“Amalgam disease” – poisoning, allergy, or psychic disorder?

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Abstract

Frequently, patients in environmental health out-patient units relate various complaints to their amalgam fillings. However, an association between the toxic exposure and the reported complaints appears plausible only in few cases. We investigated toxicological, allergological and psychological parameters in patients with amalgam-associated complaints and compared them to controls with similar numbers of amalgam fillings. Forty patients with health disturbances related to amalgam were compared to a control group without amalgam-associated complaints (n = 40), carefully matched for age, sex, and dental status. Mercury concentrations were analyzed in blood, saliva, and 24-h-urine. Atopic predisposition, determination of IgE, patch testing with amalgam and amalgam-associated metals and a psychometric assessment were performed in all participants. Mercury concentrations in blood or urine were similar in patients and controls. Atopic predisposition was markedly enhanced in patients (11/40) as compared to controls (5/40). Only one patient with a lichen ruber of the oral mucosa showed a contact sensitization to amalgam. Patients reported more psychic strain and higher depression scores than controls. Somatization disorders were found in 10 patients (25%) and in one control. Eighteen patients (45%) neither showed an atopic predisposition nor an influence of psychosocial factors. Toxic exposure to mercury does not appear to play a role in “amalgam disease”. Since many of these patients are atopic without an “amalgam allergy”, but with more psychic strain and notably more depression, the treatment should be focused on allergologic and psychological factors.

Key words: Mercury – amalgam-related complaints – atopic – psychosomatic

Introduction

Patients with subjective physical complaints are abundantly seen in environmental health and allergy out-patient units. Often they relate their discomfort to their amalgam fillings and they fear to suffer from “amalgam poisoning” or “amalgam allergy.” These patients complain about nonspecific symptoms like fatigue, dizziness, dry mouth, tachycardia, or headache with a long list of visits to many specialists.

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They often demand mercury detoxification with chelating agents, thorough allergy diagnosis or dental treatment even including complete tooth extraction.

Amalgam fillings contribute to the inner exposure of the organism with mercury (Zander et al., 1990; Skare and Engqvist, 1994; Eley, 1997). Individuals with amalgam fillings have two- to fourfold higher mercury concentration in urine (HgU) than people without amalgam. The mercury concentration in urine increases significantly with an increasing number of amalgam surfaces (Kingman et al., 1998). In Germany, persons without amalgam fillings show an average HgU concentration of 0.3 µg/l, as compared to those with more than 10 amalgam fillings with an average HgU concentration of 1.5 µg/l (Krause et al., 1996). Nonspecific toxic symptoms such as tiredness, difficulties to concentrate or nervousness are found only at HgU concentrations above 50 µg/l even in particularly sensitive individuals (WHO, 1991).

Patients who relate their complaints to amalgam are often referred to an allergist for “amalgam allergy”. However, the prevalence of contact sensitization to amalgam is low (McGivern et al., 2000). Less than 2% of the German population show a positive reaction to amalgam in the patch test (von Mayenburg et al., 1991). Amalgam allergies with systemic reactions and symptoms such as erythema, tachycardia, or respiratory distress are very rare. Since 1900, only 50 cases have been documented world-wide (US Department of Health and Human Services, 1993).

The prevalence of psychosomatic and psychiatric disorders in patients with amalgam-associated disturbances is 40–60% higher than in the general population (Herrström and Högstedt, 1993; Malt et al., 1997, Bailer et al., 2001). Anxiety disorders, depression and somatization disorders have been primarily diagnosed but a relationship with Hg exposure has not been confirmed (Bratel et al., 1997; Osborne and Albino, 2001).

In this report toxicological, allergologic, dental and psychometric examinations were carried out in a group of patients and compared to a control group without amalgam-related complaints to check the following hypotheses:

- Patients with amalgam-associated complaints do not have elevated levels of Hg in blood, saliva, and urine in comparison to controls with similar numbers of amalgam fillings.
- These patients do not have “amalgam allergies” (contact sensitization to amalgam) more often than controls.
- They report higher psychic strain than the control group.

