

# Evidence that Mercury from Dental Amalgam May Cause Hearing Loss in Multiple Sclerosis Patients

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## Abstract

*Seven female subjects diagnosed with multiple sclerosis were tested for hearing at threshold frequencies of 250, 500, 1000, 4000 and 8000 Hz. The subjects then had their silver dental fillings (amalgams) removed. Between six and eight months after amalgam removal, testing for hearing was repeated. Six of the seven subjects showed improvement in hearing of the right ear and five of the seven showed improvement in the left ear. Four of the six frequencies tested in the right ear improved significantly and three of six improved significantly in the left ear. The total frequencies were averaged before amalgam removal and compared to after amalgam removal. Hearing improved an average of 8 dB ( $p=0.02$ ).*

## Introduction

One of the many symptoms of mercury toxicity is hearing loss.<sup>1</sup> The silver dental filling commonly called the amalgam is composed of approximately 50% mercury.<sup>2</sup> Studies have shown that mercury escapes from the amalgam in the form of elemental mercury vapor.<sup>3,4</sup> A large percentage of mercury vapor can be inhaled into the lungs, where it enters the blood stream and can be transported to all parts of the body.<sup>5,6</sup> Elemental mercury can readily cross the blood brain barrier and cause damage to the central nervous system.<sup>7</sup> There has been evidence associating mercury from dental amalgam and multiple sclerosis (MS).<sup>8</sup> The neurotoxic effect of mercury can produce effects similar to that found in MS. These toxic effects include demyelination of the nerve fiber<sup>7</sup> damage to the blood brain barrier,<sup>7</sup>

slow nerve conduction velocity,<sup>9</sup> and autoimmune responses.<sup>10</sup> Epidemiological studies have correlated dental fillings to Multiple Sclerosis (MS).<sup>8</sup> A recent study has given evidence that MS subjects with amalgam removal have significantly fewer exacerbations of symptoms, compared to a control group of MS subjects with amalgams<sup>11</sup> who also had significantly higher total T-lymphocytes and (CD8) suppressor T-cells. In 1971-72, an outbreak of methylmercury poisoning occurred in Iraq, where hundreds of people were poisoned. Severely affected children became deaf, and many adults developed a marked hearing loss.<sup>1</sup> Alkyl mercury can cause a sensorineural hearing loss.<sup>12</sup> This study was undertaken to determine hearing sensitivity changes of MS subjects after the removal of silver dental fillings. Because of mercury's known ability to damage hearing, before and after hearing tests were performed on the subjects.

## Materials and Methods

An ad was placed in a Denver newspaper to recruit MS volunteers with silver dental amalgams. Seven females whose average age was 37.7 (age range: 32-46) participated in the research. Magnetic Resonance Imaging (MRI) was performed by MDRMI in Denver to validate the diagnosis of MS. A hearing test in a sound booth was then performed at the Denver Ear Institute in Englewood, Colorado, utilizing standard protocol. Threshold frequencies of 250, 500, 1,000, 2,000, 4,000, and 8,000 HZ were measured by an audiologist in each ear of the seven volunteers. Tynanometry was also done to assure normal middle ear function. These seven MS subjects then had all their dental fillings

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removed by seven Colorado dentists, who volunteered their time and materials. The amalgam fillings were replaced by composites that did not contain mercury. Between six and eight months after amalgam removal, hearing tests were again performed at the Denver Ear Institute. Statistical analysis was performed by the Statistics Lab at Colorado State University. Analysis of variance and the student "t" test were utilized in the analysis. For discussion purposes, the level of significance of 0.10 was utilized because of the low number of patients.

**Results**

*Hearing Right Ear:* Six of the seven subjects showed improvement in hearing of the right ear. Of the six frequencies tested and seven subjects responding to each, 28 of 41 before

and after responses improved, four tested worse, and nine remained the same. There was one invalid response (Table 1, below).

*Hearing Left Ear:* Five of the seven subjects showed improvement in hearing of the left ear. Twenty-nine of 42 before and after responses improved, eight deteriorated, and five remained the same (Table 2, p.242).

*Hearing Right Ear and Left Ear:* All frequencies tested in the right ear improved significantly. Five of six frequencies tested in the left ear improved significantly and two approached significance. The total frequencies were averaged before amalgam removal and compared to after amalgam removal. Hearing improved an average of 8 dB (Table 3, p.243).

**Discussion**

This study suggests that dental amalgam mercury may be involved in hearing

Table 1. Right ear hearing thresholds (db hl) for seven MS patients before and six months after dental amalgam removal.

| Amalgam Removal Subject | 250 HZ* | 500 HZ | 1000 HZ | 2000 HZ | 4000 HZ | 8000HZ |
|-------------------------|---------|--------|---------|---------|---------|--------|
| 1 Before                | 25**    | 10     | 6       | 5       | 5       | 15     |
| After                   | -10     | -10    | -10     | -10     | -7      | 3      |
| 2 Before                | 0       | 0      | 0       | 0       | 0       | 55     |
| After                   | 10      | 0      | 7       | 0       | -5      | 53     |
| 3 Before                | 45      | 55     | 72      | 87      | 110     | -      |
| After                   | 50      | 52     | 61      | 82      | 110     | (95)   |
| 4 Before                | 17      | 7      | 5       | 6       | 12      | 12     |
| After                   | 5       | -10    | 16      | 0       | 2       | -5     |
| 5 Before                | 20      | 15     | 11      | 10      | 11      | 6      |
| After                   | 8       | 8      | 5       | 0       | 4       | 4      |
| 6 Before                | 10      | 10     | 4       | 0       | 10      | 20     |
| After                   | 7       | 5      | 4       | 10      | 10      | 15     |
| 7 Before                | 40      | 41     | 41      | 45      | 15      | 36     |
| After                   | 15      | 20     | 15      | 32      | 3       | 25     |

