 because of the low number of subjects and because the study was looking for trends.

The Statistics Lab at Colorado State University compared and statistically analyzed all before and after psychological findings.

Results

Minnesota Multiphasic Personality Inventory-2

The MMPI-2 consists of 567 questions that make up a total of sixty-one component scales, which in turn make up twenty subscales. Significant improvement at the P=0.10 level was found in forty-one of the sixty-one component scales, and significant improvement at the P=0.05 level was found in thirty-three of the sixty-one component scales (Table 1, p.203). Twelve of the twenty subscales improved significantly at the P=0.05 level and thirteen of the twenty subscales improved at the P=0.10 level (Table 2, p.204). The subscales that improved significantly were schizophrenia, hysteria, psychopathiate deviate, paranoia, social introversion, fears, health concerns, bizarre mentation, anger, cynicism, low self-esteem, social discomfort, and family problems.

Millon Clinical Multiaxial Inventory-II

Consisting of 175 true or false questions, the MCMI-II is made up of twenty-five diagnostic scales and five categories. Sixteen of the twenty-five diagnostic scales improved at the P=0.05 level, and seventeen improved significantly at the P=0.10 level (Table 3, p.204). They include disclosure, debasement, schizoid, avoidant, dependent, histrionic, narcissistic, antisocial, agressive-sadistic, compulsive, passive-agressive, self-defeating, anxiety disorders, bipolar, alcohol dependent, drug dependent, and thought disorder. All five categories improved signifi-

Table 1. Minnesota Multiphasic Personality Inventory-2 (Significant findings)

(S) Schizophrenia Subscales	Before Mean	Before S.D.	After Mean	After S.D.	F value	P 1-tail
Subjective Depression	65.88	15.36	55.25	19.92	2.04	0.092
Physical Malfunctioning	64.63	14.18	55.63	14.42	3.93	0.023
Mental Dullness	67.38	16.08	56.25	15.59	2.03	0.092
Brooding	63.00	13.98	53.13	16.81	2.24	0.072
Denial of Social Anxiety	46.75	11.77	49.88	10.27	22.26	0.0003
Lassitude-Malaise	64.88	19.31	54.50	15.40	3.89	0.023
Somatic Complaints	57.63	13.07	56.75	20.10	5.54	0.010
Familial Discord	52.63	16.23	52.50	17.52	93.06	0.0001
Social Imperturbability	46.00	11.62	47.88	12.78	32.46	0.0001
Social Alienation	61.75	16.35	53.63	19.63	9.77	0.002
Self-Alienation	58.50	13.18	47.63	13.14	2.20	0.080
Persecutory Ideas	64.38	27.78	57.63	22.19	12.33	0.001
Social Alienation (S)	63.13	8.89	58.88	11.84	7.60	0.004
Emotional Alienation (S)	66.25	17.93	57.13	16.70	3.28	0.035
Lack of Ego Mastery (S)	67.88	24.05	57.13	21.01	4.16	0.020
Bizarre Sensory Exper. (S)	65.50	17.30	56.13	16.26	10.26	0.002
Amorality	54.38	7.71	51.25	9.48	2.94	0.045
Psychomotor Acceleration	49.00	9.30	40.25	7.54	2.25	0.077
Imperturbability	46.50	9.38	51.75	8.86	6.84	0.005
Ego Inflation	50.38	15.04	46.63	11.48	2.50	0.063
Shyness	52.75	10.29	51.00	10.92	13.76	0.0007
Social Avoidance	50.50	9.55	51.38	12.88	3.22	0.036
Alienation–Self & Others	50.50	8.93	46.13	9.31	2.30	0.074
Marital Distress	55.88	9.91	55.50	16.14	3.79	0.025
Addiction Potential	45.88	11.68	40.00	8.57	5.26	0.011
Addiction Admission	53.00	8.33	47.50	7.29	6.94	0.005
Generalized Fearfulness	64.38	24.28	52.25	14.99	3.72	0.026
Multiple Fears	50.38	7.13	47.38	10.80	5.55	0.010
Dysphoria	62.00	18.75	53.38	15.45	2.01	0.095
Self-Depreciation	57.25	13.63	48.50	9.44	2.08	0.089
Gastrointestinal Symptoms	61.63	14.20	55.50	15.56	2.74	0.052
Neurological Symptoms	60.13	16.33	59.38	20.75	5.93	0.008
General Health Concerns	58.13	12.17	51.00	12.04	6.00	0.008
Psychotic Symptomatology	65.25	26.64	55.38	19.60	2.82	0.049
Schizotypal Characteristics	55.13	11.15	48.13	8.63	5.72	0.009
Explosive Behavior	46.88	9.96	42.13	4.82	4.69	0.015
Irritability	50.25	11.49	44.00	4.14	3.26	0.035
Misanthropic Beliefs	47.75	9.85	46.25	10.11	3.41	0.032
Interpersonal Suspiciousness	53.75	11.95	45.63	11.03	10.41	0.001
Antisocial Behavior	46.38	8.09	44.75	9.84	4.81	0.014
Self-Doubt	57.00	13.42	46.00	9.37	2.79	0.050
Introversion	54.63	10.46	51.38	9.13	2.34	0.070
Familial Alienation	53.63	10.15	47.88	13.70	3.12	0.040