In addition we wanted to look for other possible psychological aspects and compared somatization and depression in patients and controls. The findings of the study reveal the parameters that were different between patients with amalgam anxiety and controls with the same amalgam exposure. Likewise, the outcome of the study was helpful referring the patients to the adequate treatment.

### Materials and methods

Patients of the Allergy Out-Patient Unit of the Department of Dermatology, University of Giessen, who related amalgam to their health disturbances, were asked to participate in this study dealing with health complaints due to dental materials. Controls with similar numbers of amalgam fillings but without amalgam-associated complaints were recruited by the Department of Dentistry, University of Giessen. Only individuals were accepted into the control group who stated that they were not impaired by their fillings. Exclusion criteria in both groups was a mercury mobilization test during the last 4 weeks. The two groups were matched with respect to sex, age, and number of amalgam fillings. The participation in the study was voluntary and could be refused or discontinued at any time. The study was approved by the local ethic committee and informed consent was obtained from all participants.

We asked all 55 patients who went to the Department of Dermatology because of amalgam-associated problems in 1997. Nine of these patients did not fix a date after the first contact, six patients had all their amalgam fillings taken out in the meantime. Forty patients (73%) finally took part in the study, one of them did not appear for the second recording of the patch test. Forty-nine controls were recruited in the Department of Dentistry. Six of them did not come to the first appointment, three of them attributed various disturbances to palladium or to amalgam and were therefore excluded. All 40 controls (82%) who finally participated in the study appeared on all three arranged dates.

The age of the participants ranged from 22 to 67 years. The mean age of the patients was 42.8 (SD 11.4) and of the controls 39.9 years (SD 10.4). In both groups were 17 men (42%) and 23 women (58%). The patients had 1 to 18 (mean 7.5; SD 4.3) and the controls 1 to 16 amalgam fillings (mean 7.8; SD 3.8). Although one female patient with various amalgam-associated complaints had her fillings removed six weeks ago, she still worried about a possible mercury poisoning and was therefore included.

The group of patients and the control group did not differ significantly with respect to age, sex or number and surface of amalgam fillings (Table 1). The quality of the fillings (polished/unpolished) and alterations of the oral mucosa did not show significant differences between the
groups. One patient had a lichen ruber nearby to a large amalgam filling.

Dental examination
The number, material, and quality of the restorations were clinically examined in all participants. The oral mucosa was examined for periodontal diseases, lichenoid lesions or amalgam tattoos. Silicone casts (Permagum Putty Soft, Espe, Germany) were made of the upper and lower jaws and the total surface area of the fillings was determined.

Allergy examination
All participants were examined dermatologically and the personal and the family history of atopic diseases was recorded. A patch test with amalgam and amalgam-alloy metals (5% of amalgam in vaseline and 20% of a mixture of silver, copper, tin and zinc in vaseline, Hermal Reinbek, Germany) was performed and read after 48 and 72 h according to the recommendations of the International Contact Dermatitis Research Group (Wahlberg, 1992). Blood samples were taken for the determination of total IgE (Pharmacia CAP, Erlangen, Germany). A structured recording of complaints that cannot be explained by any diagnosable physical disease, which allows the application of the ICD-10-diagnosis of somatization disorder. All questionnaires are standardized, checked for validity and of good reliability (Cronbach’s α between .80 and .89).

Psychometric assessment
A psychologist performed the psychometric assessments separately for each participant. The participants filled in questionnaires regarding psychic strain, experienced distress, somatization, and depressive symptoms. We used the check list for symptoms SCL-90-R (Derogatis, 1977), a structured recording of complaints that cannot be explained by any diagnosable physical disease, which allows the application of the ICD-10-diagnosis of somatization disorder. All questionnaires are standardized, checked for validity and of good reliability (Cronbach’s α between .80 and .89).

