Defensive characteristics in individuals with amalgam illness as measured by the percept-genetic method Defense Mechanism Test

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Twenty patients complaining of symptoms deriving from their amalgam fillings and a non-patient group were assessed by means of the perceptual projective Defense Mechanism Test (DMT). The test protocols were scored for 130 DMT variables and analyzed by means of the multivariate statistical method Partial Least Squares discriminant analysis. The objective was to try to distinguish the group with amalgam illness from the non-patient group by means of the DMT. The results showed that it was possible to distinguish the two groups significantly from each other. The most characteristic traits of the patient group were a general lateness in perception and few emotional responses compared with the non-patient group and, especially, an inability to perceive the aggressive component in the stimulus picture. The DMT seems to be a powerful method in the effort to understand the mechanisms underlying the problems of amalgam illness. □ *Facial pain; personality test; PLS discriminant analysis; projective methods; psychosomatic*

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There is an ongoing debate in Sweden about the factors that influence the etiology of amalgam illness symptoms and distress purported to be caused by amalgam fillings. Amalgam illness could be defined as experienced, systematic poisoning symptoms (1), but epidemiologic studies have in general given weak support to a theory claiming a connection between the number of amalgam fillings and reported symptoms (2). There are several findings indicating that a substantial proportion of the patients have social problems or psychiatric disturbances (3). Bergdahl (4) studied patients with burning mouth syndrome both odontologically and psychologically and found that only 32% of the patients recovered after odontologic or medical treatment. The commonest odontologic treatment for these patients was replacement of amalgam fillings. The conclusion was that this finding suggests that burning mouth is multicausal. He also studied patients with oral lichenoid reaction on the basis of their psychologic functioning, measured by, among other things, self-rating inventories. The findings showed that they rated themselves as tense, suspicious, non-aggressive, anxious, and having sad thoughts. The conclusion was that these individuals can be labeled depressive and that a psychologic investigation is necessary to understand how to treat both these groups.

Other studies have also focused interest on the relationship between the individual's personality and the development of symptoms (1, 5). For example, Elander-Lindberg et al. (1) studied patients with amalgam illness, using psychodynamically oriented in-depth interviews. Their findings showed that all the subjects had experienced an important psychic trauma in close connection with the first appearance of the symptoms, and their interpretation was that these subjects had not been able to mourn in an adequate manner. The body had been forced to symbolize the great pain in their souls: the symptoms of amalgam illness were alleged to be psychosomatic.

Similar findings were also reported from a study conducted by Nilsson et al. (6). They compared patients with amalgam illness and healthy controls by means of a personality test, the Defense Mechanism Test (DMT). They found that affective and defensive patterns on the DMT clearly differed between the two groups. The patients used much more primitive defense mechanisms, such as splitting maneuvers, and had problems in perceiving the threatening part of the stimulus picture. Their conclusion was that the patient group showed difficulties deriving from preneurotic problems. They also noted that this group had suffered from the loss of an important person in childhood more often than the control group. In the study by Nilsson et al. (6) the results were statistically computed at a bivariate level, which limited the possibilities for detecting more detailed DMT patterns that might explain the differences between the groups. An alternative approach is to use the multivariate method Partial Least Squares (PLS) projection to latent structures to capture the information contained in the relation between the variables by considering all variables simultaneously. This approach also involves a change in how the researcher asks statistical questions. However, it is not possible to discuss the variables separately.

To sum up, there seems to be some amount of agreement in these studies that there are differences in personality functioning between the group of patients alleged to have amalgam illness and non-patients.

The DMT is a projective percept-genetic test developed by Kragh and based on psychoanalytic and percept-genetic theory (7). It has been used in various

clinical and experimental studies in Scandinavia and in the selection of personnel in stressful professions such as pilots. DMT has also proved to be a very powerful method in clinical settings to distinguish between different personality disorders as defined by the DSM-III classification system within the field of psychiatry (8) and also between different personality organization levels on the basis of Kernberg's concepts (9–11).

