Personality variables in patients with self-reported reactions to dental amalgam

Knut Dalen, Gunvor Bentung Lygre, Hallgrim Kløve and Nils Roar Gjerdet

Department of Clinical Neuropsychology, University of Bergen, Bergen, Norway; Department of Odontology—Dental Biomaterials, University of Bergen, Bergen, Norway; The Dental Biomaterials Adverse Reaction Unit, UNIFOB, Bergen, Norway

Dalen K, Lygre GB, Kløve H, Gjerdet NR. Personality variables in patients with self-reported reactions to dental amalgam. Acta Odontol Scand 2003;61:310–314. Oslo. ISSN 0001-6357.

Personality variables in persons with self-reported reactions to dental amalgam (amalgam patients, $n = 26$, 17 F, 9 M) and in others without such symptoms (controls, $n = 21$, 14 F, 7 M) are compared. The groups were comparable regarding age, education, and amount of amalgam. Minnesota Multiphasic Personality Inventory-2 (MMPI-2) profiles were obtained for all subjects. On MMPI-2, the amalgam patients presented a 'conversion V' pattern, and elevated psychasthenia and schizophrenia scales, reflecting an increased prevalence of psychological and somatic complaints compared with the controls. This indicates that amalgam patients experience ill health, as their personality profiles bear several similarities with other groups with long-lasting symptoms. □ *Dental amalgam, adverse effects; mercury, adverse effects; MMPI; personality disorders, diagnosis*

Knut Dalen, Department of Clinical Neuropsychology, University of Bergen, Jonas Liesvei 91, NO-5009 Bergen, Norway. Tel. +47 55 58 62 17, fax. +47 55 58 98 73, e-mail. knut.dalen@psych.uib.no

During past decades there has been debate about the possible influence of mercury from dental amalgam restorations on general health and well-being (1–5). It appears that there is widespread concern about dental amalgam fillings in the population, as demonstrated by an Australian survey where 37.5% expressed concern (6).

Persons with amalgam-related illness have been described as suffering from chronic ill health with a multitude of symptoms associated with exposure to mercury from dental amalgam (7). Lack of concentration and memory disturbances are ranked among the most common complaints (8, 9). Extreme fatigue is also frequently reported (1, 10). Studies in Swedish twins (mean age 66 years) involving physical and mental health, however, have not revealed adverse effects related to the presence of dental amalgam (11). It has been maintained that the multiple symptoms and signs of distress displayed by amalgam patients cannot be explained by data from dental or medical examination of the patients (12, 13).

Dental amalgam fillings comprise approximately 50% mercury and 50% alloy powder consisting mainly of silver, tin and copper, with smaller amounts of other metals (14). Inorganic mercury is absorbed in smaller amounts from dental amalgam fillings (1).

Different forms of psychopathology, such as depression, general anxiety, panic anxiety, and somatization have been reported in persons with amalgam-related complaints (15–17). It appears that the Minnesota Multiphasic Personality Inventory-2 (MMPI-2), or previous versions of the test, has never been used in the study of amalgam-related problems.

As far as symptoms are concerned, the group of patients with self-reported reactions to amalgam is fairly heterogeneous. The symptoms are non-specific and compatible with a variety of somatic and psychiatric disorders. The existence of a syndrome related to mercury exposure from dental amalgam has been questioned (18, 19). Epidemiological studies have not demonstrated a correlation between number of amalgam fillings and symptoms associated with mercury poisoning (20, 21). On the population level, no correlation has been observed between amount of amalgam and type and number of subjective symptoms (19, 20, 22, 23).

On the other hand it has been suggested that neurobehavioral effects could be detected, in a population with slightly elevated mercury burden (dentists) (24), and also in a population with low-level exposure (25).

The aim of this study was to map personality aspects of persons with self-reported reactions to dental amalgam (amalgam patients) and of others without such symptoms (controls) in order to reveal possible differences between the two groups.