The study lasted one year, from January 1997 until January 1998. The tests were carried out during three days in one week. On the first appointment the dental and oral examination was performed and saliva samples were collected. The atopic predisposition was recorded, and after the dermatological examination the patch test was applied. The participants were instructed how to collect the 24-h-urine and were asked to avoid fish during the next three days. On the second appointment, the 48 h reaction of the patch test was recorded, a blood sample was taken

<p>| Table 1. Dental status and toxicological parameters of patients and controls. |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|</p>
<table>
<thead>
<tr>
<th>Patients X (SD)</th>
<th>Controls X (SD)</th>
<th>Mean difference (95% CI)</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of fillings</td>
<td>n = 40</td>
<td>n = 40</td>
<td>-0.21 (-2.04 -1.62)</td>
<td>-22</td>
</tr>
<tr>
<td>7.5 (4.3)</td>
<td>7.8 (3.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface of fillings (mm²)</td>
<td>n = 40</td>
<td>n = 40</td>
<td>42.00 (-36.32 -120.34)</td>
<td>1.06</td>
</tr>
<tr>
<td>292.85 (190.86)</td>
<td>250.85 (15759)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Hg (µg/l)</td>
<td>n = 37</td>
<td>n = 40</td>
<td>0.14 (0.03 -31)</td>
<td>1.55</td>
</tr>
<tr>
<td>95 (90)</td>
<td>95 (90)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobilized Hg in saliva (µg/l)</td>
<td>n = 38</td>
<td>n = 39</td>
<td>-43.81 (-79.45 -8.18)</td>
<td>-2.44</td>
</tr>
<tr>
<td>39.54 (49.24)</td>
<td>83.36 (98.97)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hg in 24-h-urine (µg/l)</td>
<td>n = 39</td>
<td>n = 40</td>
<td>-0.00 (-0.39 -37)</td>
<td>-0.03</td>
</tr>
<tr>
<td>.95 (.90)</td>
<td>.95 (.80)</td>
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</table>
for Hg-analysis, the urine was processed and the psycho-
metric tests were carried out. On the third appointment,
the 72 h reaction of the patch test was recorded.

**Statistical analysis**
Data were statistically analyzed by the T-test for indepen-
dent samples and the Chi²-test using SPSS for Windows
8.0. Differences at the 5 % level were accepted as
statistically significant. Bonferroni t-adjustments were
made for the SCL-90 results because of several t-tests for
the SCL-90-subscales.

**Results**
Patients with amalgam-associated complaints
showed an average serum concentration of
0.65 g/l mercury (95% CI 0.51 – 0.79) as compared to
controls with the same number of amalgam fillings with 0.51 g/l mercury (95% CI 0.40 – 0.62).
Although the average mercury concentration in the
serum of the patients was slightly higher, no
significant differences were found between the two
groups (Table 1). Patients had significantly lower
concentrations of mobilized Hg in the saliva than the
control group. The mean mercury concentration in
the 24-h-urine was similar in patients (0.95 g/l, 95% CI 0.67 – 1.22) and controls (0.95 g/l, 95% CI 0.69 – 1.20). None of the participants showed mercury values higher than the reference values of the German population with 5 µg Hg/l in urine and 2 µg Hg/l in blood.

Atopy was diagnosed in eleven patients (28%), but
only in five control group individuals (13%). Five of
the eleven patients suffered from allergic rhinitis.
One of these five patients had also allergic asthma
and six had atopic eczema. In addition contact
allergies toward textile dyes (n = 3) and Type I
hypersensitivity to food (n = 2) were elaborated in
the five patients. In the five atopic control individ-
uals hay fever, asthma, and other allergies e.g.
against house dust, animal hair, and apples had been
diagnosed. The patch test with amalgam was
positive only in one patient without atopy. She had
a lichen ruber close to an extended amalgam filling
that was confirmed by biopsy.