Aim

The overall aim of the present study is partly to replicate the study by Nilsson et al. (6), but here using multivariate methods. The following question is addressed: what are the similarities/differences between the group of individuals with amalgam illness and healthy controls in terms of different reactions to the DMT?

Table 1. List of the 130 DMT variables

1	Sex (the subject's)
2	Age (the subject's)
3	Anxiety (such as blackening)
4–17	Threshold values
18–28	Disappearance and Reduction
29–31	Interchanges of sex
32–39, 68, 130	Manifestation of emotion
40–47	Repression
48–63	Isolation
64–67	Denial
69–76	Reaction formation
77–83	Identification with the aggressor
84–94	Introaggression (turning against the self)
95–114	Introjection
115–116	Projection
117–122	Projected introaggression
123	Regression
124	Whole-gestalt responses
125	Sexualization
126–129	Observed test behavior

Materials and methods

Subjects

Twenty patients (6 men and 14 women; mean age, 54 years) participating in a study of 681 patients (12) in the region of Västernorrland, Sweden, were assessed by means of the DMT. These 20 patients (AI) were randomly selected from the larger group. All the subjects complained of symptoms caused by their tooth fillings.

The non-patient group (NP) consisted of students and ward staff (n = 37; 22 men and 15 women; mean age, 31 years). They had no known psychologic or other symptoms.

Defense Mechanism Test (DMT)

The DMT consists of repeated exposures of an anxiety-provoking stimulus picture with a younger person (Hero) to identify with and a threatening older person (the Peripheral Person) in the background. In addition, an attribute is placed in front of the Hero. In the test situation the subject is shown this picture in a tachistoscope with increasing exposures from 5 msec to 2 sec or until the subject perceives the picture correctly, with a maximum of 22 exposures. The provoking element of the picture is purported to give rise to anxiety, activating different defense mechanisms. During this process the subject makes a lot of subjectively interpreted perceptions with greater or lesser deviations from the original picture, and this gives us the opportunity to interpret the deviations in terms of perceptual defenses. These perceptual defenses may then be understood on the basis of their similarities with the defense mechanisms defined by psychoanalytic theory (13). Most of the deviations from the original picture are interpreted in terms of defense mechanisms, using a manual developed over several years (7). This manual describes 10 main categories of perceptual defenses. This objective evaluation system is a clear advantage of the DMT, with a minimum of subjective interpretations of the responses in the coding procedure, reflected by interrater reliability coefficients ranging from 0.80 to 0.95 (7, 14). In this study, only one of the two standard pictures was used.

The subject's responses were scored on the basis of 130 DMT variables created by Sundbom & Armelius (15). The variables consist of the 10 categories of perceptual defenses defined by the manual but also other relevant responses not systematized in the manual. Some of the variables are also scored in accordance with whether they occur early, in the middle, or late in the percept-genesis. The reason for this is that both theoretical and empirical evidence suggests that defenses may have different meanings depending on where in the percept-genesis they occur (11). In Table 1 a short presentation of the 130 variables is given. A more detailed description of the variables and the theoretical assumptions underlying this method is given elsewhere (15).

Principal component analysis (PCA) and Partial Least Squares (PLS) projection to latent structures discriminant analysis

In the present study we have used the multivariate methods of PCA and PLS (16). Both methods have been developed to deal with a large number of variables even when there are few subjects in a study. PCA is used to examine the data and find underlying relations between variables and subjects. PLS is then used to optimize the relation between a set of X descriptors (DMT variables) and Y variables (AI and NP groups), resulting in a