Table 2. Minnesota Multiphasic Personality Inventory-2 Subscales (Significant findings)

Subscales	Before Mean	Before S.D.	After Mean	After S.D.	F value	P 1-tail
Hysteria	271.13	14.25	267.88	31.85	2.26	0.076
Psychopathiate Deviate	270.25	38.21	253.00	44.66	5.71	0.009
Paranoia	177.63	41.94	165.88	29.58	11.14	0.001
Schizophrenia	389.50	83.13	331.75	92.6	1 4.39	0.017
Social Introversion	153.50	21.15	148.50	26.94	4.91	0.013
Fears	50.38	7.13	47.38	10.80	8.21	0.003
Health Concerns	179.88	32.74	165.88	44.33	5.48	0.001
Bizarre Mentation	120.38	35.09	102.25	27.13	3.50	0.030
Anger	46.88	9.96	42.13	4.82	4.42	0.017
Cynicism	101.50	20.17	91.88	20.32	5.59	0.009
Low Self-Esteem	106.38	19.06	92.50	16.41	5.38	0.010
Social Discomfort	106.00	15.82	101.38	18.18	5.33	0.011
Family Problems	100.13	22.71	96.50	19.91	14.92	0.001

Table 3. Million Clinical Multiaxial Inventory-II

Significant findings	Before Mean	Before S.D.	After Mean	After S.D.	F value	P 1-tail
Disclosure	53.50	25.44	40.88	26.19	4.65	0.015
Debasement	49.38	32.34	38.75	25.53	7.04	0.065
Schizoid	59.13	59.13	55.74	51.13	4.76	0.014
Avoidant	66.50	33.50	51.38	40.70	5.85	0.008
Dependent	79.00	13.34	69.88	29.20	2.93	0.045
Histrionic	69.00	20.21	62.75	10.86	2.31	0.070
Narcissistic	58.38	40.45	52.38	31.03	3.69	0.027
Antisocial	63.00	27.38	43.75	23.79	7.24	0.005
Aggressive/Sadistic	43.88	34.80	36.38	22.60	6.20	0.007
Compulsive	59.38	12.44	57.75	16.85	3.56	0.029
Passive/Aggressive	39.63	37.24	35.00	38.40	16.20	0.007
Self-Defeating	65.75	26.68	51.00	34.42	8.52	0.003
Anxiety Disorder	58.13	39.15	46.00	26.09	3.02	0.042
Bipolar	59.88	14.36	48.13	16.41	2.27	0.076
Alcohol Dependent	45.88	26.70	28.38	24.15	3.77	0.026
Drug Dependent	51.50	22.06	34.13	20.03	8.00	0.004
Thought Disorder	51.13	34.02	39.50	38.27	2.83	0.049
Index Modifiers (3 items)	164.63	63.36	135.38	51.72	5.10	0.012
Clinical Personality Pattern(10 items)	603.63	189.29	511.38	152.24	8.12	0.003
Severe Personality Pattern (3 items)	174.63	78.43	133.25	74.17	3.57	0.029
Clinical Syndrome (6 items)	324.75	146.99	253.78	92.32	3.42	0.032
Severe Syndrome (3 items)	155.00	75.80	124.75	76.03	4.04	0.021

cantly: index modifiers, clinical personality pattern, severe personality pattern, clinical syndrome, and severe syndrome.

Symptom Check List-90

The SCL-90 is composed of ninety questions that comprise nine dimensions. Improvement in four of the nine dimensions was significant at the P = 0.10 level and one of nine at the P = 0.05 level. They include obsessive-compulsive, interpersonal sensitivity, depression, and psychoticism (Table 4, p206).

Health History

The health history questionnaire was comprised of 177 questions that made up thirteen health categories. The mental health category improved by 43 percent and the dental symptom category improved by 46 percent after amalgam removal. Overall 9 percent improvement (decline) of reported somatic health symptoms was observed, i.e., not including the mental health category (Table 5, p.206).

Blood Results

No significant differences between the before and after blood tests were found, and the results are not reported in this paper.

