



# Psychological symptoms and self-image of patients with complaints attributed to dental restorative materials

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## Abstract

**Objectives** The aim was to study self-image and the level of psychological symptoms in patients with symptoms attributed to their dental restorative materials.

**Materials and methods** A questionnaire containing questions regarding dental and medical history was answered by 257 participants, one group with local oral symptoms only (LSO), and one group with multi-symptoms (M-S). A reference group was randomly selected from a research database at the Department of Psychology, Umeå University, Sweden. The self-image was assessed using the Structural Analysis of Social Behavior (SASB). Psychological symptoms such as somatization, depression, and anxiety were assessed using the Symptom Check List 90 (SCL-90) and the Global Severity Index (GSI) was used to determine the level of psychological symptoms.

**Results** SASB showed that the M-S group and the LSO-group scored significantly higher on the “spontaneous” and “positive self-image” than the reference group. In the SCL-90, the M-S group scored significantly higher than the LSO-group and the references on the somatization subscales. On depression, anxiety, and the GSI scale, the M-S group scored significantly higher than the reference group.

**Conclusions** The two subgroups scored significantly higher on the SASB Spontaneous and Positive clusters which indicates that these patients have an excessively positive self-image, are very spontaneous and have an overconfidence in themselves compared to the reference group. In the M-S group there was a clear tendency to somatization, depression, and anxiety and they were more psychologically stressed than the reference group.

**Clinical relevance** Among the patients with illness attributed to their dental materials, the M-S-patients had a significantly higher level of general psychological distress and somatization than the control group which may lead to mental stress.

**Keywords** Dental materials · Environmental intolerance · SASB · SCL-90

## Introduction

Health problems associated with dental restorative materials, especially dental amalgam, have in Sweden been discussed extensively on and off during the last 30 years [1–3]. These health complaints resemble the symptoms reported by patients with other environmental intolerances, for example multiple chemical sensitivity which is characterized by somatic distress upon exposure to odors [4]. Furthermore, during the last decades, symptoms attributed to indoor environment [5] and electromagnetic fields [6] have been debated. Studies have shown that a mixture of symptoms often is present simultaneously [7]. When there are somatic symptoms without an organic disease and a lack of demonstrable structural lesions or established biochemical changes, patients often get the diagnosis “medically unexplained physical disorder” [8, 9]. All

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these syndromes are characterized by the patients' belief that his or her symptoms are caused by a very low exposure to various environmental factors [10]. Patients with symptoms attributed to dental restorative materials often present multi-symptomatic conditions with symptoms like dizziness, fatigue, palpitations, headache, and musculoskeletal pain, as well as sleeping problems and disturbances of concentration and memory [7, 11]. Oral symptoms such as dry mouth and burning mouth are also common [12, 13].

It has not been possible to explain why some individuals experience "illness conditions" when there are no positive laboratory findings to support the conditions. In the early 1970s, Engel claimed that psychological well-being plays a protective role in the dynamic balance between health and disease and therefore proposed "The bio-psychosocial model" [14]. In the 1990s, Sparks proposed three major views in the explanation of environmental intolerance [15–17]. One view was that it is a physical or psychophysiological reaction to multiple environmental chemicals. A second view was that symptoms may be triggered by low-level environmental chemical exposures, but the underlying increased sensitivity may be initiated by psychological stress. A third view suggested that symptoms might be due to a misdiagnosed physical or psychological illness, a misdiagnosis in that chemical exposures are not the cause of the symptoms [15, 16]. Guidelines for taking care of patients with medically unexplained symptoms and somatoform disorders were published 2012 [18] showing that these patients still are a challenge clinically.

In patients with symptoms attributed to dental materials, research on the health effects of mercury released from dental amalgam and its subsequent uptake has failed to explain the clinical symptoms [19–21]. Bågedal et al. studied other factors than mercury release in these patients and the most striking finding was the high prevalence of psychiatric disorders, nearly 50% had somatoform disorders. They also found that the patients reported more symptoms indicating mental illness than the controls [22]. There are also other studies that support the view of the syndrome as a psychosomatic disorder [23] or a vulnerable personality as being the cause for the disorder [24]. In a study by Sundström et al. [25] it was found that individuals with amalgam-related complaints reported more symptoms and negative life events than the controls [25]. In a latter study by Sundström et al. [26], no association was found between cognitive functions and the presence of amalgam-related complaints. Patients with symptoms attributed to dental fillings and/or to electromagnetic fields have also been found to be more depressed, anxious and stressed than healthy controls [17, 27].