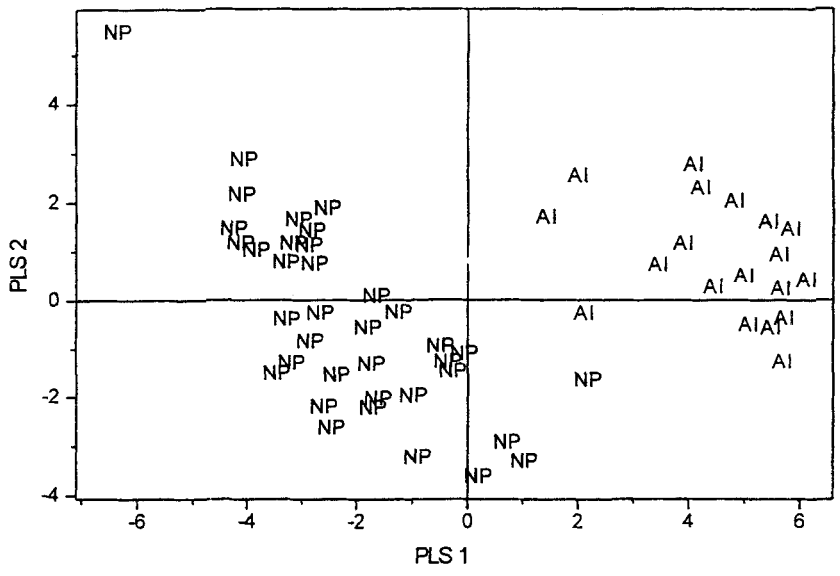

Fig. 1. Partial least squares (PLS) discriminant analysis. Projections for each individual plotted in a two-dimensional window created by the two descriptors PLS 1 and PLS 2. NP = non-patients; AI = amalgam illness.

projection of the subjects and the variables on a minimum of significant information-bearing dimensions (16). In studies with few cases and many variables PLS solves the problem of 'overfitting' by using cross-validation criteria to estimate the level of significance in the model. This method has proved to be a very powerful indicator of possible chance correlations and more effective than traditional tests based on the assumption of a normal independent distribution of variables. The conclusion is that the use of cross-validation is a powerful tool in producing reliable models (17).

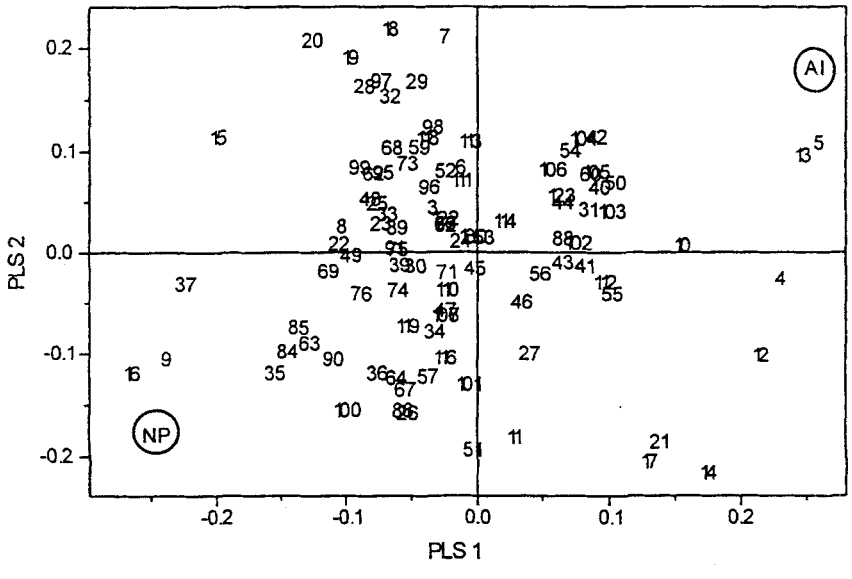

Fig. 2. Partial least squares (PLS) loadings of the DMT variables participating in the separation of the amalgam illness (AI) and non-patient (NP) groups.

