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Relationships of Mood Disturbance, Symptom Experience, and Attentional Function in Women with Breast Cancer Based upon the Theory of Unpleasant Symptoms

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Purpose. The purpose of this study was to identify direct, mediating, and moderating relationships of mood disturbance, symptom experience, and attentional function in Korean women with breast cancer based upon a middle-range theory of unpleasant symptoms.

Methods. This study used a cross-sectional, correlational design. A convenience sample of 125 women receiving chemotherapy for breast cancer was recruited from a university hospital in South Korea. The women completed questionnaires on mood disturbance, symptom experience, and attentional function using the Linear Analogue Self-Assessment Scale, the Symptom Experience Scale, and the Attentional Function Index, respectively.

Results. Each mood disturbance and symptom experience showed a significant relationship with attentional function. Symptom experience did not act as a mediator between mood disturbance and attentional function, but it did act as a moderator: patients with a higher level of mood disturbance exhibited a lower level of attentional function when their symptoms were at the level of medium, but not when their symptoms were either high or low.

Conclusion. This suggests that clinical interventions for attenuating the influence of mood disturbance on attentional function may be effective only in women experiencing medium level of symptoms.

Key Words : Breast cancer, symptom, mood, attention

INTRODUCTION

The Problem

The prevalence of breast cancer in Korea increased rapidly between 1995 and 2001, from 12.5 to 16.1 per 100,000 women, and it is now the most common type of cancer among women (Korean Ministry of Health and Welfare, 2003). Since the 1970s, adjuvant chemotherapy has been used after the local treatment of primary breast cancer to eradicate the growth of possible occult metastases that would become fatal. This treatment has been shown to reduce the mortality from the disease; however, it is accompanied by various side effects (Early Breast Cancer Trialists' Collaborative Group, 1998), one of which is decreased attentional function (Brezden, Phillips, Abdolell, Bunston, & Tannock, 2000; van Dam et al., 1998).

Decreased attentional function may result in difficulties in understanding treatments, hinder acquiring infor-

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mation for self-care, impair relationships with others, and decrease adjustment in domestic, vocational, and social life; furthermore, it can decrease the quality of life of patients with cancer (Cimprich, 1992; Lehto & Cimprich, 1999; Olin, 2001). Therefore, it is important for oncology nurses to consider the level of attentional function when caring for patients undergoing chemotherapy. However, few previous studies have empirically explored attentional function-related variables in patients with cancer (van Dam et al, 1998), and most had methodological limitations: low statistical power due to a small sample size, use of unreliable and invalid instruments, and uncontrolled confounding variables, such as gender, age, type of cancer, or metastasis (Brezden et al, 2000; van Dam, 1998; Schagen et al., 1999). Thus, the present study examined attentional function-related variables in patients undergoing chemotherapy, especially women with breast cancer, based upon the Theory of Unpleasant Symptoms (TOUS) (Lenz, Pugh, Milligan, Gift, & Suppe, 1997).

Framework for the Study

The TOUS is a middle-range theory that consists of three major components: (1) the symptoms a patient experiences, (2) the influential factors on the symptom experience, and (3) the consequence of the symptom experience. Symptoms are the perceived indicators of change in normal functioning as experienced by patients. Symptoms can occur alone, but in many cases multiple symptoms occur simultaneously. Influential factors include physiological (e.g., existence of any pathology), psychologic (e.g., mood status or affects), and situational (e.g., social support, noise, or heat) variables. The consequence of symptom experience is performance, conceptualized to include functional activities (e.g., daily activities or role functioning) and cognitive functioning (e.g., attention or thinking). The TOUS denotes that the physiological, psychological, and situational variables as well as symptom experience are directly related to performance, such as attentional function. The TOUS also notes that symptom experience can act as either a mediator or a moderator in the relationship between psychology variables and performance. van Dam and his colleagues (1998) reported that the impairment of cognitive function was significantly higher in patients with breast cancer who undergo high- or standard-dose chemotherapy than in those who undergo surgery. Another study showed that patients with breast cancer treated with adjuvant chemotherapy had a significantly higher impairment of cognitive function than those not treated with chemotherapy (Schagen et al., 1999). Brezden et al. (2000) found that cognitive function was lower in patients undergoing chemotherapy for breast cancer than in healthy women. These findings all indicate that cognitive function is important in patients with breast cancer undergoing chemotherapy. According to Kaplan (1995), attention is a cornerstone of cognitive function: it permits a person to perceive and think clearly, and maintain purposeful activity in daily life despite distractions in the internal or external environment (Cimprich, 1992). In other words, attentional function is a problem with women undergoing chemotherapy for breast cancer.