The etiology of environmental intolerances is not entirely elucidated and the question of the psychological consequences for individuals with environmental intolerance and symptoms attributed to dental restorative materials remain

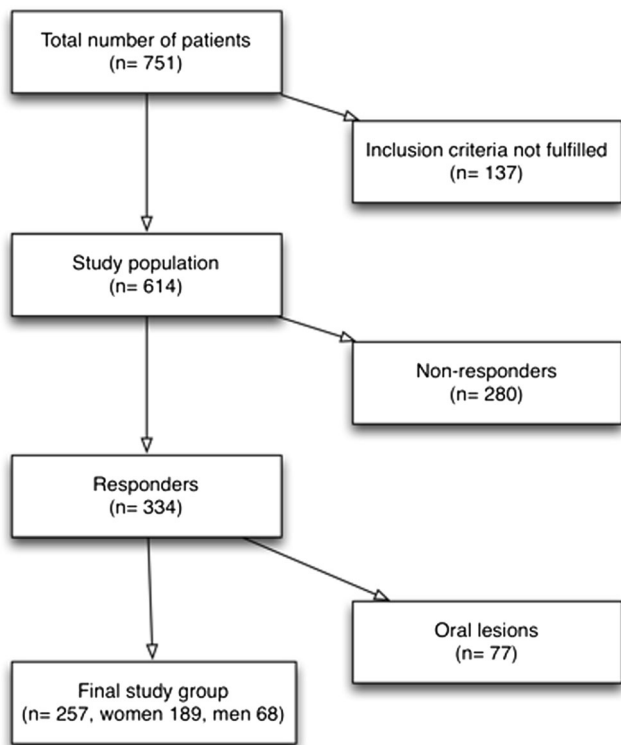
unsolved. Therefore, to achieve a better understanding and to develop adequate treatment methods for these patient groups, there is a need of further evaluation of the psychological factors, such as psychological symptoms and self-image, simultaneously with an evaluation of both medical and odontological factors.

Thus, the aim was to determine the level of psychological symptoms and to study the self-image in two groups of patients with symptoms attributed to their dental restorative materials, one with local oral symptoms only (LSO) and one with multi-symptoms (M-S). The hypothesis was that patients with M-S have more psychological symptoms and a self-image deviant from that of patients with LSO.

## Material and methods

### Subjects

The study population consisted of consecutive patients referred by dentists/physicians to the Department of Oral Diagnosis, School of Dentistry in Umeå, Sweden during 1991–1998 for an examination of symptoms attributed to their dental restorative materials. The study population used is described in Fig. 1. The examination at baseline included a clinical examination and a structured interview according to a predetermined protocol with questions regarding among others, civil status, present health, medical and dental treatment, and other measures and precautions taken owing to the problems referred for. A total of 751 patients had been examined during the period and 137 were excluded of reasons such as missing dental records, no dental examination, confirmed medical diagnosis that explained their symptoms and patients who had deceased between baseline and follow-up. The inclusion criteria for participating in the study for the remaining patients were that they at baseline should have stated that they believed that their dental restorative materials caused their symptoms, or had oral lesions that the referring dentist/physician suspected to be caused by the patients' dental materials. At follow-up, i.e., on average 5 years after the baseline examination, a questionnaire was mailed to 614 patients and 334 (55%) were returned. A total of 280 persons (45%) did not return a completed questionnaire. The dropout group was divided into subgroups and every sixth patient was contacted for a telephone interview. A total of 46 dropouts were interviewed and the most common reason for not responding was dissatisfaction with the questionnaire, especially with the psychological questions. The dropouts perceived worse health status and wellbeing in comparison with the response group at follow-up. Their complaints from the baseline investigation were still present and to a higher degree than before. In the dropout group, 30% experienced no change regarding reported problems compared to 19% in the response group. The



**Fig. 1** The study group used for the follow-up

dropout analysis indicates that non-responders can be overrepresented among individuals with multiple health problems.