Discussion

The purpose of this pilot study was to determine whether the mental health of schizophrenia subjects improved upon removal of mercury-bearing dental amalgam. A significant improvement did occur as demonstrated by all three psychological tests when comparing before and after results. The study confirmed previous studies[1,2,3,4] that people with mercury dental amalgam have significantly more mental health problems, suggesting that mercury from the filling may play an etiological role in schizophrenia.

Psychotherapists believe that schizophrenia is one of the most crippling psychological disorders.[9] Its characteristic psychotic symptoms result in disturbances of thought process and perception. As a result, social and occupational functioning severely deteriorates. The cause of schizophrenia is lengthy and usually involves many debilitating residual symptoms.[9] Schizophrenia usually appears during adolescence or early adulthood, but may begin up to middle adulthood. Symptoms may include delusions, thought disturbances evidenced by loose associations of speech and distortions of words. Blocking, an interruption of speech before the thought has been completed, may occur. Hallucinations may occur of which auditory (hearing voices) is the most common. Others may be tactile (tingling), somatic (snakes crawling inside the abdomen), visual, or olfactory. Schizophrenics often have a difficult time initiating goal-directed activity.[9]

The DSM-III-R (Decision Base questionnaire) recognizes five types of schizophrenia.[19] Catonic type is characterized by marked psychomotor disturbances that involve stupor, rigidity, excitement, or posturing. The disorganized type is characterized by incoherence, loosening of associations, or grossly disorganized behavior. Paranoid schizophrenia involves preoccupation with one or more systemized delusions or auditory hallucinations related to a single theme. Associated with it are anxiety, anger, argumentativeness, or possible violence. Undifferentiated schizophrenia is a frequent diagnosis for long-term residents in mental hospitals. They have prominent psychotic symptoms such as delusions, hallucinations, and incoherence. Residual type schizophrenia involves at least one episode of schizophrenic symptoms, but no prominent psychotic feature. Signs of the disorder may persist, such as eccentric behavior or illogical thinking.

The exact cause of schizophrenia is not known. A dominant theory of schizophrenia has been the disease model. It asserts schizophrenia results from "abnormalities in brain structure, arising in part from ge-

Table 4. Symptom Check List-90 (Significant findings).

	Before Mean	Before S.D.	After Mean	After S.D.	F value	P 1-tail
Obsessive-Compulsive	13.63	7.63	8.38	8.94	3.27	0.060
Interpersonal-Sensitivity	10.88	8.15	6.63	9.65	4.9	0.064
Depression	20.88	15.09	12.00	12.63	3.69	0.052
Psychoticism	7.50	6.35	4.63	8.43	3.40	0.057

Table 5. Health History

Category	Somatic Symptoms Before	After
Skin	9	8
Cardiovascular	5	2
Neurological	7	8
Digestion	9	13
Blood	1	0
Glandular	7	9
Mental	46	26
Sleep	16	16
Allergies	7	4
Disease	0	1
Eye	16	10
Dental	23	12
Other	24	30
Total	170*	139**
Mental	-46	-26
	124***	113****

*Before: 21.3 symptoms per subject
**After: 17.4 symptoms per subject Difference: 18%

Excluding Mental Symptoms:
***Before: 15.5 symptoms per subject
****After: 14.1 symptoms per subject Difference: 9%

netic factors leading to biochemical and physiological differences in the central nervous system of affected individuals."[20] Other factors such as brain injury or viral infection may be involved.[21]

Physical factors have been implicated in the etiology. Some suggest there may be two subgroups of schizophrenia.[5] One subgroup of the disorder arises from a genetic predisposition, and the other arises from a clear-cut cerebral disease or abnormality.

The genetic factor has some credence. Among the general population, an incident rate of 0.9 percent exists for schizophrenia. The incidence increases to 4.2 percent for parents of schizophrenic children, to 7.5 percent for children with schizophrenic siblings, and to 9.7 percent for children with

a schizophrenic parent. If both parents are schizophrenic, the probability for an individual becoming schizophrenic jumps to 46.3 percent.[22]

Neurological disease such as temporal lobe epilepsy, Huntington's chorea, and brain tumor all present symptoms similar to schizophrenia.[23] Brain injury, particularly at birth, give symptoms similar to schizophrenia. Compared with a control group, schizophrenics have an anatomically greater thickness of the corpus collosum.[24] The brains of schizophrenics are approximately six percent lighter than non-schizophrenic patients.[25] Viral infections resulting from a dormant virus have been suggested as a cause.[26] This might explain why so many schizophrenics are born during early winter at the peak of flu season. No viruses have been found.