The patient group reported significantly (p = 0.004) higher psychic strain (0.61, SD 0.57, in the
global index GSI of the SCL-90-R) than the control
group (0.34, SD 0.37, see Table 2). Likewise the
patients had significantly (p = 0.02) higher depression
scores in the BDI (10.02, SD 8.01) than the
controls (7.07, SD 5.38). A somatization disorder
according to ICD-10 was significantly more fre-
fquent (Chi² = 8.35, p = 0.003) in the patients than in
controls. Ten patients (25%) and only one control
(2.5%) fulfilled the ICD criteria. Three of them and
none of the controls showed BDI depression scores
that were concomitantly elevated in a clinically
relevant manner. Neither allergies nor affective or
somatoform disorders were detected in 18 of the
patients (45%).

**Discussion**
Amalgam is a very controversial topic and only
studies with matched control groups can seriously
contribute to the elucidation of the question in which
parameters patients who relate their health prob-
blems to amalgam differ from persons without such
attributed complaints. The knowledge of these
differences would also facilitate the referral to an
adequate therapy.

Whether patients feel impaired by their amalgam
fillings obviously does not depend on the exposure
to mercury. In our study patients and controls did not
differ significantly in the Hg serum concentration,
although patients showed slightly higher values. The
mercury concentration in serum mirrors predomi-
nantly short-term exposure with methyl-Hg present

<table>
<thead>
<tr>
<th></th>
<th>Patients X (SD)</th>
<th>Controls X (SD)</th>
<th>Mean difference (95% CI)</th>
<th>t (df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCL-90-R</td>
<td>n = 36</td>
<td>n = 38</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somatization</td>
<td>.89 (.74)</td>
<td>.42 (.47)</td>
<td>.46 (.17 – .74)</td>
<td>3.21 (72)</td>
<td>.001</td>
</tr>
<tr>
<td>Obsessive-compulsive</td>
<td>.85 (.86)</td>
<td>.51 (.48)</td>
<td>.34 (.02 – .66)</td>
<td>2.12 (72)</td>
<td>.018</td>
</tr>
<tr>
<td>Interpersonal sensitivity</td>
<td>.57 (.65)</td>
<td>.37 (.38)</td>
<td>.20 (.04 – .44)</td>
<td>1.62 (72)</td>
<td>.055</td>
</tr>
<tr>
<td>Depression</td>
<td>.66 (.65)</td>
<td>.35 (.33)</td>
<td>.30 (.06 – .54)</td>
<td>2.56 (72)</td>
<td>.006</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.59 (.62)</td>
<td>.31 (.29)</td>
<td>.28 (.05 – .50)</td>
<td>2.52 (72)</td>
<td>.007</td>
</tr>
<tr>
<td>Anger-hostility</td>
<td>.53 (.51)</td>
<td>.31 (.27)</td>
<td>.21 (.02 – .40)</td>
<td>2.27 (72)</td>
<td>.013</td>
</tr>
<tr>
<td>Phobic anxiety</td>
<td>.27 (.50)</td>
<td>.13 (.23)</td>
<td>.13 (.04 – .31)</td>
<td>1.53 (72)</td>
<td>.069</td>
</tr>
<tr>
<td>Paranoid ideation</td>
<td>.53 (.61)</td>
<td>.39 (.40)</td>
<td>.13 (.04 – .37)</td>
<td>1.10 (72)</td>
<td>.136</td>
</tr>
<tr>
<td>Psychoticism</td>
<td>.33 (.42)</td>
<td>.18 (.24)</td>
<td>.15 (.08 – .31)</td>
<td>1.88 (72)</td>
<td>.031</td>
</tr>
<tr>
<td>Positive symptom distress index (PSDI)</td>
<td>1.51 (.43)</td>
<td>1.24 (.35)</td>
<td>.26 (.08 – .45)</td>
<td>2.93 (72)</td>
<td>.002</td>
</tr>
</tbody>
</table>
in fish and sea food. Two controls had remarkably high levels of mobilized mercury (283 and 504 µg/l). Hg concentration in saliva is influenced by several variables, can increase short-term and it is known that it varies over a broad range in individual cases (Staehle, 1998) Patients and controls did not differ significantly in their concentration of mobilized Hg in saliva after exclusion of these data from analysis.