Among the returned questionnaires, 77 patients diagnosed having oral lesions such as oral lichen planus, oral lichenoid contact reactions, and lingua geographica, were excluded, since these oral lesions could explain their symptoms. The remaining 257 patients had symptoms that they at baseline had stated that they believed were caused by their dental restorations (Fig. 1). The final study group consisted of 74% women ( $n = 189$ ) and 26% men ( $n = 68$ ). The mean age at follow-up was 55.6 yrs., range 23–89 yrs. To study the self-image and psychological symptoms in this study, reference groups with sex- and age-matched healthy subjects were randomly selected from a research database at the Department of Psychology, Umeå University, Sweden.

### Classification of patient groups

The patients were classified into subgroups according to symptoms by two dentists (AT, LM). The classification has been presented in a previously published study by Tillberg et al. [7, 28]. One subgroup consisted of patients with local oral symptoms only (LSO), for example burning mouth, dry mouth, taste disturbances, and temporomandibular joint disorders. The other subgroup consisted of patients with both local and general symptoms such as pain from muscles and joints, fatigue, headache and vertigo and was called the multi-symptom group (M-S) [7]. The majority were M-S patients,

195 subjects (76%), 141 women and 54 men, while the LSO-group consisted of 62 subjects (24%), 48 women and 14 men. The mean age of the subjects in the LSO-group was 62 yrs. (range 29–83) while the corresponding figure for the M-S-group was 54 yrs. (range 23–89).

### Questionnaire

The questionnaire was based on a version previously used in other environmental studies [6, 29]. Besides the questions regarding psychological symptoms and self-image, the questionnaire contained questions on among others, civil status, local and general symptoms, and medical and odontological treatments.

### Assessment of self-image

Structural Analysis of Social Behavior (SASB) was used to measure the self-image [30, 31]. The SASB model is based on a social theory where personality is defined in a dynamic way as how you treat yourself. The model consists of two basic dimensions; affiliation (love-hate) and interdependence (spontaneity–control). The two basic dimensions are formulated as statements rated on a scale between 0 and 100 describing how well the statement characterizes the person. In this study, four clusters were assessed: spontaneity, control, positive, and negative. The SASB-model has a high test-retest reliability and internal consistency [30, 32, 33].

### Assessment of psychological symptoms

The Symptom Check List 90 (SCL-90) was administrated to assess psychological symptoms [34, 35]. The SCL-90 consists of 90 items, scored from 0 (not at all) to 4 (extremely) and grouped into 9 different symptom subscales. In this study, the somatization, depression and anxiety subscales were used. Furthermore, the Global Severity Index (GSI) was used to measure the level of psychological symptoms and is the mean score of all 90 items. According to Derogatis [36], GSI is the best single indicator of severity of disorder and should be used in most instances where a single summary measure is required. The SCL-90 has a high internal consistency and high test-retest reliability [34, 35].

### Statistical analysis

Comparisons between proportions were made using Chi-square test and the significance level was set to 0.05. Mean values, standard deviations, and frequencies are presented for the different variables studied. In order to compare the LSO, M-S, and the reference groups, variations between means were tested by the analysis of variance (ANOVA) with Bonferroni test for corrections of multiple comparisons.

Multivariate analysis was used to test whether age and gender influenced the results. All analyses were conducted using SPSS 20 for Macintosh.

## Results

The SASB showed that both the LSO group and the M-S group scored significantly higher on “spontaneous” and “positive self-image” than the reference group (Table 1). For the cluster “controlled”, both groups scored lower than the references and on the cluster “negative” both groups scored higher than the references, but the differences between the groups were not significant (Table 1).

The SCL-90 showed that the M-S group scored significantly higher than the reference group on the somatization subscales and also significantly higher on depression, anxiety, and on the GSI scale compared to the reference group (Table 2). Furthermore, the M-S group also scored significantly higher than the LSO group on the somatization subscales.

The results of SASB, SCL-90, and GSI did not differ significantly with age and gender in the present study.

## Discussion

In order to explore psychological factors in patients with symptoms attributed to dental restorative materials, the aim was to measure self-image and determine the extent of psychological symptoms in these patients.