Materials and methods

There were 26 amalgam patients (17 F and 9 M) and 21 controls (14 F and 7 M). Demographic data and amounts of amalgam (expressed as amalgam points) are given in Table 1. The amalgam patients were consecutively selected among those referred from dentists or physicians to the Dental Biomaterials Adverse Reaction Unit of the University of Bergen, Norway, because of self-related amalgam illness with subjective symptoms. The routine medical examination is described elsewhere (26). Persons who had been on sick leave, regardless of the reason, for a

Taylor & Francis healthsciences

DOI 10.1080/00016350310006762

Table 1. Group means (M), standard deviations (*s*), and P values for two sample t tests (unequal variances) for control variables age, amalgam points, and length of education. Females and males analyzed together

	Amalgam patients ($n = 26$) M (*s*)	Controls ($n = 21$) M (*s*)	*P* values
Age (years)	42.0 (6.7)	41.8 (7.2)	.91
Amalgam points	94.8 (30.1)	86.4 (28.5)	.33
Education (years)	13.4 (2.8)	14.2 (3.5)	.37

s = standard deviation.

continuous period of more than 6 months were excluded. The control persons were recruited from general dental practice, based on matching of age, education, and amount of amalgam. The same exclusion criteria were applied for the controls as described for the amalgam patients.

The amalgam restorations varied in size, depending on tooth type and extent of previous carious lesions. To adjust for these differences, each restoration surface was assigned a score from 1 to 3, depending on its size (27). The lowest score, 1, was used to denote small restorations usually denoted as 'pits'. Score 2 was used to describe restorations of intermediate size in premolars. The highest score, 3, was used for fillings in molars. The scoring of amalgam surfaces was done during clinical examination by the same dentist. In the amalgam patients the mean was 94.8 and in the controls 86.4.

Personality variables were measured using the MMPI-2 (28), which was constructed on principles of actuarial prediction. It consists of 567 items and is scored for 13 scales. Three validity scales (L, F, and K) provide information about the subjects' competency to take the test. The L-scale reflects behaviors that, although socially desirable, are all rarely true of a given individual. The F-scale contains items answered with relatively low frequency by the majority of the original normative group, identifying persons intentionally faking pathology. The K-scale identifies tendencies towards a defensive way of responding to the test (response set). The validity scales provide information about the likelihood of someone malingering or denying real problems, and of test-taking attitudes such as defensiveness or help-seeking. On the 10 clinical scales the patient's response pattern is compared with those of the normal control subjects and the different diagnostic groups of psychiatric patients (29). Scale scores are computed in the form of standardized T scores; scores above 65 are considered as significantly elevated (30).

The MMPI-2 profiles of the amalgam patients and the controls were visually compared with MMPI-2 profiles of temporomandibular joint (TMJ) dysfunction patients (31), chronic pain patients (32), and tension headache patients (33).

Informed consent was obtained from patients and controls, and the study was conducted according to 'Ethical principles for Nordic psychologists'.

Statistics

Comparisons between data from amalgam patients and controls were performed using 2 sample *t* tests assuming unequal variances.

Results

Demographic data

There were no significant differences between amalgam patients and controls concerning demographic variables (Table 1). When females and males were analyzed separately, no differences in demographic variables reached significance levels.

Personality variables

MMPI-2 data for females and males when analyzed as one group are presented in Fig. 1. Standard deviations for the MMPI-2 scale scores varied from 6.17 to 14.61. Significant differences were observed in the validation scale 'L' and in the following clinical scales: hypochondriasis, depression, hysteria, psychasthenia, and schizophrenia.

MMPI-2 data, when analyzed for females separately (Fig. 2), revealed significant differences in the following clinical scales: hypochondriasis, depression, hysteria, psychasthenia, and schizophrenia.

When MMPI-2 data were analyzed for males separately (Fig. 3), significant differences were observed in the following clinical scales: hypochondriasis, hysteria, psychopathic deviate, psychasthenia, and schizophrenia.

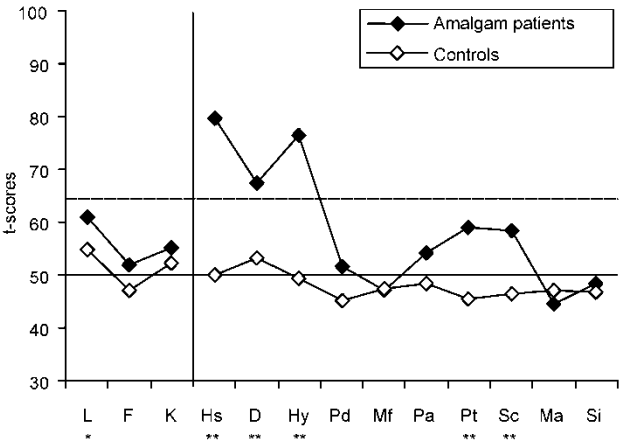

Fig. 1. Group mean MMPI-2 standard scale profiles for amalgam patients and controls. Females and males analyzed together. The dotted line represents T-score 65, i.e. significant elevation of the scale. The validity scales: L = Lie, F = fake, and K = correction. The clinical scales: HS = Hypochondriasis, D = Depression, Hy = Hysteria, Pd = Psychopathic Deviate, Mf = Masculinity-Femininity, Pa = Paranoia, Pt = Psychasthenia, Sc = Schizophrenia, Ma = Hypomania, and Si = Social Introversion. * $P < 0.05$, ** $P < 0.01$.

