27. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br. J. Psychiatry* 1987; **150**: 782–786.
28. Okano T, Masuji F, Murata M *et al.* Validation and reliability of Japanese version of the EPDS. *Arch. Psychiatr. Diagn. Clin. Eval.* 1996; **7**: 525–533.
29. Figueiredo B, Costa R. Mother's stress, mood and emotional involvement with the infant: 3 months before and 3 months after childbirth. *Arch. Womens Ment. Health* 2009; **12**: 143–153.
30. Condon JT, Corkindale C. The correlates of antenatal attachment in pregnant women. *Br. J. Med. Psychol.* 1997; **70** (Pt 4): 359–372.
31. Murray L, Hipwell A, Hooper R, Stein A, Cooper P. The cognitive development of 5-year-old children of postnatally depressed mothers. *J. Child Psychol. Psychiatry* 1996; **37**: 927–935.
32. Murray L, Kempton C, Woolgar M, Hooper R. Depressed mothers' speech to their infants and its relation to infant gender and cognitive development. *J. Child Psychol. Psychiatry* 1993; **34**: 1083–1101.
33. Righetti-Veltema M, Conne-Perreard E, Bousquet A, Manzano J. Postpartum depression and mother-infant relationship at 3 months old. *J. Affect. Disord.* 2002; **70**: 291–306.
34. Hirano S, Sato T, Narita T *et al.* Evaluating the state dependency of the Temperament and Character Inventory dimensions in patients with major depression: A methodological contribution. *J. Affect. Disord.* 2002; **69**: 31–38.
35. Da Costa D, Larouche J, Dritsa M, Brender W. Variations in stress levels over the course of pregnancy: Factors associated with elevated hassles, state anxiety and pregnancy-specific stress. *J. Psychosom. Res.* 1999; **47**: 609–621.
36. Smith R, Thomson M. Neuroendocrinology of the hypothalamo-pituitary-adrenal axis in pregnancy and the puerperium. *Baillieres Clin. Endocrinol. Metab.* 1991; **5**: 167–186.
37. Su KP, Chiu TH, Huang CL *et al.* Different cutoff points for different trimesters? The use of Edinburgh Postnatal Depression Scale and Beck Depression Inventory to screen for depression in pregnant Taiwanese women. *Gen. Hosp. Psychiatry* 2007; **29**: 436–441.

PLOS ONE

Factor Structure of the Japanese Version of the Edinburgh Postnatal Depression Scale in the Postpartum Period

Chika Kubota[1], Takashi Okada[1]*, Branko Aleksic[1], Yukako Nakamura[1], Shohko Kunimoto[1], Mako Morikawa[1], Tomoko Shiino[1], Ai Tamaji[1], Harue Ohoka[2], Naomi Banno[1], Tokiko Morita[3], Satomi Murase[4], Setsuko Goto[5], Atsuko Kanai[6], Tomoko Masuda[7], Masahiko Ando[8], Norio Ozaki[1]

1 Department of Psychiatry, Nagoya University Graduate School of Medicine, Nagoya, Aichi, Japan, **2** Nihon Fukushi University Chuo College of Social Services, Nagoya, Aichi, Japan, **3** Meijo University Graduate School of Pharmaceutical Sciences, Nagoya, Aichi, Japan, **4** Liaison Medical Marunouchi, Nagoya, Aichi, Japan, **5** Nagoya University Graduate School of Medicine, Nagoya, Aichi, Japan, **6** Graduate School of Education and Human Development, Nagoya University, Nagoya, Aichi, Japan, **7** Graduate School of Law, Nagoya University, Nagoya, Aichi, Japan, **8** Center for Advanced Medicine and Clinical Research, Nagoya University Graduate School of Medicine, Nagoya, Aichi, Japan

Abstract

Background: The Edinburgh Postnatal Depression Scale (EPDS) is a widely used screening tool for postpartum depression (PPD). Although the reliability and validity of EPDS in Japanese has been confirmed and the prevalence of PPD is found to be about the same as Western countries, the factor structure of the Japanese version of EPDS has not been elucidated yet.

Methods: 690 Japanese mothers completed all items of the EPDS at 1 month postpartum. We divided them randomly into two sample sets. The first sample set (n = 345) was used for exploratory factor analysis, and the second sample set was used (n = 345) for confirmatory factor analysis.

Results: The result of exploratory factor analysis indicated a three-factor model consisting of anxiety, depression and anhedonia. The results of confirmatory factor analysis suggested that the anxiety and anhedonia factors existed for EPDS in a sample of Japanese women at 1 month postpartum. The depression factor varies by the models of acceptable fit.

Conclusions: We examined EPDS scores. As a result, "anxiety" and "anhedonia" exist for EPDS among postpartum women in Japan as already reported in Western countries. Cross-cultural research is needed for future research.

Citation: Kubota C, Okada T, Aleksic B, Nakamura Y, Kunimoto S, et al. (2014) Factor Structure of the Japanese Version of the Edinburgh Postnatal Depression Scale in the Postpartum Period. PLoS ONE 9(8): e103941. doi:10.1371/journal.pone.0103941

Editor: James Coyne, University of Pennsylvania, United States of America

Received December 11, 2013; **Accepted** July 7, 2014; **Published** August 4, 2014

Funding: Funding for this study was provided by research grants from the Ministry of Education, Culture, Sports, Science and Technology of Japan; the Ministry of Health, Labor and Welfare of Japan; The Academic Frontier Project for Private Universities, Comparative Cognitive Science Institutes, Meijo University; the Core Research for Evolutional Science and Technology; Intramural Research Grant (21B-2) for Neurological and Psychiatric Disorders of NCNP; and the Specific Research Fund 2012 for East Japan Great Earthquake Revival by The New Technology Development Foundation. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: Branko Aleksic and Norio Ozaki are PLOS ONE Editorial Board members. This does not alter the authors' adherence to PLOS ONE Editorial policies and criteria.

* Email: okada@med.nagoya-u.ac.jp

Introduction

Postpartum depression (PPD) is a type of major depressive disorder after childbirth and is distinguished from maternity blues in terms of onset, severity and duration of symptoms. The prevalence of PPD is estimated at approximately 13% from meta-analysis [1,2]. Our study shows 10.4% of women in Japan experienced depressive symptomatology assessed by the Edinburgh Postnatal Depression Scale (EPDS) [3]. PPD is a major mental health problem in women with children [4]. First, PPD reduces maternal mental health and quality of life. 5–14% of perinatal and postnatal women have thoughts of self-harm, and suicides account for up to 20% of postpartum deaths [5]. Second, PPD has a negative influence on child health and development [6,7] because it interferes with the mother's ability to care for a baby and handle other daily tasks. Third, the mother-child relationship often worsens because of PPD [8]. Severe depression is also reported to be associated with child abuse [9].

Early detection and intervention are essential for maternal and child health. EPDS, a 10-item self-administered questionnaire for early detection of PPD [10], has been the most widely used screening tool for PPD across countries and cultures. In recent studies, the factor structure of the original English version of EPDS has been reported as shown in Table 1 [11–18]. These results suggest that anxiety symptoms account for a significant part of PPD symptoms, unlike typical major depressive disorders. There are only a few studies about the factor structure of EPDS outside Western countries, but these studies show similar results: that EPDS was found to contain at least two factors, a depressive factor

Table 1. Factor structure of the English version of the EPDS.

First author, Publishied year	Period	Country	N	Method	Rotation	Factor structure		
						Factor 1	Factor 2	Factor 3
Tuohy & McVey,2008	Postpartum 6.47 months	U.K.	440	EEA	Oblimin	Non-specific depressive symptoms:7, 8, 9, 10	Anhedonia:1, 2	Anxiety symptoms:3, 4, 5
King, 2012	Postpartum 1 week-12 months	U.S.A.	169	CFA	None	Non-specific depressive symptoms:7, 8, 9, 10	Anhedonia:1, 2	Anxiety symptoms:3, 4, 5
Astbury, 1994	Postpartum 8–9 months	Australia	790	PCA	Oblimin	Depression:1, 2, 6, 7, 8, 9, 10	Anxiety:3, 4, 5	-
Matthey, 2008	Postpartum 6 weeks	Australia	238	PCA	Varimax	Depression:1, 2, 6, 7, 8, 9, 10	Anxiety:3, 4, 5	-
Phillips, 2009	Postpartum 0–12 months	Australia	309	EEA/CFA	Oblimin	Depression:1, 2, 6, 7, 8, 9, 10	Anxiety:3, 4, 5	-
Ross, 2003	Pregnant 36 weeks/Postpartum 6 and 16 weeks	Canada	150	PCA	Varimax	Depression:1, 2, 8, 9	Anxiety:3, 4, 5	Suicide 10
Jomeen, 2005	Postpartum 13.6 weeks	U.K.	101	EEA/CFA	Oblimin	Depression:1, 2, 6, 7, 8, 9	Anxiety:3, 4, 5	Suicide 10
Swalm, 2010	Postpartum 26 weeks	Australia	4706	PCA	Varimax	Anhedonia:1, 2	Anxiety:3, 4, 5	-

(EEA: exploratory factor analysis, CFA: confirmatory factor analysis, PCA: principal component analysis).
doi:10.1371/journal.pone.0103941.t001

and an anxiety factor in Brazil [19], China [19], and the Netherlands [19].

The pathology of PPD has been thought to be caused by biological and psychosocial changes with pregnancy and childbirth. There is no direct evidence that PPD has a common pathology across different populations, ethnicities and cultures; however, the commonality of the prevalence of PPD [20] supports this idea. If a common pathophysiology can be proven and this hypothesis supported, it will become a significant step towards understanding the common pathology of PPD. Because the cross-cultural consistency of the factor structure of EPDS, however, has yet not been examined, particularly outside Western countries, more research is needed to answer the question.

In Japan, the reliability and validity of EPDS in Japanese has been confirmed and the prevalence of PPD is found to be comparable to the Western countries, but the factor structure of the Japanese version of EPDS has not been elucidated. Therefore, we examined the symptomatological structure of PPD measured with the Japanese version of EPDS to compare with the structure of the original English version of EPDS already reported in Western countries.