Mood disturbance (e.g., anxiety and depression) has been noted as a serious psychological problem in patients with cancer (Dow, 1996; Nam, 1987). Depression and anxiety reported by 25% of breast cancer patients (Hoopwood, Howell & Maguire, 1991; Pinder et al., 1993). Some researchers have noted that mood disturbance (anxiety and depression) affect cognitive function (Cunningham, 2003; Tannock, Ahles, Ganz, & van Dam, 2004), and it has been found empirically that mood disturbance in patients with breast cancer significantly weakens attentional function in daily life (Cull, Stewart & Altman, 1995; Letho & Cimprich, 1999; Schagen et al., 1999). Based upon the TOUS, mood disturbance is a psychological factor that influences attentional function characterized as performance in women undergoing chemotherapy for breast cancer.

Associated with breast cancer and its treatment, especially chemotherapy, women experience multiple symptoms, such as nausea, vomiting, fatigue, weight change, and hair loss (Olivitto, Gelmon & Kuusk, 1996). It was reported that 88% of patients felt nausea and 64% had one or more episodes of vomiting during the week after the administration of chemotherapy (Molassiotis, Mok, & Yam, 2002). The National Comprehensive Cancer Network reported that fatigue affects 70% to 100% of patients with cancer (Atkinson, 2000). For women undergoing chemotherapy for breast cancer, the incidence of fatigue was reported in approximately 90% of the women, and the level of fatigue remained stable throughout the treatment cycles (de Jong, Courtens, Abd-Saad, & Schouten, 2002). Increased body weight occurs in 50% to 90% of patients with breast cancer receiving adjuvant chemotherapy (Dow, 1996). Alopecia was reported as one of the most upsetting experiences

for women undergoing chemotherapy (Olivitto, 1996). From the perspective of the TOUS, the multiple symptoms described above, which occur in patients with breast cancer receiving chemotherapy, can be considered to directly influence performance, such as attentional function. Based upon the propositions of the TOUS, it can also be assumed that symptom experience can act as a mediator or moderator between mood disturbance (a psychological variable) and attentional function (performance) (Figure 1).

From the TOUS and a literature review on breast cancer, the following four hypotheses were tested in this study: (1) there is a direct relationship between mood disturbance and attentional function, (2) there is a relationship between symptom experience and attentional function, (3) symptom experience acts as a mediator on the relationship between mood disturbance and attentional function, and (4) symptom experience acts as a moderator on the relationship between mood disturbance and attentional function.

METHODS

Design and Sample

The present study used a cross-sectional, correlational design with a convenience sample of 125 women who were diagnosed with breast cancer, undergoing adjuvant chemotherapy, prescribed antiemetic medicine, over 18 years of age, and literate in Korean. None of the patients had metastatic breast cancer, mental or cognitive problems, or were taking medication known to either enhance or impair attention. According to the sample-size guidelines by Cohen (1988), the sample size of 125 in this study met the requirement for a Pearson's correlation analysis to detect a moderate effect ($r = 0.30$) at an alpha of 0.05 with a statistical power of 0.8, and the requirement for a standard multiple regression analysis with two predictors and a hierarchical multiple regression analysis with two predictors and one cross-product term to detect a moderate effect ($f2 = 0.15$) at an alpha of 0.05 with a statistical power of 0.8. The 125 women ranged in age from 30 to 69 years (mean 45.69 years, SD = 8.62 years), 86.4% of them were currently married, 64.0% had at least a high school education, and 68.8% of them had received a modified radical mastectomy (Table 1).

Instruments

Attentional function was measured using the Attentional Function Index (AFI) (Cimprich, 1992), which consists of fourteen 100-mm visual analogue scales ranging from 0 (not at all) to 100 (extremely well) on which subjects self-rate how well they are able to perform cognitive activities, such as planning daily activities, making decisions, getting started on tasks, and keeping a train of thought. A composite score is computed as the mean of the 14 scales, with higher scores indicating a higher level of attentional function. The range of