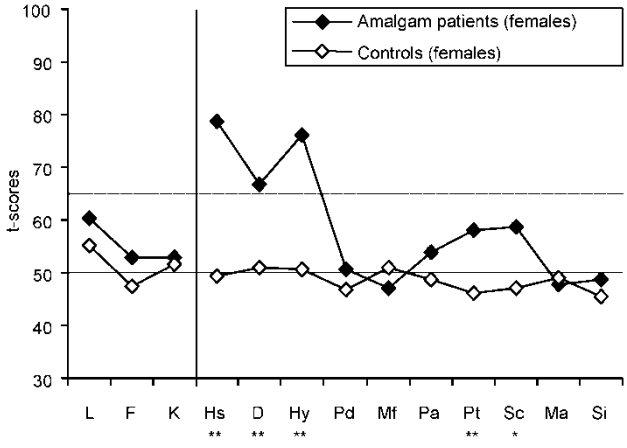

Fig. 2. Group mean MMPI-2 standard scale profiles for amalgam patients and controls. Data for the females are analyzed separately. See Fig. 1 for legend.

The MMPI-2 profiles of the amalgam patients and the controls have been visually compared with MMPI-2 profiles of temporomandibular joint (TMJ) dysfunction patients (31), chronic pain patients (32), and tension headache patients (33) in Fig. 4. The profiles of the amalgam patients are strikingly similar to those of the other patient groups, compared with the profile of the control group.

Discussion

The MMPI-2 is the most widely used of all paper-and-pencil personality tests. When using the MMPI-2 in the study of amalgam-related problems, the results can be compared with those of other patient groups.

A significant difference in validation scale 'L' was observed when comparing amalgam patients with controls. The L-scale reflects behaviors that, although socially desirable, are all rarely true of a given individual. According to Greene (29), an elevation of the L-scale at a moderate level indicates normal persons who are slightly more conforming than usual, or persons who have a tendency to resort to denial mechansims.

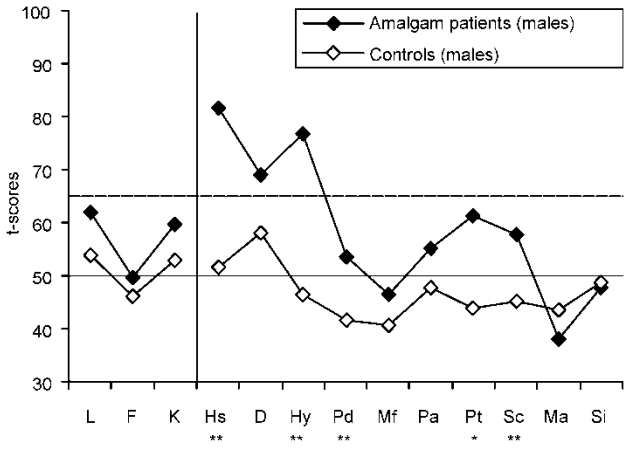

Fig. 3. Group mean MMPI-2 standard scale profiles for amalgam patients and controls. Data for the males are analyzed separately. See Fig. 1 for legend.

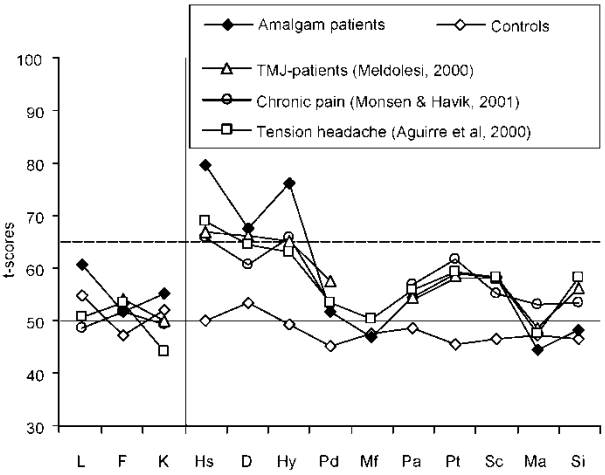

Fig. 4. Group mean MMPI-2 profiles of temporomandibular joint (TMJ) dysfunction patients, chronic pain patients, and tension headache patients compared with amalgam patients and controls. See Fig. 1 for legend.