Methods

Participants

Participants were recruited between August 2004 and October 2012. Every participant was an outpatient in a maternity ward at one of three obstetrics and gynecology hospitals in Nagoya, Japan. The three obstetrics hospitals were a general hospital (Nagoya Teishin Hospital), an obstetrics and gynecology hospital (Kaseki Hospital), and a university hospital (Nagoya University Hospital).

The eligibility criteria were as follows:

(1) attending at one of the three hospitals consecutively
(2) 20 years of age or older
(3) ability to understand the questionnaire written in Japanese.

Procedure

We explained our research design and methods to pregnant women at maternity programs or outpatient care. In these three hospitals, every outpatient equally receives an orientation for birth hospitalization during the second trimester at outpatient care or maternity program. We matched the timing of the invitation with the timing of the orientation during the second trimester which every patient participates. At the same time, participants received a set of agreement documents and questionnaires. Each woman was asked to participate in the study voluntarily and to answer all of the questions according to the predefined schedule. If she agreed to participate in the study, she was requested to return the two sealed envelopes that contained the anonymous questionnaire and the signed agreement separately. This was to guarantee privacy. We considered a voluntarily returned envelope consent to participate in this research.

Measurements

We assessed depressive symptoms in participants as well as their social background (i.e. years of schooling, demographic parameters). Depressive symptoms were evaluated by EPDS at about 1 month after childbirth.

EPDS is a 10-item self-report screening tool for postnatal depression. Each item is scored on a 4-point scale ranging from 0 to 3. Total scores can range from 0 to 30. The English version of

EPDS has good internal consistency (Cronbach's alpha = 0.87) and reliability (split half reliability = 0.88) [10].

EPDS was translated into Japanese by Okano et al. in 1996 and confirmed that the retranslated English version was the equivalent to the original English version [21]. The validity and reliability of this Japanese version of EPDS were also examined against 115 non-pregnant women and 47 women at 1 month postpartum by Okano et al [21]. It had good internal consistency (Cronbach's alpha = 0.78) and test–retest reliability (Spearman correlation = 0.92) [21]. The validity was examined against a diagnosis of major depressive disorder from the semi-structured interview-based Research Diagnostic Criteria (RDC) [22] as external criteria. The total score of the women who have postpartum depression (N = 4) was higher than that of the non-depressive postpartum women (N = 43) [21] and the cut-off point of ≥9 showed good sensitivity (75%) and specificity (93%) [21].

This is the standardized Japanese version and no other Japanese version of EPDS is used in Japan. In this study, we used this Japanese version of EPDS and the cut-off point of ≥9 in accordance with the previous study [21].

Data analysis

We randomly divided all participants who completed all items of EPDS into two sample sets. The first sample set was used for exploratory factor analysis, and the second sample set for confirmatory factor analysis.

Exploratory Factor Analysis (EFA)

The number of factors was determined by scree plot. An EFA with maximum-likelihood extraction was undertaken on the full 10-item EPDS. Oblique rotation using the promax rotation was performed due to an expectation that factors would be correlated.

Confirmatory Factor Analysis (CFA)

We chose the model identified in EFA and the models reported in the original English version of EPDS as follows:

(1) Tuohy & McVey/King; three-factor [11,15]
(2) Astbury et al. /Matthey/Phillips et al.; two-factor [13,16,17]
(3) Ross et al.; three-factor [14]
(4) Jomeen et al.; three-factor [12]
(5) Swalm et al.; two-factor [18]
(6) Model identified in the EFA; three-factor

As recommended for structural equation modeling applications [23,24], we used the goodness-of-fit index (GFI) [25], adjusted goodness-of-fit index (AGFI) [23], comparative fit index (CFI) [26], and root mean square error of approximation (RMSEA) [27]. A good fit is defined as a GFI greater than 0.95, an AGFI greater than 0.90, a CFI greater than 0.97 and an RMSEA less than 0.05. An acceptable fit is defined as a GFI greater than 0.90, an AGFI greater than 0.85, a CFI greater than 0.95 and an RMSEA less than 0.08 [25] [23] [26] [27]. Data were analyzed using SPSS version 20.0 and Amos 19.0 (IBM Japan, Tokyo, Japan).

Results

Characteristics of participants

812 participants agreed to participate in this study. The mean age of the participants was 32.1 years (range: 20 to 45 years, Standard Deviation (S.D.) 4.5 years, interquartile range (IQR) 29–35). Average years of schooling were 14.4 years (range: 9 to 18 years, S.D. = 1.6 years, IQR 14–16). In terms of parity, 67.0% of participants were nulliparous, 24.4% of participants were primiparous, 7.9% of participants had given birth two times, and 0.6% of participants had given birth three times (range: 0 to 3 children, S.D. = 0.7, IQR 0–1). 690 out of the 812 women completed all items of EPDS. The non-response rate is 75 of 812 and the non-valid response rate is 51 of 812.

EPDS scores

The median postpartum EPDS score was 3 (range: 0–22, S.D. = 4.53, IQR 1–7). Approximately 18.4% of women scored 9–22 and were considered at high risk of postpartum depression. The median infant age was 31.7 days (range: 16–64, S.D. = 6.9 days, IQR 30–34).

Factor analysis

690 participants who completed all items of EPDS were divided randomly into two groups. The first sample set of 345 participants was used for EFA, and the second sample set of 345 participants was used for CFA.

EFA

The dataset was found suitable for factor analysis (the Kaiser-Meyer-Olkin index = 0.886). The Cronbach's alpha for the 10-item EPDS was 0.856, indicating the test has good instrument

Table 2. Factor analysis of the Japanese version Edinburgh Postnatal Depression Scale.

Items of the EPDS	Factor 1	Factor 2	Factor 3
1. I have been able to laugh and see the funny side of things.	−.034	1.055	−.075
2. I have looked forward with enjoyment to things.	.026	.599	.135
3. I have blamed myself unnecessarily when things went wrong.	.684	.067	.026
4. I have been anxious or worried for no good reason.	.755	.023	−.072
5. I have felt scared or panicky for not very good reason.	.803	−.078	−.044
6. Things have been getting on top of me.	.238	.140	.141
7. I have been so unhappy that I have had difficulty sleeping.	.011	.028	.741
8. I have felt sad or miserable.	.352	.065	.497
9. I have been so unhappy that I have been crying.	−.112	.000	.824
10. The thought of harming myself has occurred to me.	.255	−.086	.267

(N = 690, maximum-likelihood estimation, promax rotation).
doi:10.1371/journal.pone.0103941.t002

internal reliability. The scree test indicated a three-factor solution which accounted for 64.4% of the variance. The anhedonia, anxiety and depression factors appeared consistent with factors identified in our studies. A coefficient level of 0.45 or above was chosen to indicate significant item factor loading.

The first factor, which explained 43.4% of the total variance, included EPDS items 3, 4, 5 with factor loadings >0.45 (listed in Table 2). Items 3, 4 and 5 were found to have the highest factor loadings (all>0.65), consistent with previous findings that identified this factor as an "anxiety" subscale within EPDS. The second factor explained 12.1% of the total variance, and included items 1 and 2 with factor loadings>0.45. Items 1 and 2 had the highest factor loadings (>0.55), consistent with previous findings that identified this factor as an "anhedonia" subscale within EPDS. The third factor explained 8.8% of the total variance, and included items 7, 8 and 9 with factor loadings >0.45. Items 7 and 9 had the highest factor loadings (>0.7), consistent with previous findings that identified this factor as a "depression" subscale within EPDS.

CFA

The goodness-of-fit for the data represented by GFI, AGFI, CFI and RMSEA are shown in Table 3. In the models of Tuohy & McVey and King, GFI and AGFI showed good fit while CFI and RMSEA showed acceptable fit. In the models of Astbury et al. and Matthey and Phillips et al., GFI, AGFI, CFI and RMSEA showed unsatisfactory fit. In the model of Ross et al., GFI, AGFI, CFI and RMSEA showed unsatisfactory fit. In the model of Jomeen et al., GFI, AGFI, CFI and RMSEA showed unsatisfactory fit. In the model of Swalm et al., GFI, AGFI, CFI and RMSEA showed good fit. In the model identified in EFA, GFI and AGFI showed good fit. CFI and RMSEA showed acceptable fit. We therefore concluded that there were four acceptable models: those of Tuohy & McVey, King, Swalm et al., and as identified in EFA. We also concluded that the models of Astbury et al., Matthey and Phillips et al., Ross et al. and Jomeen et al. were unsatisfactory.

Correlations between factors in the models of an acceptable fit or a good fit were as follows. In the models of Tuohy & McVey and King, correlation between "anxiety" and "depression" was 0.84, correlation between "depression" and "anhedonia" was 0.64, and correlation between "anhedonia" and "anxiety" was 0.60. In the model of Swalm et al., correlation between "anhedonia" and "anxiety" was 0.60. In the model identified in EFA, correlation between "anxiety" and "depression" was 0.85, correlation between "depression" and "anhedonia" was 0.66, and correlation between "anhedonia" and "anxiety" was 0.60.

Discussion

This is the first study demonstrating the factor structure of the Japanese version of EPDS using a large sample of postpartum women. The model of EFA reported by Tuohy & McVey, King and Swalm et al., was consistent with our model in the present study of the Japanese version of EPDS. The model consists of common factors, an anxiety factor (items 3, 4 and 5) and an anhedonia factor (items 1 and 2). Thus, our findings suggest that factor structure of EPDS in Japan is basically the same as already reported in Western countries, although there was variance between studies on some items of EPDS.

No previous papers have reported the factor structure of the Japanese version of EPDS, however there are some studies about the symptoms of PPD in Japan. Tamaki et al. showed that women with PPD have strong anxiety symptoms by the State-Trait Anxiety Inventory Trait test [28]. Sato Y et al. revealed that the

Table 3. Goodness-of-fit of the models.