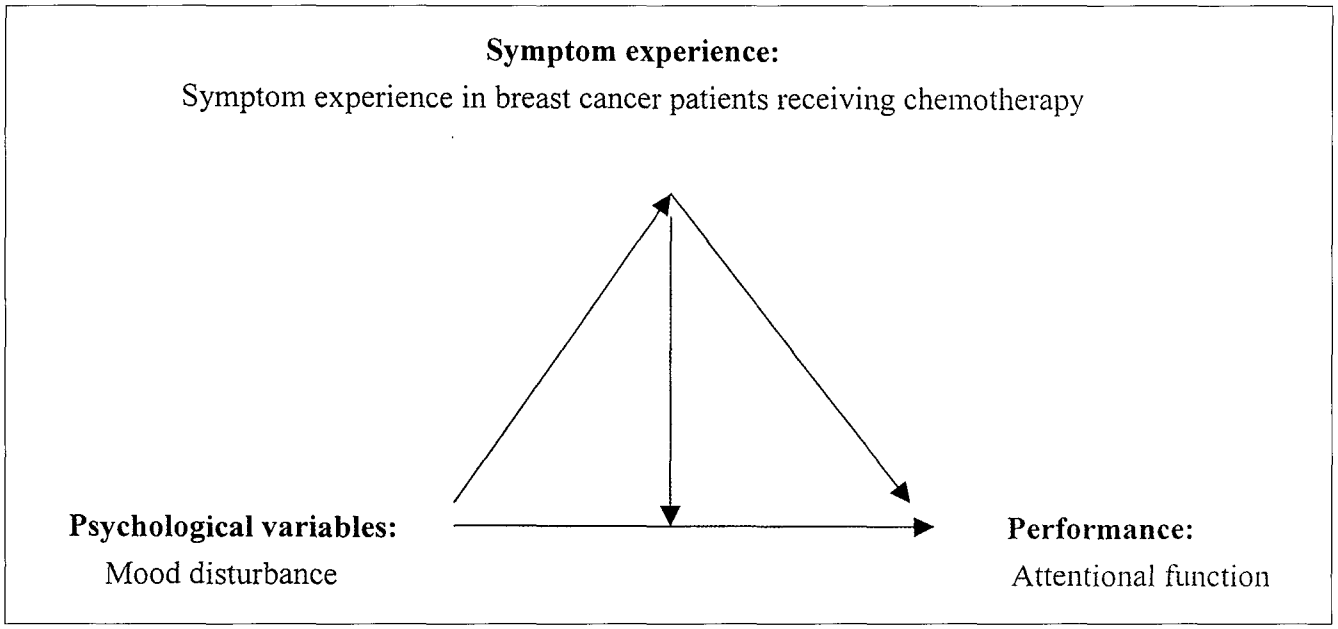

Figure 1. Framework for the study

possible scores was 0 to 100. Cronbach's alpha of the AFI was 0.94 with American women with breast cancer (Cimprich, 1993), and was 0.90 in this study.

Mood disturbance was measured using the Linear Analogue Self-Assessment Scale (LASAS) (Sutherland, Lockwood, & Cunningham, 1989), which consists of six 100-mm linear visual analogue scales for quantifying the following aspects of mood: anxiety, confusion, depression, fatigue, anger, and energy. A total score is obtained by summing the scores for the items (with the score of energy weighted negatively), and a higher score indicates a higher level of mood disturbance. Tests of concurrent validity with the Profile of Mood Status (McNare, Lorr, & Droppleman, 1971) yielded Spearman rank correlation coefficients of 0.79–0.83. Cronbach's alpha in a longitudinal study with six time points involving 121 women with breast cancer ranged from 0.74 to 0.87 (Irvine, Vincent, Grydon & Bubela, 1998); in the present study, Cronbach's alpha was 0.83. In the present study, the item measuring fatigue was not included in the scoring because there was a conceptual overlap between this item and the items used to measure symptoms experience (Samarel et al., 1996). Thus, the possible scores for the LASAS in this study ranged from −100 to 400.

Symptom experience was measured using the Symptom Experience Scale (SES) (Samarel et al., 1996). The SES consists of eight common symptoms associated with treatment for breast cancer: nausea, pain, appetite and sleep disturbances, fatigue, irregular bowel patterns, concentration difficulties, and appearance change. Each symptom is measured for its frequency, intensity, and associated distress, and hence the SES consists of a total of 24 items. The items are measured on a 5-point Likert-type scale containing descriptions of the frequency, intensity, and distress of the symptoms. When the SES was developed, its Cronbach's alpha was reported as 0.94, and its construct validity was established. In this study, Cronbach's alpha was 0.92. A total score is obtained by summing all the item scores, with higher scores indicating a more adverse symptom experience. In this study, the items of concentration were not included in the scoring due to a conceptual overlap with the AFI. Therefore, the range of possible scores was 0 to 84.