Significant differences in personality profiles were also observed when comparing amalgam patients with controls.

The constellation of the scales hypochondriasis, depression and hysteria in the amalgam patients, as seen in the Figs 1–3, deserves further comment. This constellation, named 'the conversion V' or 'conversion valley', is widely described in most interpretive manuals for the MMPI and the MMPI-2 (28, 29, 34–36).

Amalgam patients are frequently in the problematic situation where they have sought a wide range of medical and dental expertise, usually without a positive outcome. Taking into consideration the personality profile, as well as the potential effect of a long-lasting ill being which could influence the personality, dentists should avoid irreversible physical procedures (e.g. tooth extraction at the patient's request) if clear objective indications do not exist. This aspect has been discussed in studies in other patient groups (37).

It can be discussed whether persons in the two groups perceive symptoms differently. The subjective definition of an event in terms of a symptom may increase the consequences of the event as well as affect the behavior of the person involved. Persons with a strong tendency to explain common problems as symptoms of illness will probably seek medical diagnosis and treatment. Others with a low inclination to explain the same phenomena as illness may have a lesser tendency to adopt the patient role (38). Such differences in attribution styles can result in important differences in illness behavior.

Although groups with and without dental amalgam have not been compared in the present study, some data are available from other reports. In one study (38), the psychiatric scores for 25 women with amalgam fillings were compared with those of 23 women without amalgam fillings. Women with amalgam fillings had significantly higher scores on the Beck Depression Inventory, reported more symptoms of fatigue and insomnia, expressed anger without provocation and experienced more intense feelings of anger. Anxiety scores showed that the women with amalgam fillings were significantly less pleasant, satisfied, happy, secure, and steady, and had a more difficult time making decisions. They had significantly higher trait anxiety scores. The authors suggest that amalgam mercury may be an etiological factor in depression, excessive anger, and anxiety because mercury can produce such symptoms, perhaps by affecting neurotransmitters in the brain (38).

In one study (19), 50 consecutive patients referred for self-reported complaints, which they related to dental amalgam restorations, were compared with matched control patients. A psychiatric diagnosis was established in 70% of the patients with amalgam-related complaints versus 14% in the control group. The prevailing symptoms were anxiety, asthenia and depression. Mercury levels in blood, urine, and hair were similar in the 2 groups, and were below levels considered to cause mercury intoxication. There was no correlation between mercury levels and severity of the reported symptoms. As concluded by the authors, mercury was not a likely cause of the complaints. Instead, the reported symptoms were part of a broad spectrum of mental disorders.

The effect of acute, extreme exposure to mercury from paint has been studied by Haut et al. (39). In the exposed group, blood levels of Hg in blood were about 8 times higher than in the control group. Numerous differences were obtained between the groups on the MMPI. The profile from the exposed group suggests depression with a focus on physical symptoms. Our study, on the other hand, demonstrates that significantly different personality traits may be observed in amalgam patients and controls, despite similar amalgam levels.

The amalgam patients included in the present study had several complaints. It could be argued whether persons on long-term sick leave should be excluded or not from study. Our rationale for excluding them was the fact that long-term sick-leave periods often decrease the patient's general activity level, generating secondary problems (40). By excluding these persons, secondary problems caused by long-term sick-leave periods per se are reduced. However, patients with possible severe amalgam-related illness may have been excluded from the study. It must be discussed whether the differences observed in personality factors are secondary to illness-related factors. When comparing amalgam patients with patients with long-lasting symptoms, some striking similarities in personality profiles can be observed. As shown in Fig. 4, the personality profiles of TMJ-dysfunction patients (31), chronic pain patients (32), and tension headache patients (33) all have the same pattern. The personality profiles might therefore reflect the consequences of living with chronic, diffuse symptoms, i.e. the subjective experience of having an illness. This interpretation of the psychological impact of the conversion-V is in accordance with Vendrig's (41) interpretation concerning MMPI profiles in chronic pain patients.