First author, Published year	Factor structure			Goodness-of-fit of the models			
	Factor 1	Factor 2	Factor 3	GFI	AGFI	CFI	RMSEA
1. Tuohy & McVey, 2008/King, 2012	Non-specific depressive symptoms:7, 8, 9, 10	Anhedonia:1, 2	Anxiety symptoms:3, 4, 5	0.965	0.934	0.958	0.065
2. Astbury, 1994/Matthey, 2008/Phillips, 2009	Depression:1, 2, 6, 7, 8, 9, 10	Anxiety:3, 4, 5	-	0.870	0.796	0.852	0.136
3. Ross, 2003	Depression:1, 2, 8, 9	Anxiety:3, 4, 5	Suicide:10	0.896	0.790	0.881	0.152
4. Jomeen, 2005	Depression:1, 2, 6, 7, 8, 9	Anxiety:3, 4, 5	Suicide:10	0.883	0.810	0.868	0.132
5. Swalm, 2010	Anhedonia:1, 2	Anxiety:3, 4, 5	-	0.992	0.970	0.995	0.05
6. Model identified in the EFA in this study	Anxiety:3, 4, 5	Anhedonia:1, 2	Depression:7, 8, 9	0.954	0.902	0.962	0.092

doi:10.1371/journal.pone.0103941.t003

prevalence of anxiety symptoms was higher than that of depressive symptoms after childbirth [29]. These results also suggest that anxiety symptoms are important to understand the symptomatic character of PPD in Japan.

In the other Asian countries, there are a few studies of the factor structure of EPDS. Small et al. analyzed the factor structure of EPDS in Vietnam, Turkey and Philippines [30].Small et al. pointed out that Item 6 loaded less consistently in the different countries, however they also suggest that EPDS have two or three factors which consists of anxiety and depression. Lau Y et al. showed that EPDS in China consists of the three factors as depression factor(items 6, 7, 8. 9 and 10), anxiety factor(items 3,4 and 5) and anhedonia factor(items 1 and 2) [31]. These results are very similar to the factor structure of EPDS in Japan by our study.

The depression factor

The depression factor varies across studies. Tuohy & McVey and King suggested items 7, 8, 9, and 10, Swalm suggested no depression factor, and the EFA in our study showed items 7, 8, and 9. Though the best fit was the model of Swalm et al., we proposed the EFA model because the model of Swalm excluded half of all EPDS items. Cross-cultural studies are needed to examine whether a common depression factor exists or not.

The anhedonia factor

All of the acceptable models show the anhedonia factor (items 1 and 2), which is reverse scoring. As reverse scoring items tend to be in the same cluster [32], we must take into account that reverse scoring items has been found to affect factor analysis.

The anxiety factor

The anxiety factor (items 3, 4 and 5) was shown in many countries, such as Brazil [33,34], China [31], and the Netherlands [19]. Considering the existence of a common anxiety factor across different countries and cultures, the importance of anxiety symptoms for PPD has been revealed. In fact, it is reported that about 10% of the women experiencing postpartum depression have anxiety symptoms [35].

The utility of the anxiety factor (items 3, 4 and 5) is discussed in some studies as follows. Some studies have suggested that items 3, 4 and 5 can measure anxiety disorder [18,36], and other studies suggested that items 3, 4 and 5 are enough for PPD screening [14] [37]. Although the utility of the anxiety factor (item 3, 4 and 5) varies by study, as mentioned before, there is some possibility of common utility of the anxiety factor around the world.

Correlation between factors

The correlations between "anxiety" and "depression" were found to be high in the models of acceptable fit to the data. These results suggested that there was a very close relationship between depression and anxiety, as previously reported [38,39], and showed that it was important to focus on anxiety symptoms in PPD screening and care.

Limitations

There are some types of study bias in this study. First, there is a self-selection bias. They participated in this study voluntarily. This also means that they pay more attention to their mental health. Second, there are losses to follow up. Women with depression are hard to reply the questionnaire. Third, there is a membership bias. We cannot affirm that a standard population in Japan is shown in these participants from three characteristic hospitals, a general hospital, an obstetrical and gynecological hospital, and a university hospital. The patients at the university hospital tended to have pregnancy complications, but these participants accounted for a small percentage of all participants (N = 42, 5.2%). Fourth, there is a non-response bias, however the non-response rate is 75 of 812 and the non-valid response rate is 51 of 812. We consider that these rates are not so high and the result is not affected.

Furthermore, there is a problem with this study design. We did not ask participants for their nationality, citizenship or ethnicity. However, Japan is considered to be highly homogenous in terms of population, therefore we consider this problem does not affect the result of the study.

Conclusions

We examined factor structure of the Japanese version of EPDS in a large sample size of postpartum women in Japan. As a result, "anxiety", "depression" and "anhedonia" factors exist for EPDS, as already reported in Western countries. Our findings suggest that the factor structure of EPDS is mostly common across countries and cultures.

Ethics Statement

This study protocol has been approved by the Ethics Committee of the Nagoya University Graduate School of Medicine.

Author Contributions

Conceived and designed the experiments: SM SG AK TM NO. Performed the experiments: CK YN SK MM TS AT HO NB TM. Analyzed the data: CK MA NO. Contributed reagents/materials/analysis tools: CK YN SK MM TS AT HO NB TM. Wrote the paper: CK TO BA YN SK MA NO.

References

1. O'hara MW, Swain AM (1996) Rates and risk of postpartum depression—a meta-analysis. International Review of Psychiatry 8: 37–54.
2. Beck CT (2001) Predictors of postpartum depression: an update. Nurs Res 50: 275–285.
3. Ishikawa N, Goto S, Murase S, Kanai A, Masuda T, et al. (2011) Prospective study of maternal depressive symptomatology among Japanese women. J Psychosom Res 71: 264–269.
4. Weissman MM, Jensen P (2002) What research suggests for depressed women with children. J Clin Psychiatry 63: 641–647.
5. Lindahl V, Pearson JL, Colpe L (2005) Prevalence of suicidality during pregnancy and the postpartum. Arch Womens Ment Health 8: 77–87.
6. Beck CT (1998) The effects of postpartum depression on child development: a meta-analysis. Arch Psychiatr Nurs 12: 12–20.
7. Luoma I, Tamminen T, Kaukonen P, Laippala P, Puura K, et al. (2001) Longitudinal study of maternal depressive symptoms and child well-being. J Am Acad Child Adolesc Psychiatry 40: 1367–1374.
8. Murray L, Fiori-Cowley A, Hooper R, Cooper P (1996) The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. Child Dev 67: 2512–2526.
9. Buist A (1998) Childhood abuse, postpartum depression and parenting difficulties: a literature review of associations. Aust N Z J Psychiatry 32: 370–378.
10. Cox JL, Holden JM, Sagovsky R (1987) Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. Br J Psychiatry 150: 782–786.
11. Tuohy A, McVey C (2008) Subscales measuring symptoms of non-specific depression, anhedonia, and anxiety in the Edinburgh Postnatal Depression Scale. Br J Clin Psychol 47: 153–169.
12. Jomeen J, Martin CR (2007) Replicability and stability of the multidimensional model of the Edinburgh Postnatal Depression Scale in late pregnancy. J Psychiatr Ment Health Nurs 14: 319–324.
13. Phillips J, Charles M, Sharpe L, Matthey S (2009) Validation of the subscales of the Edinburgh Postnatal Depression Scale in a sample of women with unsettled infants. J Affect Disord 118: 101–112.
14. Ross LE, Gilbert Evans SE, Sellers EM, Romach MK (2003) Measurement issues in postpartum depression part 1: anxiety as a feature of postpartum depression. Arch Womens Ment Health 6: 51–57.

15. King PA (2012) Replicability of structural models of the Edinburgh Postnatal Depression Scale (EPDS) in a community sample of postpartum African American women with low socioeconomic status. Arch Womens Ment Health 15: 77–86.
16. Astbury J, Brown S, Lumley J, Small R (1994) Birth events, birth experiences and social differences in postnatal depression. Aust J Public Health 18: 176–184.
17. Matthey S (2008) Using the Edinburgh Postnatal Depression Scale to screen for anxiety disorders. Depress Anxiety 25: 926–931.
18. Swalm D, Brooks J, Doherty D, Nathan E, Jacques A (2010) Using the Edinburgh postnatal depression scale to screen for perinatal anxiety. Arch Womens Ment Health 13: 515–522.
19. Pop VJ, Komproe IH, van Son MJ (1992) Characteristics of the Edinburgh Post Natal Depression Scale in The Netherlands. J Affect Disord 26: 105–110.
20. Oates MR, Cox JL, Neema S, Asten P, Glangeaud-Freudenthal N, et al. (2004) Postnatal depression across countries and cultures: a qualitative study. Br J Psychiatry Suppl 46: s10–16.
21. Okano T MM, Masuji F, Tamaki R, Nomura J, Miyaoko H (1996) Validation and reliability of Japanese version of the EPDS. Arch Psychiatr Diag Clin Evaluat 7: 525–533.
22. Spitzer RL, Endicott J, Robins E (1978) Research diagnostic criteria: Rationale and reliability. Archives of General Psychiatry 35: 773–782.
23. Kelloway EK (1998) Using LISREL for structural equation modeling: A researcher's guide: Sage Publications, Incorporated.
24. Bollen KA, Long JS (1993) Testing structural equation models: Sage Publications, Incorporated.
25. Jöreskog KG, Sörbom D (1993) LISREL 8 user's guide. Chicago: Scientific Software International.
26. Bentler PM (1990) Comparative fit indexes in structural models. Psychol Bull 107: 238–246.
27. Browne MW, Cudeck R, Bollen KA, Long JS (1993) Alternative ways of assessing model fit. Sage Focus Editions 154: 136–136.
28. Tamaki R, Murata M, Okano T (1997) Risk factors for postpartum depression in Japan. Psychiatry and Clinical Neurosciences 51: 93–98.
29. Sato Y, Kato T, Kakee N (2008) A six-month follow-up study of maternal anxiety and depressive symptoms among Japanese. J Epidemiol 18: 84–87.
30. Small R, Lumley J, Yelland J, Brown S (2007) The performance of the Edinburgh Postnatal Depression Scale in English speaking and non-English speaking populations in Australia. Soc Psychiatry Psychiatr Epidemiol 42: 70–78.
31. Lau Y, Wang Y, Yin L, Chan KS, Guo X (2010) Validation of the Mainland Chinese version of the Edinburgh Postnatal Depression Scale in Chengdu mothers. Int J Nurs Stud 47: 1139–1151.
32. Carlson M, Wilcox R, Chou CP, Chang M, Yang F, et al. (2011) Psychometric properties of reverse-scored items on the CES-D in a sample of ethnically diverse older adults. Psychol Assess 23: 558–562.
33. Lobato G, Moraes CL, Dias AS, Reichenheim ME (2011) Postpartum depression according to time frames and sub-groups: a survey in primary health care settings in Rio de Janeiro, Brazil. Arch Womens Ment Health 14: 187–193.
34. Brouwers EP, van Baar AL, Pop VJ (2001) Does the Edinburgh Postnatal Depression Scale measure anxiety? J Psychosom Res 51: 659–663.
35. Yelland J, Sutherland G, Brown SJ (2010) Postpartum anxiety, depression and social health: findings from a population-based survey of Australian women. BMC Public Health 10: 771.
36. Matthey S, Fisher J, Rowe H (2012) Using the Edinburgh postnatal depression scale to screen for anxiety disorders: Conceptual and methodological considerations. J Affect Disord.
37. Kabir K, Sheeder J, Kelly LS (2008) Identifying postpartum depression: are 3 questions as good as 10? Pediatrics 122: e696–702.
38. Lydiard RB, Brawman-Mintzer O (1998) Anxious depression. J Clin Psychiatry 59 Suppl 18: 10–17.
39. Stavrakaki C, Vargo B (1986) The relationship of anxiety and depression: a review of the literature. Br J Psychiatry 149: 7–16.