Data Collection Procedure

After receiving approval from the institutional review board of a medical center located in a South Korean city, participants were recruited from the outpatient clinic. Those who wished to participate were met in the waiting room or a small private room while they were waiting to be seen by a physician or while waiting for the administration of chemotherapy. During the contact, the purpose of the study and the nature of participation were outlined. If a patient articulated an understanding of the study and agreed to participate, the patient signed a consent form and was given a packet containing questionnaires and a stamped, self-addressed return envelope. The questionnaires were completed at home and posted in the envelope. A total of 181 patients agreed to participate and signed informed consent forms, and 130 questionnaires were returned (a response rate of 71.8%). Five questionnaires returned were not used as due to more than 45% of the data was missing, and thus a total of 125 women finally participated in this study.

Table 1. General characteristics and medical information (N = 125)

Variable	Category	n	Percentage
Age	30–39 years	32	25.6
	40–49 years	58	46.4
	50–59 years	24	19.2
	60–69 years	11	8.8
Marital status	Married	108	86.4
	Divorced/widowed/separated	15	12.0
	Missing	2	1.6
Educational status	Elementary school	16	12.8
	Middle school	24	19.2
	High school	57	45.6
	Baccalaureate and higher	23	18.4
	Missing	5	4.0
Type of surgery	Modified radical mastectomy	86	68.8
	Partial mastectomy	39	31.2

Data Analysis

The Statistical Package for the Social Sciences (Windows, version 10) was used to analyze the data. Descriptive statistics were computed for the study variables. Hypotheses 1 and 2 were tested using Pearson correlation analyses, hypothesis 3 was tested using single and multiple regression analyses (Olivitto, 1996), and hypothesis 4 was tested using hierarchical multiple regressions (Cohen & Cohen, 1983; Jaccard, Turris & Wan, 1990).

RESULTS

Descriptive statistics of the main variables are presented in Table 2. The mean scores of attentional function, symptoms experience, and mood disturbance were 57.84 (SD = 16.23), 28.85 (SD = 13.33), and 105.60 (SD = 90.83), respectively, indicating that the majority of the sample experienced low-to-moderate values of these measures. There was little skewness in the distributions of symptom experience and mood disturbance, meaning they were relatively symmetrical in distribution. Mood disturbance ($r = -0.46$, $p < 0.01$) and symptom experience ($r = -0.20$, $p < 0.05$) were negatively and significantly correlated with attentional function, which supported the hypothesis 1 and 2.

According to Baron and Kenny (1986), the following three regression equations are needed to test for a mediation effect (i.e., hypothesis 3) in this study: (1) the presumed mediator (symptom experience) regressed on the independent variable (mood disturbance), (2) the dependent variable (attentional function) regressed on the independent variable (mood disturbance), and (3) the dependent variable (attentional function) regressed both on the independent variable (mood disturbance) and on the mediator (symptom experience). To establish a mediation effect, the three regression equations must be statistically significant. Then, the beta coefficient of the independent variable (mood disturbance) on the dependent variable (attentional function) must be lower in the third equation (symptom experience controlled) than in the second equation (symptom experience not controlled).

The three regression equations calculated for hypothesis 3 (Table 3) produced the following results: (1) mood disturbance significantly accounted for the variance in symptom experience ($R = 0.39$, $F = 22.10$, $p < 0.001$),

Table 2. Descriptive Statistics of the Main Study Variables

Variable/subdomain or subitem	M	SD	Actual range (Possible range)	Skewness/SE skewness
Attentional function	57.84	16.23	21.19-94.56 (0-100)	0
Symptom experience	28.85	13.33	0-62 (0-84)	1.15
Nausea	4.48	2.69	0-12 (0-12)	
Pain	3.90	2.47	0-12 (0-12)	
Appetite	4.22	3.40	0-12 (0-12)	
Sleep	3.54	2.95	0-12 (0-12)	
Fatigue	4.87	2.30	0-12 (0-12)	
Bowel pattern	3.99	3.12	0-12 (0-12)	
Appearance	3.79	2.74	0-12 (0-12)	
Mood disturbance*	105.60	90.83	-71-312 (-100-400)	0.31
Anxiety	40.16	25.91	2-90 (0-100)	
Confusion	33.88	24.97	1-88 (0-100)	
Depression	38.19	26.79	2-92 (0-100)	
Anger	35.14	27.08	0-93 (0-100)	
Energy	41.78	23.72	2-99 (0-100)	

* The score of energy was negatively weighted when scoring the mood disturbance.
Note: SE skewness = standard error of skewness.