The differences observed between amalgam patients and controls cannot be attributed to differences in demographic variables or differences in amalgam points. Amalgam-related problems are at times referred to as female problems. When gender differences were compared across patient and control groups, no significant differences in MMPI-2 profiles were observed.

Significant differences between amalgam patients and controls were observed in several personality variables as measured by the MMPI-2. The differences observed seem crucial in the symptomatology of amalgam patients. Personality characteristics must be taken into account if extensive and irreversible treatment procedures are considered, indicating the existence of psychological problems comorbid with somatic problems (41).

In order to provide adequate diagnosis, treatment, and care-taking, a multidisciplinary approach to general complaints associated with dental restoration problems is recommended. The MMPI-2 should be regarded as a valuable tool in this multidisciplinary approach.

References

1. World Health Organization. Environmental Health Criteria 118. Inorganic mercury. Geneva: WHO; 1991.
2. Socialstyrelsen. Blir man sjuk av amalgam? Stockholm: Socialstyrelsen; 1994.
3. Eley BM, Cox SW. The release, absorption and possible health effects of mercury from dental amalgam: a review of recent findings. Br Dent J 1993;175:355–62.
4. Lorscheider FL, Vimy MJ, Summers AO. Mercury exposure from 'silver' tooth fillings: emerging evidence questions a traditional dental paradigm. FASEB J 1995;9:504–8.
5. Health Canada. The Safety of Dental Amalgam. Canada; 1996 Report No.: Cat. H49–105/1996E.
6. Thomson WM, Stewart JF, Carter KD, Spencer AJ. The Australian public's perception of mercury risk from dental restorations. Community Dent Oral Epidemiol 1997;25:391–5.
7. Lindh U, Hudecek R, Danersund A, Eriksson S, Lindvall A. Removal of dental amalgam and other metal alloys supported by antioxidant therapy alleviates symptoms and improves quality of life in patients with amalgam-associated ill health. Neuroendocrinol Lett 2002;23:459–82.
8. Melchart D, Wühr E, Weidenhammer W, Kremers L. A multicenter survey of amalgam fillings and subjective complaints in non-selected patients in the dental practice. Eur J Oral Sci 1998; 106:770–7.
9. Lichtenberg H. Mercury vapor in the oral cavity in relation to number of amalgam surfaces and the classic symptoms of chronic mercury poisoning. J Orthomol Med 1996;11:87–94.
10. Hanson M, Pleva J. The dental amalgam issue. A review. Experientia 1991;47:9–22.
11. Björkman L, Pedersen NL, Lichtenstein P. Physical and mental health related to dental amalgam fillings in Swedish twins. Community Dent Oral Epidemiol 1996;24:260–7.
12. Bågedahl-Strindlund M, Ilie M, Furhoff AK, Tomson Y, Larsson KS, Sandborgh-Englund G, et al. A multidisciplinary clinical