JJCO Japanese Journal of Clinical Oncology

Jpn J Clin Oncol 2014;44(4)311–317
doi:10.1093/jjco/hyu002
Advance Access Publication 5 February 2014

Preoperative Level of Depression is a Predictor of Postoperative Levels of Depression in Patients with Head and Neck Cancer

Yasunori Adachi[1,2], Hiroyuki Kimura[1,*], Naohiro Sato[1], Wataru Nagashima[1,3], Kouki Nakamura[4], Branko Aleksic[1], Keizo Yoshida[5], Yasushi Fujimoto[6], Tsutomu Nakashima[6] and Norio Ozaki[1]

[1]Department of Psychiatry, Graduate School of Medicine, Nagoya University, Nagoya, [2]Department of Psychiatry, Minami Toyota Hospital, Toyota, [3]Department of Psychiatry, Kasugai Municipal Hospital, Kasugai, [4]Department of Psychiatry, Kariya Toyota General Hospital, Kariya, [5]Health Care Promotion Division, DENSO Corporation, Kariya and [6]Department of Otorhinolaryngology, Graduate School of Medicine, Nagoya University, Nagoya, Japan

*For reprints and all correspondence: Hiroyuki Kimura, Department of Psychiatry, Graduate School of Medicine, Nagoya University, 65 Tsurumai-cho, Showa-ku, Nagoya 466-8560, Japan. E-mail: kimurahi@med.nagoya-u.ac.jp

Received September 4, 2013; accepted January 1, 2014

Objective: Emotional distress is considered to be higher in patients with head and neck cancer than other types of cancer. The present study aimed to identify predictors of the postoperative levels of depression in patients with head and neck cancer who have undergone surgery.
Methods: Postoperative levels of depression were assessed at 3, 6 and 12 months after surgery. The preoperative factors that were significant predictors of the postoperative level of depression at each time point were extracted using multiple regression analyses.
Results: The preoperative level of depression was a significant predictor of the postoperative level of depression at the 3rd, 6th and 12th postoperative months. At the sixth postoperative month, negative adjustment to cancer at baseline was also a significant predictor of the postoperative level of depression.
Conclusion: Evaluating the level of depression and negative adjustment before surgery is considered to be effective for identifying patients who will develop depression after surgery.

Key words: depression – esthetics – head and neck neoplasms – psychological adaptation – reconstructive surgical procedures

INTRODUCTION

Head and neck cancer (HNC) is considered to be one of the most traumatic types of cancer. The prevalence of major depression is estimated to be 15–50% and the suicide rate has shown to be particularly high (1–3). Researchers have focused on a trajectory of psychological distress, including depressive symptoms, among cancer patients. Prior research has demonstrated increased levels of distress in cancer patients after diagnosis, during active treatment and until ~4 years after treatment (4–8). Depressive symptoms are also present in HNC patients throughout the course of the cancer trajectory: prior to diagnosis, at diagnosis, during treatment and after treatment (9). Furthermore, depression rates were particularly high at the time the diagnosis is made, during treatment and at follow-up. Posttreatment depression is considered to be common among HNC patients.

Depression has a negative effect on various aspects of people's life. It is a leading cause of premature death and ongoing disability in the general population (10), and has the second highest reduction in disability–adjusted years of life among all human diseases (11). It can significantly compromise a quality of life and length of hospital stay, complications with therapy, ability to care for oneself and survival time in patients with cancer (12). Cancer patients who are depressed are less likely to participate in treatment decisions and to seek out social support, and more likely to have declines in physical functioning during treatment, to drop out of treatment and to

have shorter survival times than those who are not depressed (13). Many research studies have focused on the impact of depression on treatment outcomes, such as mortality or disease progression, among cancer patients (14). Although the results have been inconsistent, most researchers suggest that a connection may exist (15–18). A meta-analysis conducted by Satin et al. (19) showed that depression is a predictor of mortality among cancer patients. However, depression is frequently underdiagnosed and consequently undertreated (12). The increasing duration of untreated illness has been reported to be associated with a worse treatment outcome of depression (20). Therefore, early identification or prediction of depression is crucial.

Studies have been conducted to identify predictors of depression in patients with various types of cancer, which include lung, breast, colorectal, gastrointestinal and mixed cancers. They have identified disease-related predictors such as tumor stage and physical symptoms due to cancer or treatment, and patient-related predictors such as age, sex, social support, cognitive impairment and use of antidepressants (21–26). Several studies have also been conducted to find out predictors in HNC patients, and similar ones as in patients with various types of cancer have been identified (12,27–29).

These studies have not included the degree of facial disfigurement and posttraumatic stress symptoms (PTSSs) as explanatory variables. Facial disfigurement is defined as a visible and negative alteration in appearance caused by disruption of skin, soft tissue or bony structures (30). Facial disfigurement, which results from HNC and its treatment, has been hypothesized to be one of the major reasons for distress among HNC patients. It is associated with basic aspects of a person's identity and communication, and cannot be concealed (3). Nevertheless, no prospective longitudinal studies have included the degree of facial disfigurement assessed using a rating scale. Cancer as a life-threatening trauma has been noted as one of the possible triggers for the onset of posttraumatic stress disorder (PTSD) and PTSSs (31,32). The incidence of first-onset depression is elevated among individuals who develop PTSD following trauma compared with those who do not develop PTSD (33). A high proportion of cancer patients experienced PTSSs following diagnosis, while most patients never met diagnostic criteria for PTSD (34). We think it necessary to take the influence of pre-existing PTSSs on later depression into account; however, no existing research in the field of HNC has addressed this issue. We hypothesized that the predisposition to depression among HNC patients can be a consequence of not only the previously reported patient-related predictors such as pretreatment depression, social support, adjustment style and sex but also the degree of facial disfigurement and PTSSs.

The aims of the present prospective study are to investigate the trajectory of depression and to determine which preoperative factors are predictors of the postoperative level of depression among HNC patients.

PATIENTS AND METHODS

Assessments

The assessments were performed at four time points: baseline (T0), the 3rd postoperative month (T1), the 6th postoperative month (T2) and the 12th postoperative month (T3). At baseline, we assessed the preoperative level of depression, PTSSs, social support and coping 2 days before surgery and the degree of facial disfigurement 3 or 4 weeks after surgery. The postoperative levels of depression were evaluated as primary outcomes at T1, T2 and T3.

Patients

The enrollment period was from April 2006 to September 2011. The surveillance period was from April 2006 to December 2011. Because of cancer death and other reasons, it was impossible for all of the patients to complete the assessment at four time points. Patients who completed the assessments at baseline (T0) and any one of the three postoperative time points (T1, T2 and T3) were included into the statistical analysis. A consecutive series of inpatients with HNC who planned to be treated surgically at Nagoya University Hospital during the surveillance period were asked to participate. Oncologists made the diagnosis of HNC. Psychiatrists interviewed only patients who agreed to participate. We excluded patients with a diagnosis of recurrent cancer and those with cognitive disorders, schizophrenia or a history of other psychotic disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) (35) (Table 1). Demographic and medical data were obtained at interview or compiled from the medical records at baseline. This study was approved under the guidelines for epidemiological studies by the Ethics Review Committee of Nagoya University Graduate School of Medicine and Nagoya University Hospital, and was conducted in accordance with the Helsinki Declaration. Written informed consent was obtained from each subject by psychiatrists before the start of the study.

Measures

The Japanese version of the Hospital Anxiety and Depression Scale (HADS) was used to assess the level of depression in our patients (36). This instrument has been widely used in psycho-oncology research and practice as an effective

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Patients were included if they were: 1. Diagnosed as HNC by oncologists 2. Treated surgically	Patients were excluded if their diagnoses were: 1. Recurrent cancer 2. Cognitive disorders, schizophrenia or history of other psychiatric disorders according to DSM-IV-TR

screening tool for anxiety and depression. It is a 14-item self-report questionnaire and each item has a 4-point (0–3) Likert-type scale. The HADS consists of two subscales, one for assessing depression and the other for assessing anxiety. The total score ranges from 0 to 42 (37); the best threshold for screening for any depressive disorder is considered to be 15 (38).