This study showed a clear difference in self-image in SASB between the two groups of patients with symptoms attributed to dental materials and the reference group. Both the LSO-group and the M-S group scored significantly higher on the “spontaneous” and “positive self-image” than the references. The combination of an elevated positive and spontaneous self-image may result in an overconfident and impulsive behavior. This behavior can be manifested as a frustration both intra-

psychically (an individual relating to him or herself) and inter-psychically (an individual relating to another) and therefore result in difficulties in setting limits, and may in combination with high demands result in mental stress. Stress is supposed to be a significant risk factor for impaired health and decreased well-being. Over a prolonged period of time, the stress-related symptoms can be manifested as fatigue and concentration difficulties or an increase in the sensitivity to environmental factors [37]. This may also result in various psychosocial problems in the interpersonal relations. The interpretations of the results in the present study have support in other studies [37, 38] and can be compared with studies of patients with other environmental intolerances. Bergdahl et al. [17] found that patients with sensitivity to electromagnetic fields scored higher on the spontaneous and positive clusters than a control group and normal on the negative self-image on the SASB. They suggested that individuals with this self-image might have an unrealistic view of their own capacity, which can result in an increased psychosocial vulnerability and this could result in stress-related symptoms such as fatigue and to various psychosocial problems in the interpersonal relations, such as conflicts at work [17]. Also in a study by Edvardsson et al. [37] of patients with symptoms attributed to Indoor Environment, they found that a female patient group rated higher on the spontaneous and positive cluster and lower on the controlled and negative cluster than a control group. This combination was interpreted as contributing to the risk of developing long-standing symptoms under certain circumstances. The present study with symptoms attributed to dental materials, shows similar results in SASB. Ryum et al. found that improvement in self-image may be important in order to achieve a good outcome in psychotherapy [39] and self-image may also be modified by psychotherapy, but a person’s personality profile is assumed to remain stable [24, 40].

Regarding the psychological symptoms assessed in SCL-90, the M-S group scored significantly higher on the somatization subscales compared to the reference group and the LSO-group. The clear tendency to somatization in this study,

**Table 1** SASB scores of the two subgroups and the reference group. Mean score, standard deviation, and *p* values are shown

Parameters SASB	Local symptoms only (a)			Multi-symptoms (b)			Reference group (ref)			<i>p</i> value
	N	Mean	SD	N	Mean	SD	N	Mean	SD	
Spontaneous	52	60.6	31.8	181	57.4	30.2	135	42.5	15.2	a > ref. 0.000★, b > ref. 0.000★
Controlled	49	44.7	33.5	179	46.8	34.4	135	50.7	18.1	a < ref. 0.647, b < ref. 0.699
Positive	53	72.3	20.4	181	72.0	27.4	135	56.5	15.4	a > ref. 0.000★, b > ref. 0.000★
Negative	50	22.4	18.1	181	23.8	22.0	135	21.3	16.4	a > ref. 1.0, b > ref. 0.822

★*p* < 0.05

**Table 2** SCL-90 scores of the two study groups and the reference group. Mean score, standard deviation, and *p* values are shown

Parameters SCL-90	Local symptoms only (a)			Multi-symptoms (b)			Reference group (ref)			<i>p</i> value
	N	Mean	SD	N	Mean	SD	N	Mean	SD	
Somatization	57	0.8	0.7	187	1.2	0.8	69	0.6	0.6	a > ref. 0.347, b > a 0.001★, b > ref. 0.000★
Depression	56	0.7	0.6	187	0.8	0.7	69	0.5	0.5	a > ref. 0.145, b > ref. 0.001★
Anxiety	56	0.4	0.5	187	0.6	0.6	69	0.4	0.4	a > ref. 1.0, b > ref. 0.025★
GSI	58	0.5	0.5	187	0.6	0.5	69	0.4	0.4	a > ref. 0.344, b > ref. 0.001★

★*p* < 0.05

which was also reported by Langworth et al. [41], can be considered to reflect either a secondary manifestation of illness, or a secondary manifestation of an unmanageable social situation. The results are in accordance with the results of Bratel et al. [42], who found that stress-related somatoform disorders were more common in patients with symptoms related to amalgam fillings than in a control group. To resist psychosocial explanations to illness may be a factor that can make functional coping of experienced traumas more difficult. In some cases, somatization can be seen as a way of coping [41]. Furthermore, the M-S group scored significantly higher than the reference group on the depression and anxiety subscales and also on the GSI, which indicates that they are more psychologically stressed than the reference group. The LSO group, however, did not differ from the references regarding depression, anxiety, and GSI scale.