study of patients suffering from illness associated with mercury release from dental restorations: psychiatric aspects. Acta Psychiatr Scand 1997;96:475–82.
13. Furhoff AK, Tomson Y, Ilie M, Bågedahl-Strindlund M, Larsson KS, Sandborgh-Englund G, et al. A multidisciplinary clinical study of patients suffering from illness associated with release of mercury from dental restorations. Medical and odontological aspects. Scand J Prim Health Care 1998;16:247–52.
14. International Organization for Standardization. ISO 1559: Dental Materials—Alloys for dental amalgam. Geneva: ISO; 1995.
15. Herrström P, Högstedt B. Clinical study of oral galvanism: no evidence of toxic mercury exposure but anxiety disorder an important background. Scand J Dent Res 1993;101:232–7.
16. Malt UF, Nerdrum P, Oppedal B, Gundersen R, Holte M, Løne J. Physical and mental problems attributed to dental amalgam fillings. Psychosom Med 1997;59:32–41.
17. Gottwald B, Kupfer J, Traenckner I, Ganss C, Gieler U. Psychological, allergic, and toxicological aspects of patients with amalgam-related complaints. Psychother Psychosom 2002; 71: 223–32.
18. Hansen DJ, Hørsted-Bindslev P, Tarp U. [Dental amalgam: a toxicological evaluation]. Ugeskr Laeger 1993;155:2990–4.
19. Bratel J, Haraldson T, Ottoson J-O. Potential side effects of dental amalgam restorations. (II). No relation between mercury levels in the body and mental disorders. Eur J Oral Sci 1997;105: 244–50.
20. Ahlqwist M, Bengtsson C, Furunes B, Hollender L, Lapidus L. Number of amalgam tooth fillings in relation to subjectively experienced symptoms in a study of Swedish women. Community Dent Oral Epidemiol 1988;16:227–31.
21. Department of Health and Human Services. Dental Amalgam. Washington: Department of Health and Human Services; 1993, January.
22. Barregård L, Ellingsen DD, Alexander J, Thomassen Y, Aaseth J. [Mercury exposure from dental amalgam. Risk evaluation and clinical evaluation]. Tidsskr Nor Laegeforen 1998;118:58–62.
23. Lygre G, Grønningsæter A, Gjerdet N. [Mercury and dental amalgam fillings]. Tidsskr Nor Laegeforen 1998;118:1698–701.
24. Echeverria D, Heyer NJ, Martin MD, Naleway CA, Woods JS, Bittner AC. Behavioral effects of low-level exposure to Hg-0 among dentists. Neurotoxicol Teratol 1995;17:161–8.
25. Echeverria D, Aposhian HV, Woods JS, Heyer NJ, Aposhian MM, Bittner AC, et al. Neurobehavioral effects from exposure to dental amalgam Hg: new distinctions between recent exposure and Hg body burden. FASEB J 1998;12:971–80.
26. Vamnes JS, Lygre GB, Grønningsæter A, Gjerdet NR. Four years of clinical experience with an adverse reaction unit for dental biomaterials. Community Dent Oral Epidemiol 2003. In press.
27. Olstad ML, Holland RI, Wandel N, Hensten-Pettersen A. Correlation between amalgam restorations and mercury concentration in urine. J Dent Res 1987;66:1179–82.
28. Graham JR. MMPI-2: Assessing personality and psychopathology. New York: Oxford University Press; 1990.
29. Greene RL. The MMPI-2/MMPI: an interpretive manual. Boston: Allyn and Bacon; 1991.
30. Keller LS, Butcher JN. Assessment of chronic pain patients with the MMPI-2. Minneapolis, MN: University of Minnesota Press; 1991.
31. Meldolesi G, Picardi A, Accivile E, Toraldo di Francia R, Biondi M. Personality and psychopathology in patients with temporomandibular joint pain-dysfunction syndrome. A controlled investigation. Psychother Psychosom 2000;69:322–8.
32. Monsen K, Havik OE. Psychological functioning and bodily conditions in patients with pain disorder associated with psychological factors. Br J Med Psychol 2001;74Part 2183–95.
33. Aguirre J, Gallardo R, Pareja JA, Perez-Miranda M. Cluster of MMPI personality profiles in chronic tension-type headache and predictable response to Fluoxetine. Cephalalgia 2000;20:51–6.
34. Gilberstadt H, Duker J. A handbook for clinical and actuarial MMPI interpretation. Philadelphia: Saunders; 1965.
35. Webb J, McNamara K. Configural interpretation of the MMPI. In: Newmark CS, editor. MMPI clinical and research trends. New York: Praeger; 1979. p. 1–52.
36. Meyer RG, Deitsch SE. The clinician's handbook. 4th ed. Boston: Allyn & Bacon; 1983.
37. Riley JL, Robinson ME, Geisser ME, Wittmer VT, Smith AG. Relationship between MMPI-2 cluster profiles and surgical outcome in low-back pain patients. J Spinal Disord 1995;8:213–9.
38. Siblerud RL, Motl J, Kienholz E. Psychometric evidence that mercury from silver dental fillings may be an etiological factor in depression, excessive anger, and anxiety. Psychol Rep 1994;74: 67–80.
39. Haut MW, Morrow LA, Pool D, Callahan TS, Haut JS, Franzen MD. Neurobehavioral effects of acute exposure to inorganic mercury vapor. Appl Neuropsychol 1999;6:193–200.
40. Marhold C, Linton SJ, Melin L. A cognitive-behavioral return-to-work program: effects on pain patients with a history of long-term versus short-term sick leave. Pain 2001;91:155–63.
41. Vendrig AA. The Minnesota Multiphasic Personality Inventory and chronic pain: a conceptual analysis of a long-standing but complicated relationship. Clin Psychol Rev 2000;20:533–59.

Received for publication 15 May 2003
Accepted 25 September 2003