Social support was assessed using the Japanese version of the six-item Social Support Questionnaire (SSQ), which has been demonstrated to have reliability and validity among psychiatric patients as well as normal populations (39,40). The SSQ consists of two subscales, one for perceived number of social support (SSQN) and the other for satisfaction with social support (SSQS). The Mental Adjustment to Cancer (MAC) scale is widely used to assess the psychological response to cancer (41). We used the Japanese version of the MAC scale, which has been proved to be reliable and valid in Japanese cancer patients (42). Because of the inconsistency among the reported results of factor analyses, Watson and Homewood (43), the authors of the original MAC scale, re-examined the factor analysis. As a result, two new subscales, positive adjustment (PA) (17 items) and negative adjustment (NA) (16 items), were established. The new subscales were utilized in this study.

The degree of facial disfigurement was rated using the observer-rated disfigurement scale (ODS), which is a 9-point ODS with demonstrated reliability and validity (30). A very high degree of concordance was reported between the ratings by surgeons and others, including a psychiatrist and a research assistant. In this study, an experienced psychiatrist made rating. PTSSs in our patients was evaluated using the Japanese version of Impact of Event Scale-Revised, which meets the DSM-IV criteria for PTSD (44,45).

Statistics

Two-tailed unpaired *t*-tests were used to analyze sex differences in the baseline measures. To analyze the time course of HADS scores including all subjects, one-way repeated measures analysis of variance (ANOVA) was used. Sex differences over the course of time for HADS scores were analyzed using the two-way repeated measures ANOVA, with sex and time (T0, T1, T2 and T3) as factors.

Stepwise multiple regression analyses were performed to examine which factors measured at baseline could be used as predictors of postoperative depression. The postoperative levels of depression were used as dependent variables and the factors measured at baseline were used as independent variables: the preoperative level of depression, PTSSs, social support, adjustment style, facial disfigurement and sex. Sex is a categorical variable; therefore, it was transferred into a dummy variable.

Correlation matrices were created using Pearson's correlation coefficients and Spearman's rank correlation coefficients in order to clarify that there was no multicollinearity (data not shown). Because there were no strong correlations between the independent variables, all variables were included. The probabilities (*P* value) for entering and removal were set at 0.05 and 0.10, respectively. A Durbin–Watson ratio was calculated to detect autocorrelation in error terms. We also calculated *R*-square (R^2), which indicates the percentage of variance of the dependent variable that accounted for the variance of the predicted value. The analyses were conducted using the data set of T1, T2 and T3, respectively.

RESULTS

Description of Sample

During the enrollment period, 153 patients agreed to participate and 142 patients were included. Of 11 patients who were excluded, 5 were not treated surgically because their treatment strategies were changed, while 6 did not complete the preoperative assessment because of progression of cancer before surgery. Of the 142 included patients, 13 had data sets with missing values at baseline and 13 could not complete all questionnaires after surgery. Accordingly, 116 were included in the analysis. Among the 116 patients, 94, 69 and 78 were included at T1, T2 and T3, respectively (Table 2). There were no significant differences between included and excluded patients at each time point with respect to mean age (T1, $P = 0.15$; T2, $P = 0.62$; T3, $P = 0.95$, unpaired *t*-test) and sex distribution (T1, $P = 0.39$; T2, $P = 0.39$; T3, $P = 0.69$, χ^2 test or Fisher's exact test where appropriate).

Demographic and medical variables are shown in Table 3. The mean age of the patients was 61.2 years and most patients were male. The majority of patients had advanced cancer of the hypopharynx, oral cavity or others. Approximately three-quarters of patients had additional radiotherapy and/or chemotherapy.

Table 2. Reasons for exclusion from the study at each time point

Time point	The number of excluded patients	Reasons for exclusion
T1	22	They canceled appointments ($N = 20$) or were transferred to another hospital ($N = 2$)
T2	47	They canceled appointments ($N = 31$), were transferred to another hospital ($N = 2$), died ($N = 3$) or did not undergo the sixth postoperative month assessment because the surveillance period ended ($N = 11$)
T3	38	They canceled appointments ($N = 7$), were transferred to another hospital ($N = 2$), died ($N = 9$), refused assessment ($N = 1$) or did not undergo the 12th postoperative month assessment because the surveillance period ended ($N = 19$)

T1, 3rd postoperative month; T2, 6th postoperative month; T3, 12th postoperative month.

Table 3. Description of sample ($N = 116$)

Characteristic	Number	Percentage
Age		
Mean	61.2	
Range	20–85	
Median	62	
SD	11.4	
Sex		
Male	91	78.4
Female	25	21.6
Stage		
I	2	1.7
II	13	11.2
III	17	14.7
IV	84	72.4
Site		
Oral cavity	28	24.1
Paranasal sinuses	26	22.4
Nasopharynx	1	0.9
Oropharynx	18	15.5
Hypopharynx	31	26.7
Larynx	8	6.9
Salivary glands	4	3.4
Treatment		
Surgery	28	24.1
Surgery + RT	18	15.5
Surgery + CT	21	18.2
Surgery + RT + CT	49	42.2

SD, standard deviation; RT, radiotherapy; CT, chemotherapy.

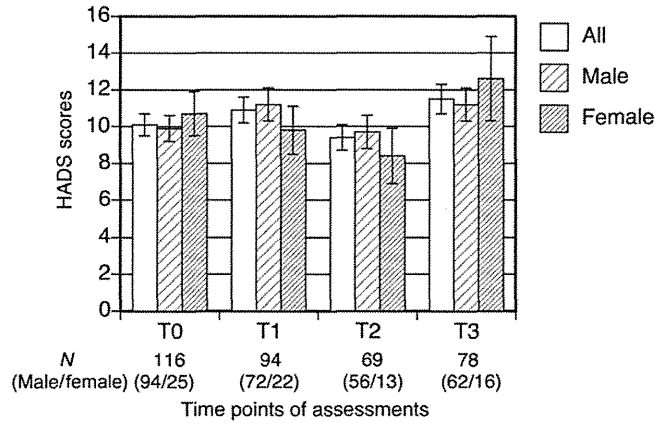


Figure 1. Time course of Hospital Anxiety and Depression Scale (HADS) scores, for all male and female subjects. Each bar represents the mean ± SD scores. For the time course of HADS scores for all subjects, one-way repeated-measures analysis of variance (ANOVA) revealed no significant results ($df = 3$, $F = 1.31$, $P = 0.27$). For male and female subjects, two-way repeated-measures ANOVA revealed no significant time × sex interaction ($df = 3$, $F = 0.62$, $P = 0.60$).

Table 4. Time course of Hospital Anxiety and Depression Scale (HADS) scores

Time point	Mean scores of the HADS			Patients with HADS scores ≥ 15	
	Score	Range	95% CI	Number	Percentage
T0 ($N = 116$)	10.1	0–31	9.8–14.1	25	21.6
T1 ($N = 94$)	10.9	0–33	10.1–14.6	29	30.6
T2 ($N = 69$)	9.4	0–26	8.4–12.4	14	20.3
T3 ($N = 78$)	11.5	0–39	9.4–13.5	24	30.8

T0, baseline; 95% CI, 95% confidence interval.

Time Course of HADS Scores

When reviewing the time course of HADS scores, one-way repeated measures ANOVA revealed no significant results ($df = 3$, $F = 1.31$, $P = 0.27$), indicating that the mean scores at each time point were not different. Scores at each time point were within a non-depressed range (38). Two-way repeated measures ANOVA revealed no significant time × sex interaction ($df = 3$, $F = 0.62$, $P = 0.60$), indicating that the time course of depressive symptoms was similar in male and female patients (Fig. 1).

Although there were no differences among the mean HADS scores at each time point, the score range was wide and the percentage of patients whose scores were within the depressed range varied at each time point (Table 4). Figure 2a and b indicate the time course of HADS scores of the patients with and without depression at T0, respectively. The data of the patients who completed the assessments at all time points are presented. Apparent individual differences were shown among their time courses. Consequently, it is considered to be meaningful to predict the postoperative HADS score.

Multiple Regression Analyses

Third Postoperative Month (T1)

Table 5 shows the results of the stepwise multiple regression analyses, which were performed to examine which factor measured at baseline could be a predictor of the postoperative levels of depression. The HADS score at T0 (HADS T0), which means the postoperative level of depression, was extracted using the stepwise multiple regression analysis ($F = 24.11$, $P < 0.01$). The Durbin–Watson ratio was 1.89; therefore, no autocorrelation in error terms was detected. R^2 was 0.21, which indicated that HADS T0 accounted for 21% of HADS T1.

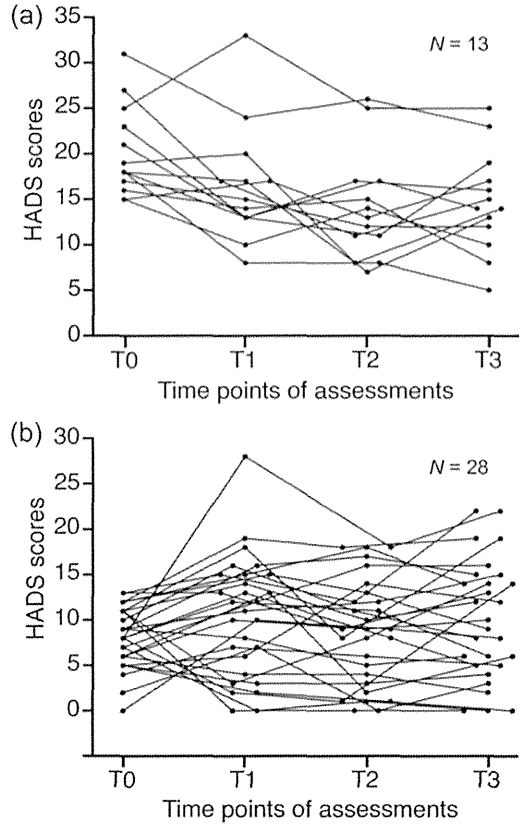


Figure 2. (a) The time course of HADS scores of the patients with depression at T0. Each line represents the time course of HADS scores of the patients whose HADS score was 15 or more at T0. The data of the patients who completed the assessments at all time points are presented. The points and corresponding lines in this figure are slightly shifted in the horizontal direction as needed for clarity. (b) The time course of HADS scores of the patients without depression at T0. Each line represents the time course of HADS scores of the patients whose HADS score was 14 or less at T0. The data of the patients who completed the assessments at all time points are presented. The points and corresponding lines in this figure are slightly shifted in the horizontal direction as needed for clarity.