Table 2. Variables defining amalgam illness patient

Var. no.	PLS 1 loading	Description of the DMT variables
		High threshold values
5	0.25	First threat is seen late
13	0.24	First Peripheral Person is seen late
4	0.22	First meaningful structure is seen late
12	0.21	First Hero structure is seen late
14	0.17	First attribute is seen late
10	0.15	Correct picture is seen late
17	0.12	Correct attribute is seen late
21	0.13	No attribute is perceived
		Introjection
103	0.10	Introjection. Total
112	0.09	Introjection. Hero >34 years
105	0.08	Introjection. Two or more Hero. Middle
		Disappearance/Reduction
50	0.10	Hero disappearance. Early
55	0.10	Peripheral Person disappearance. Late
60	0.08	Structure disappears over the whole field
		Repression
40	0.09	Total
42	0.08	Hero. Early

Table 3. Variables defining non-patient

Var. no.	PLS 1 loading	Description of the DMT variables
		Low threshold values
16	−0.27	Many Peripheral Person structures
9	−0.24	Many threats are seen. Late
15	−0.20	Total number of Hero structures
8	−0.11	Many threats and TC phases. Middle*
		Manifestation of emotion
37	−0.23	Many aggressive Peripheral Persons
35	−0.16	Hero is sad
36	−0.08	Peripheral Person is positive
84	−0.15	Introaggression. Total
85	−0.14	Introaggression. Number of variants
90	−0.11	Introaggression. Hero with Peripheral Person. Middle
69	−0.12	Reaction formation. Total
76	−0.09	Reaction formation. The whole picture
		Disappearance/Reduction
63	−0.13	Threat disappearance. Late
20	−0.13	Attribute disappearance. Late
19	−0.10	Attribute disappearance. Middle
22	−0.11	Reduction Hero. Early
28	−0.09	Reduction Hero. When the threat is seen
25	−0.08	Reduction. Peripheral Person. Late
23	−0.08	Reduction. Hero. Middle
62	−0.08	Threat disappearance. Middle
		Identification opposite sex
100	−0.10	Peripheral person. Early
99	−0.09	Hero. Late
		Isolation
49	−0.10	Number of variants
48	−0.09	Total

* TC phase: When the whole picture is correct including perception of the threat.

Results

PCA

As an initial step, PCA analysis was applied to perform a quality control of the entire data set, to obtain an overview of the data structure and identify outliers—that is, observations that have been given extreme values in comparison with other subjects. In all, two successive PCA analyses were performed and carefully scrutinized for outliers. One subject in the AI group who could be labeled outlier was identified. The reason for the deviant position was that he had an extreme value on variable 47 (Repression; Peripheral Person; late). The main results would not be affected significantly if this subject were included, but the model would not be as illustrative if he were excluded. Whereas the purpose of this study was to try to distinguish between the AI and NP groups and to find similarities and differences in the DMT pattern, it seemed justifiable not to include this subject in the following statistical calculations.

PLS discriminant analysis

To study the relationship between the AI and NP groups and the 130 DMT variables, a PLS discriminant analysis was carried out on the remaining 56 subjects. Variables 1 (sex), 2 (age), and 126–129 (describing the test situation) were excluded because they are not proper DMT variables.

One information-bearing dimension (PLS 1) was significant and accounted for 78% of the variance in group membership on the basis of 12% of the variance in the DMT variables. On the second dimension (PLS 2), which was not significant according to the cross-validation criteria, another 10% of the variance in group affiliation was accounted for by another 4% of the DMT measures. The results can be seen on a PLS projection in Fig. 1.

As we can see in Fig. 1, this model is capable of distinguishing between AI and NP in a very convincing manner. The NP group is located towards the left part of the figure and the AI group in the right part. All subjects except one are perfectly separated on PLS 1.

In Fig. 2 the variables responsible for the separation of the diagnostic groups are illustrated. Of the 124 variables, 22 were excluded because of zero variance. One hundred and two variables were active in the separation, but of these, only 40 had a more substantial influence on the model (VIP $\geq$ 0.8). In Fig. 2 all the variables are illustrated, but only the variables with higher loadings (positive or negative) located towards the periphery have participated significantly in the separation of the two groups. The variables clustered around origo in the figure did not participate in the separation.