Langworth et al. [41] reported that patients with illness attributed to dental fillings scored higher on obsession and above normal in terms of anxiety and depression. Moreover, both Bratel et al. [42] and Langworth et al. [41] reported that there was a high frequency of reported prior negative life events in patients with illness attributed to dental fillings. Similar results were reported in a more recent study by Sundström et al. [26], who showed that many participants with amalgam-related complaints had experienced negative life events before and at the onset of the amalgam-related complaints. Sundström et al. also found that patients with complaints related to dental amalgam reported significantly more symptoms than a control group [25], which also was found in the present study. The higher level of psychological stress found in the M-S groups in the present study may contribute to the remaining symptoms. It has been reported that stress factors are important in the etiology of disease and both psychiatric and somatic disorders are affected by long-lasting exposure to stress [45]. Exposure to stress factors may also often determine the onset of many illnesses, although the relationships are highly complex [45, 46]. In a group

of patients with symptoms related to indoor environment, Edvardsson et al. [37] found that certain personality traits may be potential risk factors that increase the probability of experiencing stressful work situations. Stress may in turn increase workers' susceptibility to indoor environment exposure, which can provide remaining symptoms.

There are previous studies on the personality of patients with complaints of dental materials and/or electromagnetic fields. Bergdahl et al. [24] found a more vulnerable personality in these patients with various mental and somatic symptoms, which the patients interpret as symptoms evoked by dental restorative materials and/or electromagnetic fields [24].

In the present study, it was found that among the patients with illness attributed to their dental materials, the M-S patients had a significantly higher level of general psychological distress and somatization than the control group. This might have affected the self-perceived improvements in health reported after replacement of dental materials in the present patient group [7]. The patients had several physical symptoms and a high tendency to somatization, and at the same time the treatment with an exchange of dental restorations was of physiological character—a treatment that many patients expected would improve their health. However, in patients with medically unexplained disorders, it has been shown that treatment such as psycho-physiologic interventions usually are better accepted than psychotherapeutic interventions [9]. Katsamanis et al. [9] showed that a “medicalized” treatment is better accepted than psychotherapeutic interventions and the reason might be that the patients tend to think that the problem is in the body and not in the mind, despite the lack of biomedical signs. The possible effect of placebo has also been discussed since many patients report health improvements and decrease in symptoms after treatment with exchange of dental materials [43]. However, it has been shown that specific neurotransmitter systems respond to the expectation of benefit during placebo administration, which induces measurable physiological changes [44].



It would have been interesting if it was possible to split the whole group into subgroups to look for differences in questionnaire scores, dry-mouth/not dry mouth, burning mouth/not burning mouth, type of filling materials, etc. This was not possible since the subgroups were too small to extract reliable data from. Age and gender didn't influence the results. Furthermore, the oral status was not a part of this study.

More than a decade has passed since the collection of data and some things have changed. It is not reasonable to assume that the current materials have improved dramatically regarding possible health risks. What has changed, at least in Sweden where the data was collected, is that the interest from media has decreased and consequently also the problems reported by the public regarding health effects allegedly caused by dental materials. However, this can change rapidly. The mechanisms are the same. If suspicions arise regarding serious health effects caused by a commonly used dental material, there might be a number of people with medically unexplained symptoms that start to relate their health problems to the suspected dental material. However, we are today better prepared to investigate whether the health effects are actually caused by the dental material. What is next? Maybe the materials containing nanoparticles? If nanoparticles are released are they also excreted? We have a fairly good understanding regarding release, uptake, distribution, and excretion of mercury released from dental amalgam but we don't have a lot of data on the release, uptake, and distribution of nanoparticles in dental materials. Next issue for debate?

## Conclusion

Based on the findings of the present study, the following statements can be made:

- The two subgroups in this study, patients with LSO and patients with M-S, are equal concerning self-image but unequal regarding psychological symptoms where the MS-group scored significantly higher on somatization
- Both groups are significantly more spontaneous and have a more positive self-image compared to the reference group
- The results of the tests of psychiatric symptoms indicated that the M-S group was more psychologically stressed than the LSO-group and the reference group. However, there were no significant differences between the M-S and the LSO-group regarding psychiatric symptoms.
- For patients with symptoms attributed to dental restorative materials, there seems to be both dental and medical factors as well as social and psychological factors involved in the presentation of illness

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** The study was approved by the Ethics Committee of Umeå University, Umeå, Sweden. All procedures in this prospective study were conducted in accordance with the Declaration of Helsinki (1964) and its later amendments.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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