Sixth Postoperative Month (T2)

HADS T0 and NA to cancer were extracted using the stepwise multiple regression analysis ($F = 24.64$, $P < 0.01$). The Durbin–Watson ratio was 2.20; therefore, no autocorrelation in error terms was detected. R^2 was 0.43, which indicated that HADS T0 and NA accounted for 43% of HADS T2.

Twelfth Postoperative Month (T3)

HADS T0 was extracted using the stepwise multiple regression analysis ($F = 30.18$, $P < 0.01$). The Durbin–Watson ratio was 2.17; therefore, no autocorrelation in error terms was detected. R^2 was 0.28, which indicated that HADS T0 accounted for 28% of HADS T3.

DISCUSSION

The mean HADS scores were within the non-depressed range at all time points and there was no significant difference among the mean scores at each time point. On the other hand, at least one of five patients had the possibility of having the clinical diagnosis of depression at all time points. The percentage of patients who might have clinical diagnosis of depression increased at the 3rd and 12th postoperative months and this was similar to baseline at the 6th postoperative month. Furthermore, there were apparent individual differences among the time courses of HADS scores. The preoperative level of depression was a predictor of the levels of depression at the 3rd and 12th postoperative months, and the NA in addition to the preoperative level of depression was a predictor of the level of depression at the sixth postoperative month.

Only a few previous studies have investigated the time course of HADS scores among HNC patients. Hammerlid et al. (2) focused on the time course of HADS scores both before and after treatment in 357 HNC patients. The percentages of patients scoring 8 or more on the anxiety subscale or 8 or more on the depression subscale were 36, 34, 30 and 26% at the following time points: at diagnosis, and at 3, 6 and 12 months after treatment, respectively, which indicated that the percentage tended to decline. In our sample, the percentages of patients scoring 15 or more on the HADS total were 21.6, 30.6, 20.3 and 30.8% at the following time points: baseline, and 3rd, 6th and 12th postoperative months, respectively. The inconsistency may be due to the differences in the cutoff points, the adopted treatment modalities, or race and culture between the two samples.

The present study demonstrated that the preoperative level of depression can be used as a predictor of the postoperative level of depression. De Graeff et al. (46) investigated factors that could be used as predictors of the posttreatment depressive symptoms among seven pretreatment factors. They reported that the pretreatment depressive symptoms accounted for 21% of the total score on the Center for Epidemiologic Studies Depression Scale (CES-D) at the 6th posttreatment month and 30% of that at the 12th posttreatment month. Furthermore, De Leeuw et al. (27) revealed that pretreatment depressive symptoms were included in the factors that could be used as a predictor of posttreatment depression, and accounted for 18–32% of the posttreatment CES-D score. These findings are similar to our results in that the pretreatment level of depression was a predictor of the posttreatment level of depression. However, the study designs of De Leeuw et al. and De Graeff et al. differed from ours in terms of the degree of facial disfigurement being included as an explanatory variable only in the current study.

It has been hypothesized that facial disfigurement is one of the major reasons for depression among HNC patients (47). However, the degree of facial disfigurement could not be used as a predictor of the posttreatment level of depression. The study of Katz et al. (30) is one of the few that has investigated the relationship between the degree of facial disfigurement and depression using a validated rating scale. Their cross-sectional study showed that patients with a high degree of facial disfigurement tended to have more depressive symptoms at the sixth postoperative month. Considering the

Table 5. Results of the stepwise multiple regression analyses

Time point	Unstandardized regression coefficient	Standardized regression coefficient	*P* value	95% CI	
	B	*β*		Lower	Upper
T1					
(Constant)	5.65		<0.01	3.18	8.11
HADS T0	0.49	0.46	<0.01	0.29	0.69
T2					
(Constant)	−1.21		0.63	−6.15	3.72
HADS T0	0.44	0.49	<0.01	0.25	0.63
NA	0.17	0.25	0.027	0.02	0.31
T3					
(Constant)	5.21		<0.01	2.53	7.89
HADS T0	0.59	0.53	<0.01	0.38	0.81

Dependent variables: score on HADS at T1 (HADS T1); score on HADS at T2 (HADS T2); score on HADS at T3 (HADS T3). Independent variables: score on HADS at T0 (HADS T0); IES-R score; SSQN score; SSQS score; PA score; NA score; ODS score; sex. R^2, *R*-square; ANOVA, analysis of variance.
T1: $R^2 = 0.21$, ANOVA, $P < 0.01$; T2: $R^2 = 0.43$, ANOVA, $P < 0.01$; T3: $R^2 = 0.28$, ANOVA, $P < 0.01$.

above-mentioned findings, although the degree of facial disfigurement in less than a month is not a predictor of the postoperative level of depression, a high degree of facial disfigurement prolonging for 6 months may increase the level of depression. To verify this hypothesis, studies designed to assess the degree of facial disfigurement over time are needed.

This is the first study to investigate whether the level of depression could be predicted using the new subscales of MAC, which assesses coping strategies. The results indicate that the score for NA on the MAC scale would be an effective predictor of the level of postoperative depression that is more accurate when used in combination with the preoperative level of depression.

There are several limitations of our study design. First, the R^2 was relatively small; therefore, only a small percentage of variance of the postoperative level of depression could be accounted for by the pretreatment variables extracted as predictors. It is possible that there are other factors that could also explain the postoperative level of depression. Including other possible factors, such as physical symptoms (pain, oral dysfunction or speech impairment) and the use of alcohol (29) or tobacco, into analyses would have improved the accuracy of the present results. Furthermore, we used the HADS instead of the Structural Clinical Interview for DSM-IV, which is generally considered as the gold standard for the diagnosis of depression. Another limitation is that the Japanese version of the ODS has not been validated. Finally, the sample size was small and a relatively large number of patients dropped out of the study at each time point. These limitations could have affected the accuracy of the calculated estimates based on the data presented in the study.

Depression among HNC patients may affect disease progression and mortality (19); therefore, early identification and intervention of depression is crucial. We showed that the preoperative level of depression and NA can be used as predictors of the postoperative level of depression. Assessing these factors before surgery is considered to be an effective method for identifying HNC patients who will develop depression after surgery.

Funding

This work was supported by a Health Labor Science Research Grant (H23-seishin-ippan-003) from the Japanese Ministry of Health, Labor and Welfare and a Grant-in-Aid for Science Research (24591703) from the Japanese Ministry of Education, Culture, Sports, Science and Technology.

Conflict of interest statement

The authors have no competing interest to report.

References

1. Misono S, Weiss NS, Fann JR, Redman M, Yueh B. Incidence of suicide in persons with cancer. *J Clin Oncol* 2008;26:4731–8.
2. Hammerlid E, Ahlner-Elmqvist M, Bjordal K, et al. A prospective multicentre study in Sweden and Norway of mental distress and psychiatric morbidity in head and neck cancer patients. *Br J Cancer* 1999;80:766–74.
3. Lydiatt WM, Moran J, Burke WJ. A review of depression in the head and neck cancer patient. *Clin Adv Hematol Oncol* 2009;7:397–403.
4. Stanton AL. What happens now? Psychosocial care for cancer survivors after medical treatment completion. *J Clin Oncol* 2012;30:1215–20.
5. Holland JC, Reznik I. Pathways for psychosocial care of cancer survivors. *Cancer* 2005;104(11 Suppl):2624–37.
6. Henselmans I, Helgeson VS, Seltman H, de Vries J, Sanderman R, Ranchor AV. Identification and prediction of distress trajectories in the first year after a breast cancer diagnosis. *Health Psychol* 2010;29:160–8.