The variables towards the right of the picture correspond to the AI group, and the variables towards

the left are those that correspond to the NP group. To make it easier to understand which variables have been active in the separation, an illustration is given in Tables 2 and 3.

The results clearly highlight the AI group's problem in perceiving and integrating the threat in the stimulus picture and a lateness in perceiving all the other elements in the picture. They also differ from the NP group in their choice of other defenses by a more frequent use of introjection in the AI group. Finally, the NP group scores significantly higher on the variables measuring 'manifestation of emotion'.

Discussion

The main results attest that it is possible to determine whether a person belongs to the AI group or the NP group entirely on the basis of a pattern analysis of complex sets of DMT variables. The complexity of the DMT variables can be reduced to one significant dimension describing the differences between the two groups.

One of the most important discriminators was the difference in ability in terms of threshold values and, in particular, the inability to see the threatening Peripheral Person. The NP group had no problems with the perception of this part of the picture, whereas the AI group could not see these elements until very late in the presentation of the stimulus picture. Often they did not perceive any threat at all.

Another important difference was the NP group's higher values on the variables measuring manifestation of emotion. The NP group gave many emotional responses, whereas the AI group did not. It looks as if the AI group had a problem with all aspects of emotional loading of the stimulus picture.

The AI group was also characterized by disappearance/reduction responses. As can be seen in Tables 2 and 3, the AI group had high values on these variables, indicating disappearance of the Hero, Peripheral Person, or the whole stimulus picture. The NP group showed its main emphasis on reduction of these elements and a disappearance of the threat and the attribute.

All these results point in the same direction. The AI group has major difficulties with the emotional/threatening parts of the test and seem to lack the ability to perceive these parts in a manner that makes them understandable and possible to moderate. Their defenses seem to be based more on denial mechanisms or an arrest in perceiving the situation. These results, we think, may tell us a great deal about how people with amalgam illness are prepared to deal with trying life events and other situations that may cause changes in the emotional stability of the individual.

The results are in line with the conclusions of Elander-Lindberg et al. (1). We think that our results help us to understand why trying life events are so significant for this group of patients. Their available set of defense mechanisms, or coping styles, do not seem to be adaptive enough to handle these situations. Nilsson et al. (6) showed that the patients in their study revealed introjection signs and also a great deal of discontinuity in perception. These results are confirmed in our study. Nilsson et al. suggest that these patients are prone to inhibit aggressive impulses and that this is in line with the opinion that psychosomatic patients inhibit such impulses.

In many ways descriptions of these patients are very like those of patients in the literature on psychosomatic symptoms. These patients are known to have problems with their ability to find appropriate expressions of emotional experiences (18). Sometimes they also show no or very little ability to translate their emotional experiences to a verbal level (18–20).

It is obvious that we need more knowledge to understand the problems of amalgam illness. We need to increase our understanding of this group itself and of those mechanisms involved in their struggle with emotionally loaded material. It is therefore of great importance to replicate these findings and compare the new results with those on other diagnostic groups such as psychosomatic patients. In the future these results could be used as a model for the assessment of new patients. We believe that this possibility to create stable and applicable models is the main advantage of the multivariate method of data processing. Our conclusion is that the DMT and multivariate modeling seem to be powerful methods in the assessment of amalgam illness. Shortcomings of this study are differences in mean age and sex values between the two groups. To shed light on that disparity and its influence on the main result, a separate PLS model was built for a subset of the AI group (three men and six women; age range, 30–49 years; mean age, 45.5 years) and the original NP group. Still, one significant information-bearing dimension (PLS 1) was received in a convincing manner. This dimension accounted for 73% of the variance in group membership on the basis of 11% of the variance in the DMT variables. No systematic differences can be observed with regard to age or sex on the basis of the individuals' localization in the plot within the two diagnostic groups. The conclusion is that both age and sex factors seem to have marginal influence on the significant differences between the AI and NP groups.

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