Biochemical theories abound regarding the etiology of schizophrenia. One suggests that schizophrenia arises from the abnormal accumulation of nitrogen or oxygen methylated biogenic amine derivatives. In 1952, Osmond and Symthies[27] observed that the synthesis of epinephrine requires a nitrogen methylating enzyme. They also discovered that mescaline is a powerful hallucinogen and is an oxygen methylated derivative of the catecholamines. Serotonin is similar in structure to other methylated indolamine derivatives such as LSD, which are capable of producing schizophrenic-like symptoms.[12] There is no evidence of a psychotogenic agent in body fluid to induce the accumulation of these compounds, nor have enzymes been found responsible for the aberrant metabolic process. This theory is called the "transmethylation hypothesis."

Monoamine oxidase (MAO) has also been implicated in schizophrenia. It is the primary catabolizing agent for catecholamines.[11] In twin studies,[11] there was an inverse correlation between the degree of schizophrenic symptomolgy and MAO levels, i.e., with high MAO levels there were fewer schizophrenic symptoms. Some suggest that MAO levels might serve as a genetic marker for susceptibility to schizophrenia. In a subgroup of schizophrenia patients, reduced levels of MAO were related to auditory hallucinations. The MAO theory complements the dopamine and transmethylation hypothesis since MAO metabolizes all of those compounds.[9]

The dopamine hypothesis postulates that schizophrenia is caused by an excess of dopamine-dependent neuronal activity in the brain.[10] It is believed that antipsychotic medication creates therapeutic effects by reducing dopaminergic activity. L-Dopa, the immediate precursor to dopamine, induces psychoses in some patients receiving the drug for treatment of Parkinson's disease.[9] Postmortem studies[13] have found significant elevations of dopaminergic receptor sites in schizophrenic patients when compared with nonschizophrenic subjects, especially the DA-2 receptor site. The antipsychotic drugs appear to exert their effect by blocking dopamine receptors in the brain.

This study hypothesizes that if mercury is involved in schizophrenia, it would be affecting the neurotransmitters. Mental health problems are hallmark symptoms of mercury toxicity. Animal studies have provided evidence that mercury does affect neurotransmitters. Rat studies have shown that mercury does affect the uptake of dopamine in synaptosomes.[28] It has also been demonstrated that methyl mercury causes dose-related decreases in MAO in the mitochondrial membrane.[29] Animal studies by Ram and Sathyanesan[15] have shown mercury inhibits brain MAO.

Other Factors

An ideal study would have been to have a larger sample and a control group. The original intent was to have a control group with a placebo sealant put over the amalgams so the subjects would think they were not being exposed to mercury vapor. Many subjects dropped out of the research, and

we found it very difficult to recruit schizophrenic subjects through the newspapers. After a lengthy attempt at recruitment, we decided to compare only before and after test results of the eight subjects. A previous study[1] compared manic depression subjects with amalgams to a control group who had a placebo sealant put on the amalgams. The results found a significant improvement in those subjects who had their amalgams removed, and no improvement in those given the placebo sealant. This was a pilot study that will hopefully stimulate other studies with more subjects and an appropriate control group. It is difficult to provide a perfect control group for amalgam removal. It would be unethical to remove amalgams and then place them back in the mouth. A blind study is almost impossible because a subject could look into the mirror and see whether he or she had silver amalgam or a white composite. A placebo sealant is one method we have tried in the past.

The subjects received supplemental nutrients to help neutralize the harmful effects of mercury or chelate the mercury from the body. These additional supplements may have contributed to the well-being of the subject, if a subject was deficient in the optimum nutrient. Orthomolecular psychiatrists use megadoses of nutritional supplements to treat their patients.

Conclusion

This research was a pilot study to determine if the symptoms of schizophrenia improved after removing mercury-bearing dental amalgams. The improvement was astonishing. All three psychological tests (MMPI-2, MCMI-II, and SCL-90) showed significant improvement in many psychological subscales. Whether the improvement was attributed to mercury amalgam removal, supplemental nutrients, or placebo needs to be delineated in future studies.

These results have corroborated past studies regarding mental health and dental amalgams. Previous studies have shown that symptoms of manic depression improve when amalgams are removed. Other studies have shown anxiety, anger, and depression are significantly less in subjects without mercury dental amalgam than in subjects with amalgams.

The authors hypothesize that mercury vapors reach the bloodstream when inhaled and then pass the blood-brain barrier. Mercury then interferes with the neurotransmitters, perhaps dopamine or monoamine oxidase. Animal studies have shown that mercury affects these two neurotransmitters associated with schizophrenia. Scientists have been looking for a substance that may be interfering with methylating enzymes needed for the neurotransmitter metabolism in the brain. Mercury has an affinity for methyl groups, and this may be the substance interfering with transmethylation.

Mental health sympoms are closely associated with mercury toxicity. We suggest that eliminating the source of mercury by amalgam removal and neutralizing the effects of mercury with supplemental nutrients could be the reason for mental health improvement and for improvement of schizophrenic symptoms.

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