Likewise the mean Hg concentration in urine, by which chronic burdens originating from the release of Hg from amalgam fillings can be assessed, were the same in patients and controls. The participants relating their complaints to amalgam did neither show a higher Hg concentration than the controls nor were they exposed to a greater degree than the German population. The Hg concentrations we found are one tenth lower than the values reported in epidemiological studies on toxic Hg effects (WHO, 1991). Even studies with a great number of participants did not show a relationship between the intensity of the subjective complaints and internal mercury exposure (Ahlqwist et al., 1988, Ahlqwist et al., 1999; Melchart et al., 1998).

Almost one fourth of the patients examined by us were atopic with symptoms like rhinitis allergica, atopic eczema, or allergic asthma, that would explain many of the patients’ complaints. These patients, suffering from various well documented allergies, were encouraged by the heated public debate and hoped to find the cause for their atopic disease in amalgam. However, Scandinavian studies with a larger study population did not find any indication that amalgam increases the prevalence of atopic diseases (Herrström and Högstedt, 1994). The so called “amalgam allergy” has often been quoted by the media as a frequent side-effect of amalgam but the term amalgam allergy has been falsely used by these authors to describe various subjective health disturbances. Only one of our forty patients had a contact sensitization to amalgam classified as a type IV reaction and met the criteria of an allergy, a definition first introduced by Coombs and Gell. Even in case of a positive patch test the removal of the amalgam fillings is only recommended if a contact allergy is clinically relevant, i.e. only if there is a chronological or topographic correlation between the clinical picture of contact stomatitis, gingivitis, or lichen ruber and the application of an amalgam filling (Fuchs, 1994), as was the case in one individual in our patients’ group. After removing this patient’s amalgam fillings the lichenoid lesions healed up completely, whereas the reported vegetative and psychic complaints continued even after one year.

Patients showed increased psychic strain and striking experienced distress. They mostly stated moderately pronounced depressive symptoms, and in the psychometric tests they resembled patients with psychosomatic disorders. Twenty percent of the patients had considerable depressive symptoms. A major depression was diagnosed in five of these patients and three other patients showed a depression together with a somatization disorder. More than one fourth of the patients fulfilled the diagnostic criteria of a somatization disorder according to ICD-10, a result that agrees with other studies in amalgam patients (Bågedahl-Strindlund et al., 1997). These patients are strongly convinced that they are physically ill and refuse to consider that psychosocial factors might be responsible for their symptoms. Other studies found an even higher percentage of other psychiatric disorders like anxiety disorders and depression (Bratel et al., 1997). The questionnaires that we used were self-reported data and there is a tendency for underestimation of the influence of psychological factors if they are answered conforming to social desirability. It can be assumed that some patients filled in those forms where a psychological context was recognizable in a deliberately “inconspicuous” way because they were afraid that their complaints might be considered psychiatric. This tendency did not occur as much in the SOMS which deals predominantly with physical symptoms. Current studies do not support the theory that amalgam fillings may cause psychic or neurological disorders, as often mentioned by the opponents of amalgam (Björkman et al., 1996; Saxe et al., 1995, 1999).

Our findings suggest that psychotherapy or psychiatric treatment is the adequate therapeutic approach for many patients with amalgam-related complaints. No evidence was found for the necessity of detoxification by elimination therapies, as often recommended. Likewise we don’t support the expensive replacement of the amalgam fillings with other dental materials that may be even more problematic from an allergologic point of view. The results of our study strengthen the need of an “environmentally psychosomatic” view in the expanding environmental health care system that mainly focuses on the intense testing of noxious substances. The insufficient consideration of psychosocial factors or, conversely, the undifferentiated classification of complaints as “psychogenic” prolongs the time to refer the suffering patients to an adequate therapy.

In summary, our study gives a heterogeneous picture of the patients with amalgam-related complaints. No symptoms of mercury intoxication or significantly elevated mercury concentrations were found in the patients. One fourth of the patients
suffered from various atopic diseases and in more than one third one or several psychic disorders were diagnosed. Further studies are needed in the group of patients who showed neither an atopic predisposition nor an influence of psychosocial factors.

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