7. Helgeson VS, Snyder P, Seltman H. Psychological and physical adjustment to breast cancer over 4 years: identifying distinct trajectories of change. *Health Psychol* 2004;23:3–15.
8. Hinnen C, Ranchor AV, Sanderman R, Snijders TAB, Hagedoorn M, Coyne JC. Course of distress in breast cancer patients, their partners, and matched control couples. *Ann Behav Med* 2008;36:141–8.
9. Haisfield-Wolfe ME, McGuire DB, Soeken K, Geiger-Brown J, De Forge BR. Prevalence and correlates of depression among patients with head and neck cancer: a systematic review of implications for research. *Oncol Nurs Forum* 2009;36:E107–125.
10. Hickie IB, Rogers NL. Novel melatonin-based therapies: potential advances in the treatment of major depression. *Lancet* 2011;378:621–31.
11. Falagas ME, Vardakas KZ, Vergidis PI. Under-diagnosis of common chronic diseases: prevalence and impact on human health. *Int J Clin Pract* 2007;61:1569–79.
12. de Leeuw JR, de Graeff A, Ros WJ, Blijham GH, Hordijk GJ, Winnubst JA. Prediction of depressive symptomatology after treatment of head and neck cancer: the influence of pre-treatment physical and depressive symptoms, coping, and social support. *Head Neck* 2000;22:799–807.
13. Hamilton JB, Deal AM, Moore AD, Best NC, Galbraith KV, Muss H. Psychosocial predictors of depression among older African American cancer patients. *Oncol Nurs Forum* 2013;40:394–402.
14. Prieto JM, Atala J, Blanch J, et al. Role of depression as a predictor of mortality among cancer patients after stem-cell transplantation. *J Clin Oncol* 2005;23:6063–71.
15. Watson M, Haviland JS, Greer S, Davidson J, Bliss JM. Influence of psychological response on survival in breast cancer: a population-based cohort study. *Lancet* 1999;354:1331–6.
16. Spiegel D, Giese-Davis J. Depression and cancer: mechanisms and disease progression. *Biol Psychiatry* 2003;54:269–82.
17. Faller H, Bulzebruck H, Drings P, Lang H. Coping, distress, and survival among patients with lung cancer. *Arch Gen Psychiatry* 1999;56:756–62.
18. Loberiza FR, Jr, Rizzo JD, Bredeson CN, et al. Association of depressive syndrome and early deaths among patients after stem-cell transplantation for malignant diseases. *J Clin Oncol* 2002;20:2118–26.
19. Satin JR, Linden W, Phillips MJ. Depression as a predictor of disease progression and mortality in cancer patients: a meta-analysis. *Cancer* 2009;115:5349–61.
20. Adachi Y, Aleksic B, Nobata R, et al. Combination use of Beck Depression Inventory and the two-question case-finding instrument as a screening tool for depression in the workplace. *BMJ Open* 2012;2:e000596.
21. Graves KD, Arnold SM, Love CL, Kirsh KL, Moore PG, Passik SD. Distress screening in a multidisciplinary lung cancer clinic: prevalence and predictors of clinically significant distress. *Lung Cancer* 2007;55:215–24.
22. Iwatani T, Matsuda A, Kawabata H, Miura D, Matsushima E. Predictive factors for psychological distress related to diagnosis of breast cancer. *Psychooncology* 2013;22:523–9.
23. Schleife H, Sachtleben C, Finck Barboza C, Singer S, Hinz A. Anxiety, depression, and quality of life in German ambulatory breast cancer patients. *Breast Cancer* 2012; doi: 10.1007/s12282-012-0378-6.
24. Hyphantis T, Paika V, Almyroudi A, Kampletsas EO, Pavlidis N. Personality variables as predictors of early non-metastatic colorectal cancer patients' psychological distress and health-related quality of life: a one-year prospective study. *J Psychosom Res* 2011;70:411–21.
25. Lo C, Zimmermann C, Rydall A, et al. Longitudinal study of depressive symptoms in patients with metastatic gastrointestinal and lung cancer. *J Clin Oncol* 2010;28:3084–9.
26. Mystakidou K, Parpa E, Tsilika E, et al. Geriatric depression in advanced cancer patients: the effect of cognitive and physical functioning. *Geriatr Gerontol Int* 2013;13:281–8.
27. de Leeuw JR, de Graeff A, Ros WJ, Blijham GH, Hordijk GJ, Winnubst JA. Prediction of depression 6 months to 3 years after treatment of head and neck cancer. *Head Neck* 2001;23:892–8.
28. Sehlen S, Lenk M, Herschbach P, et al. Depressive symptoms during and after radiotherapy for head and neck cancer. *Head Neck* 2003; 25:1004–18.
29. Singer S, Krauss O, Keszte J, et al. Predictors of emotional distress in patients with head and neck cancer. *Head Neck* 2012;34:180–7.
30. Katz MR, Irish JC, Devins GM, Rodin GM, Gullane PJ. Psychosocial adjustment in head and neck cancer: the impact of disfigurement, gender and social support. *Head Neck* 2003;25:103–12.
31. Smith MY, Redd WH, Peyser C, Vogl D. Post-traumatic stress disorder in cancer: a review. *Psychooncology* 1999;8:521–37.
32. Ristvedt SL, Trinkaus KM. Trait anxiety as an independent predictor of poor health-related quality of life and post-traumatic stress symptoms in rectal cancer. *Br J Health Psychol* 2009;14(Pt 4):701–15.
33. Breslau N, Davis GC, Peterson EL, Schultz LR. A second look at comorbidity in victims of trauma: the posttraumatic stress disorder-major depression connection. *Biol Psychiatry* 2000;48:902–9.
34. Kangas M, Henry JL, Bryant RA. Posttraumatic stress disorder following cancer. A conceptual and empirical review. *Clin Psychol Rev* 2002;22:499–524.
35. American Psychiatric Association. *Task Force on DSM-IV. Diagnostic and Statistical Manual of Mental Disorders: DSM-IV-TR.* 4th edn. Washington, DC: American Psychiatric Association 2000.
36. Kugaya A, Akechi T, Okuyama T, Okamura H, Uchitomi Y. Screening for psychological distress in Japanese cancer patients. *Jpn J Clin Oncol* 1998;28:333–8.
37. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67:361–70.
38. Vodermaier A, Millman RD. Accuracy of the Hospital Anxiety and Depression Scale as a screening tool in cancer patients: a systematic review and meta-analysis. *Support Care Cancer* 2011;19:1899–908.
39. Sarason I, Levine HM, Basham RB, Sarason BR. Assessing social support: The Social Support Questionnaire. *J Pers Social Psychol* 1983;44:127–39.
40. Furukawa TA, Harai H, Hirai T, Kitamura T, Takahashi K. Social Support Questionnaire among psychiatric patients with various diagnoses and normal controls. *Soc Psychiatry Psychiatr Epidemiol* 1999;34:216–22.
41. Greer S, Watson M. Mental adjustment to cancer: its measurement and prognostic importance. *Cancer Surveys* 1987;6:439–53.
42. Akechi T, Fukue-Saeki M, Kugaya A, et al. Psychometric properties of the Japanese version of the mental adjustment to cancer (MAC) scale. *Psychooncology* 2000;9:395–401.
43. Watson M, Homewood J. Mental adjustment to cancer scale: psychometric properties in a large cancer cohort. *Psychooncology* 2008;17:1146–51.
44. Weiss DS, Marmer CR. *The Impact of Event Scale—Revised.* New York: Guilford Press 1997.
45. Asukai N, Kato H, Kawamura N, et al. Reliability and validity of the Japanese-language version of the impact of event scale-revised (IES-R-J): four studies of different traumatic events. *J Nerv Ment Dis* 2002;190:175–82.
46. de Graeff A, de Leeuw JR, Ros WJ, Hordijk GJ, Blijham GH, Winnubst JA. Pretreatment factors predicting quality of life after treatment for head and neck cancer. *Head Neck* 2000;22:398–407.
47. Katz MR, Irish JC, Devins GM, Rodin GM, Gullane PJ. Reliability and validity of an observer-rated disfigurement scale for head and neck cancer patients. *Head Neck* 2000;22:132–41.

Title: Temperament and character profiles of patients with burning mouth syndrome

Short running head: Temperament and character profiles of BMS patients

Tatsuya Tokura MD, PhD [a], Hiroyuki Kimura MD, PhD [a*], Mikiko Ito DDS, PhD [b], Wataru Nagashima MD [a], Naohiro Sato M.ED [a], Yuki Kimura DDS [b], Munetaka Arao DDS, PhD [b], Branko Aleksic MD, PhD [a], Keizo Yoshida MD, PhD [c], Kenichi Kurita DDS, PhD [b], and Norio Ozaki MD, PhD [a]

[a] Department of Psychiatry, Nagoya University Graduate School of Medicine, Nagoya, Japan.
[b] Department of Oral and Maxillofacial Surgery, School of Dentistry, Aichi-Gakuin University, Nagoya, Japan.
[c] Health Care Promotion Division, Denso Corporation, Kariya, Japan.

* Corresponding author
Hiroyuki Kimura, MD, PhD
Address: Department of Psychiatry, Nagoya University Graduate School of Medicine, 65 Tsurumai, Showa, Nagoya, Aichi 466-8550, Japan
Tel.: +81 52 7442282
Fax: +81 52 7442293
E-mail: kimurahi@med.nagoya-u.ac.jp

ABSTRACT

Objective:

Burning mouth syndrome (BMS) is a chronic disease in which patients feel a burning sensation and pain in the oral cavity. Although personality traits have been suggested to influence the development and course of BMS, they have not yet been examined in detail. We therefore investigated the personality traits of BMS patients.

Methods:

Sample consisted of 65 BMS patients presenting to the Aichi-Gakuin Dental School Hospital between May 2005 and April 2009. They were also diagnosed as having pain disorder by a psychiatrist. The control group consisted of 116 healthy subjects. The Temperament and Character Inventory (TCI) was used to evaluate personality traits, while the Beck Depression Inventory (BDI) was used to evaluate the depression rate in both groups. The results obtained were compared between these groups using the unpaired t-test.

Results:

In TCI, we found that, in comparison to the control group, the novelty seeking score was significantly lower ($p=0.009$), the harm avoidance score was significantly higher ($p<0.001$), and the self-directedness score was significantly lower ($p=0.039$) in the BMS group. To remove the influence of depression, we performed an analysis of covariance of each TCI item using the BDI score as a covariate. No significant differences were observed in harm avoidance or self-directedness, whereas the differences noted in novelty seeking were significant ($p=0.008$).

Conclusion:

The novelty seeking score was low in BMS patients in comparison to the control group. They also had high harm avoidance and low self-directedness tendencies, but these were attributed to the influence of depression.

KEY WORDS

Burning Mouth Syndrome (BMS); Pain Disorder; Personality Trait; Temperament and Character Inventory (TCI); Novelty Seeking (NS); Beck Depression Inventory (BDI)

INTRODUCTION

Burning mouth syndrome (BMS) is a chronic disease that is characterized by a subjective burning sensation and pain in the oral mucosa [1]. BMS has been defined as a disease with a burning sensation and pain in the oral cavity, an abnormal sense of taste, and dry mouth despite no medical or dental cause being identified [2]. According to the diagnostic and statistical manual of mental disorders, 4th edition text revision (DSM-IV-TR) [3], the psychiatric diagnosis of BMS has been classified mainly as pain disorder. The prevalence of BMS was previously reported to be 0.7-4.6% [4-7], which revealed that the number of BMS patients was not small. BMS frequently develops in females aged 40-80 years, and the male: female ratio is approximately 1:7 [7]. Without treatment, only approximately 3% of cases achieved remission after 5 years [8,9]. Once the disease develops, symptoms persist for a long time. Thus, compared with the healthy people the quality of life (QOL) in patients with BMS is markedly impaired [10]. BMS is typically treated with antidepressants [11-13], antiepileptic drugs [14], and cognitive therapy [15]; however, no consensus has been reached regarding optimum treatment. Although the pathology of BMS remains unclear [16], its development is considered to involve psychosocial problems, including the following: difficult events in the home in childhood, insufficient adaptation in school and at work, and discord in married or home life [17]. To improve the symptoms and QOL of BMS patients, physicians have to employ a bio-psycho-social approach, for which it is important to identify the personality traits involved in BMS because these may have a marked influence on the pathology and course of BMS [18].