\* Frequency (Hertz)

\*\* dB (decibels) in Hearing Level (HL)

Before and After Responses: Improvement-28 No Change (within 5dB)-9 Worse-4 Invalid-1

loss of multiple sclerosis patients. It also raises the possibility that amalgam mercury may be an etiological factor in the hearing loss of non-MS patients. Deafness is usually divided into two types.<sup>13</sup> The first classification is nerve deafness which is caused by an impairment of the auditory nerve. The second classification is conduction deafness which is caused by impairment of the middle ear mechanisms for transmitting sound into the cochlea. One of the characteristics of nerve deafness is a decline in hearing for all frequencies. The results of this study, showing an improvement in hearing ability in all frequencies after amalgam removal, suggests that there is nerve damage. Mercury can lead to nerve damage by affecting RNA protein synthesis,<sup>7</sup> by reducing nerve conduction velocity, by demyelinating the

nerve fiber, by increasing the threshold for excitation, by blockage of action potentials without changing the resting membrane potential,<sup>7</sup> and by affecting the neurotransmitter secretion or receptor site.<sup>14,15</sup> All of these toxic effects could lead to hearing loss if the auditory nerve is involved. Evidence was presented that mercury from dental amalgam may be affecting hearing. Six of seven MS subjects showed improved hearing in the right ear six months after dental amalgam removal and five of seven showed improvement in the left ear. All six frequencies in the right and left ear showed an improvement for the seven subjects. Because all frequencies showed an improvement, it was concluded that nerve damage was causing the hearing loss. With mercury's ability to cause neurotoxic effects, the overall significant

Table 2. Left ear hearing thresholds (dbhl) for seven MS patients before and six months after dental amalgam removal.

| Amalgam<br>Removal<br>Subject | 250 HZ* | 500 HZ | 1000 HZ | 2000 HZ | 4000 HZ | 8000 HZ |
|-------------------------------|---------|--------|---------|---------|---------|---------|
| 1 Before                      | 25**    | 15     | 4       | 10      | 15      | 19      |
| After                         | -10     | -10    | -10     | -10     | 5       | 10      |
| 2 Before                      | 0       | 0      | 0       | 0       | 0       | 20      |
| After                         | 5       | 0      | 10      | 5       | 0       | 25      |
| 3 Before                      | 35      | 40     | 15      | 10      | 10      | 15      |
| After                         | 15      | 20     | 5       | -1      | -1      | -1      |
| 4 Before                      | 15      | 5      | 8       | 10      | 24      | 30      |
| After                         | 6       | -10    | 0       | 5       | 0       | -5      |
| 5 Before                      | 30      | 30     | 15      | 10      | 10      | 10      |
| After                         | 9       | 8      | 12      | 5       | 3       | 5       |
| 6 Before                      | 4       | 10     | 15      | 10      | 14      | 41      |
| After                         | 15      | 10     | 20      | 10      | 25      | 45      |
| 7 Before                      | 32      | 40     | 35      | 40      | 10      | 50      |
| After                         | 25      | 20     | 35      | 30      | 5       | 37      |

\*Frequency (Hertz)

\*\* db (decibels) in Hearing Level

Before and After Responses: Improvement - 25 No Change - 14 Worse - 3

Table 3. Improvement in hearing in right and left ears after amalgam removal.

| Hearing, Right Ear               |                   |                  |                          |       |                     |
|----------------------------------|-------------------|------------------|--------------------------|-------|---------------------|
|                                  | Mean Before<br>dB | Mean After<br>dB | Mean Difference<br>n(dB) | F     | P<br>(significance) |
| R 250 HZ                         | 21.86             | 12.14            | 9.72                     | 2.58  | 0.08                |
| R 500 HZ                         | 19.71             | 9.29             | 10.42                    | 10.12 | 0.009               |
| R 1000 HZ                        | 19.71             | 10.86            | 8.85                     | 4.71  | 0.037               |
| R 2000 HZ                        | 21.57             | 16.28            | 5.29                     | 2.77  | 0.074               |
| R 4000 HZ                        | 22.57             | 16.71            | 5.86                     | 8.15  | 0.015               |
| R 8000 HZ                        | 24.67             | 15.83            | 8.84                     | 11.89 | 0.006               |
| Hearing, Left Ear                |                   |                  |                          |       |                     |
|                                  | Mean Before<br>dB | Mean After<br>dB | Mean Difference<br>n(dB) | F     | P<br>(significance) |
| L 250 HZ                         | 18.71             | 9.29             | 9.42                     | 2.67  | 0.007               |
| L 500 HZ                         | 18.57             | 5.43             | 13.14                    | 12.40 | 0.006               |
| L 1000 HZ                        | 13.14             | 10.29            | 2.85                     | 0.79  | 0.205               |
| L 2000 HZ                        | 12.86             | 6.29             | 6.57                     | 4.61  | 0.038               |
| L 4000 HZ                        | 10.86             | 5.29             | 5.57                     | 2.31  | 0.09                |
| L 8000 HZ                        | 24.43             | 16.57            | 7.87                     | 4.46  | 0.039               |
| Total average right and left ear |                   |                  |                          |       |                     |
|                                  | Mean Before<br>dB | Mean After<br>dB | Mean Difference<br>n(dB) | F     | P<br>(significance) |
|                                  | 19.29             | 11.42            | 7.87                     | 6.60  | 0.021               |

improvement in hearing may have resulted from removal of silver/mercury dental fillings.

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