The Temperament and Character Inventory (TCI), a self-rating scale developed by Cloninger et al. in 1993, is frequently used to assess personality traits [19]. TCI was established based on a psycho-biological model. Four temperament dimensions: Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (PS), and 3 character dimensions: Self-Directedness (SD), Cooperativeness (CO), and Self-Transcendence (ST), can be measured using TCI. Cloninger et al. stated that distinguishing the temperament and character of a patient is useful for treating psychiatric disorders: character is the target of psychotherapeutic interventions and temperament is the target of pharmacological interventions [19].

Previous studies examined the personality traits of patients with pain disorder and chronic pain using TCI. The HA score was higher and SD and CO scores were lower in 207 pain disorder patients than in 105 control subjects [20]. In another study, the HA score was high in patients with chronic tension-type headaches [21] and non-specific musculoskeletal disorders [22]. However, only a few studies have investigated the personality traits of patients with BMS [23-26]. All studies involved only 13-32 BMS patients, and, to the best of our knowledge, no study has been performed based on a psycho-biological model. Thus, we considered it important to limit the pain disorder to BMS and investigate the personality traits of BMS patients based on a psychobiological model. BMS

patients are often complicated by depression [17], which is known to influence the personality traits of patients [27]. However, the influence of depression has not been taken into consideration in analyses of the personality traits of BMS patients in any study. Thus, we consider it important to take the influence of depression into consideration when evaluating the personality traits of BMS patients.

The objective of this study was to clarify the personality traits of BMS patients using TCI, prepared by Cloninger et al. based on a psychobiological model, with the aim of elucidating the pathology of BMS and improving the symptoms and QOL of BMS patients. Depression was also simultaneously evaluated in order to investigate the influence of depression on the personality traits of BMS patients. Furthermore, considering the influence of comorbid psychiatric disorders on the personality traits of BMS patients, we also performed an analysis that excluded patients with comorbid psychiatric disorders other than pain disorder.

MATERIALS AND METHODS

We established a liaison psychiatry medical team in Aichi-Gakuin Dental School Hospital in 1999, and psychiatrists and dentists cooperatively treat patients with chronic pain in the orofacial region. Dentists make a dental diagnosis and psychiatrists make a psychiatric diagnosis in all new patients who visit the liaison psychiatric clinic.

The subjects who participated in the present study were patients who presented to the liaison psychiatric clinic of Aichi-Gakuin Dental School Hospital for the first time between May 2005 and April 2009 and were diagnosed with BMS by a dentist and pain disorder (DSM-IV-TR) by a psychiatrist. BMS was diagnosed following the standard diagnostic criteria established by the Headache Classification Committee of the International Headache Society, defining the disease as a condition with a burning sensation and pain in the oral cavity, an abnormal sense of taste, and dry mouth despite no medical or dental cause being present [2]. The absence of organic abnormalities, such as inflammation, was confirmed by evaluating clinical findings in the oral cavity, performing blood and candida tests, and imaging, such as radiography and computed tomography, as needed. Exclusion criteria were as follows: past medical history of schizophrenia or other psychiatric disorders, psychotic symptoms noted on the first examination, and dementia. The control group consisted of 116 healthy subjects matched with the BMS group for the age and sex ratio without a clinical symptom in the oral cavity and current or past psychiatric disorders. We obtained written informed consent from all of the participants after a full explanation of the study.

TCI was used to assess personality traits in both groups. The temperament dimensions included NS, HA, RD and PS, and the character dimensions included SD, CO and ST. The participants

responded to each item by answering 'true' or 'false' and a total score for each temperament and character dimension was calculated. In addition, the Beck Depression Inventory (BDI) was also applied to assess depression in both groups. BDI is a self-rating scale that was developed by Beck et al. in 1961 [28], and its high ability to identify depression has been reported [29]. The results of TCI were evaluated by comparisons between the two groups using the unpaired *t*-test. To remove the influence of depression on the TCI score, an analysis of covariance (ANCOVA) of each TCI item was performed with the BDI score as a covariate. We also performed an analysis excluding patients with comorbid psychiatric disorders to remove the influence of these comorbid disorders. Data were expressed as mean ± standard deviation. $P<0.05$ was considered to be significant in all tests. Statistical analysis was performed using SPSS for Windows Version 20.0J. G*Power 3 [30] was used for the power analysis.

The Ethical Committee of the School of Dentistry, Aichi-Gakuin University, and the Ethics Review Committee of Nagoya University Graduate School of Medicine approved this study. This study was performed with sufficient consideration of the protection of personal information.

RESULTS

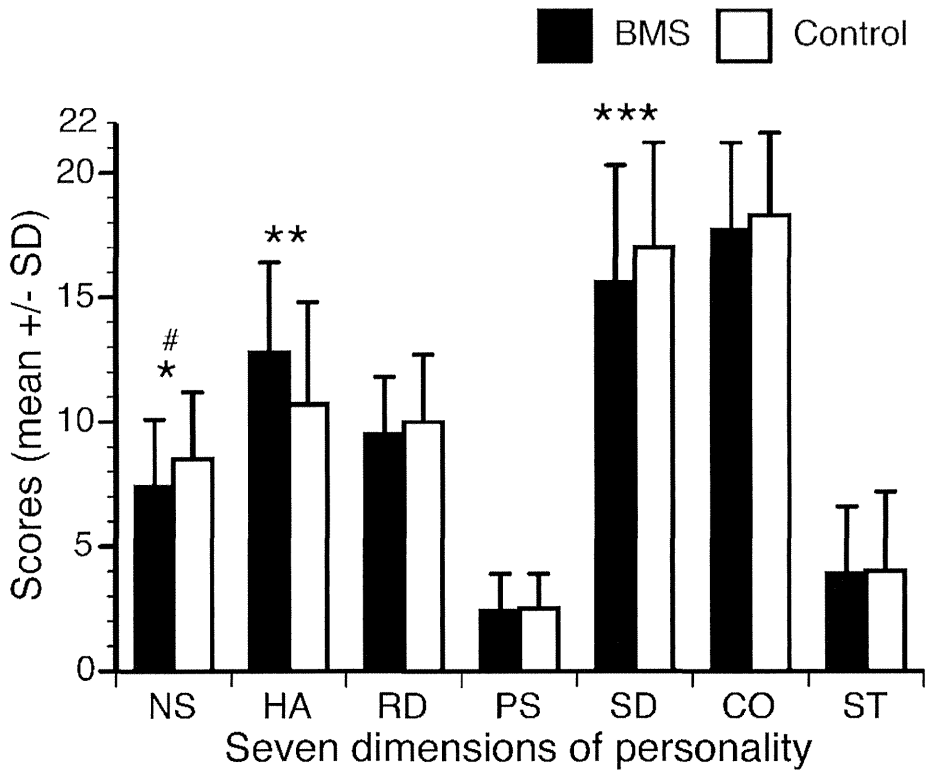
Of 368 new patients during the study period, 65 patients diagnosed with BMS were finally included in the study. The demographic characteristics of the BMS and control groups are shown in Table 1. The average age of patients was 60.0±9.9 years old in the BMS group, many of whom were middle-aged and elderly. The male: female ratio was 1:5.5 in the BMS group. In the psychiatric diagnosis using DSM-IV-TR, 11 patients were diagnosed with comorbid psychiatric disorders other than pain disorder in the BMS group: major depression disorder in nine, bipolar disorder in one, and panic disorder in one. The duration of illness was 28.5±37.9 months in the BMS group.

Table 1. Patient characteristics.

	BMS (n=65)	Control (n=116)
Age (years)	60.0±9.9	61.0±12.8
Gender		
Male	10 (15%)	25 (22%)
Female	55 (85%)	91 (78%)
Comorbid psychiatric disorders		
Major depressive disorder	9 (14%)	
Bipolar disorder	1 (2%)	
Panic disorder	1 (2%)	
Duration of illness (months)	28.5±37.9	

The score of each TCI item was compared between the BMS and control groups using the unpaired *t*-test. The NS score was significantly lower (BMS 7.4±2.7 vs. Control 8.5±2.7, p=0.009), the HA score was significant higher (12.8 ± 3.6 vs. 10.7 ± 4.1, p<0.001), and the SD score was significant lower (15.6±4.7 vs. 17.0±4.2, p=0.039) in the BMS group than in the control group. No significant differences were noted in RD (9.5±2.3 vs. 10.0±2.7, p=0.18), PS (2.4± .5 vs. 2.5±1.4, p=0.64), CO (17.7±3.5 vs. 18.3±3.3, p=0.25), or ST (3.9±2.7 vs. 4.0±3.2, p=0.84) between the groups as shown in Fig. 1.

Fig. 1. The TCI score of the BMS group and control group.



The score of each TCI item was compared between the BMS and control groups using the unpaired *t*-test. The NS score was significantly lower (*p=0.009), the HA score was significant higher (**p<0.001), and the SD score was significant lower (***p=0.039) in the BMS group than in the control group. We performed an analysis of covariance of each TCI item using the BDI score as a covariate. No significant differences were observed in HA or SD, whereas the differences noted in NS were significant (#p=0.008).

NS: Novelty Seeking HA: Harm Avoidance RD: Reward Dependence PS: Persistence SD: Self-Directedness CO: Cooperativeness ST: Self-Transcendence

The BDI scores were 11.6±8.3 and 6.8±7.0 in the BMS and the control groups, respectively, and