Table 3. Regressions for the Test of a Mediation Effect of Symptom Experience

		β	R	F
Regression equation 1	Mood disturbance	0.39	0.39	22.10*
Regression equation 2	Mood disturbance	-0.46	0.46	33.02*
Regression equation 3	Symptom experience	0.008	0.46	16.41*
	Mood disturbance	-0.46		

* $p < 0.001$

(2) the regression equation of the relationship of mood disturbance to attentional function was significant ($R = 0.46$, $F = 33.02$, $p < 0.001$), for which the beta coefficient of mood disturbance was -0.46, and (3) mood disturbance and symptom experience simultaneously accounted for the variance in attentional function ($R = 0.46$, $F = 16.41$, $p < 0.001$). Mood disturbance significantly contributed to the explanation of attentional function for the third equation (beta coefficient = -0.46, $t = -5.18$, $p < 0.001$) when symptom experience was controlled. The beta coefficient of mood disturbance for the third equation was not lower than that for the second equation, thereby providing no support for the hypothesis 3.

To test the hypothesis 4, a cross-product term between mood disturbance and symptom experience was calculated by multiplying their scores. Prior to forming the cross-product term, the scores of mood disturbance and symptom experience were centered by subtracting the respective means from each variable to prevent the occurrence of multicollinearity between the predictive variables (mood disturbance and symptom experience) and the cross-product term (Jaccard, Turris, & Wan, 1990). In step 1, mood disturbance and symptom experience were entered simultaneously in the regression equation, and then in step 2 the cross-product term was entered into the regression equation (Table 4). After step 1, mood disturbance and symptom experience significantly accounted for 21% of the variance in attentional function, and after step 2 the value of R was statistically significant [$F (3, 121) = 12.66$, $p < 0.001$]. Mood disturbance, symptom experience, and the cross-product term together significantly accounted for 24% of the variance in attentional function. The change in R^2 for the cross-product term was 0.03 ($p < 0.05$), indicating that the hypothesis 4 was supported.

When there is a statistically significant moderator effect, Cohen and Cohen(1983) suggested interpreting the influence of the independent variable on the dependent variable at "low," "medium," and "high" values of a moderator, where "low" might be defined as one standard deviation below the mean of the moderator, "medium" as the mean, and "high" as one standard deviation above the mean. Table 4 shows a multiple regression equation that includes mood disturbance, symptom experience, and the cross-product term, along with the corresponding unstandardized regression coefficient (b) and a constant. From the multiple regression equation, simple regression equations were computed at plus one standard deviation, at the mean, and at minus one standard deviation for high, medium, and low levels of symptom experience, respectively (Cohen & Cohen, 1983; Jaccard, Turris, & Wan, 1990). Table 5 displays the unstandardized simple regression coefficients for mood disturbance on attentional function at low, medium, and high levels of symptom experience. To identify whether

Table 4. Hierarchical Multiple Regression of Mood Disturbance, Symptom Experience, and Cross-product Term on Attentional Function

Step/variable entered		R	Overall F	R^2	F change
Step 1	Mood disturbance and				
	Symptom experience	0.46	F (2, 122) = 16.41**	0.21	16.41**
Step 2	Cross-product term	0.49	F (3, 121) = 12.66**	0.24	4.28*
Coefficient		b	t		
	Mood disturbance	-0.081	-5.26**		
	Symptom experience	-0.037	-0.03		
	Cross-product term	0.022	2.06*		
	Constant	56.802			

* $p < 0.05$, ** $p < 0.001$

Table 5. Unstandardized Regression Coefficients for the Relationship of Mood Disturbance to Attentional Function at High, Medium, and Low Levels of Symptom Experience

Symptom experience	b	SE	t
High	-0.052	0.1823	-0.285
Medium	-0.081	0.0154	-5.229*
Low	-0.110	0.1823	-0.603

* $p < 0.01$

the simple regression coefficients were statistically different from zero, the coefficients were divided by their associated standard error using a Bonferroni procedure (Aldwin, 1994) at an alpha level of 0.01 (for more details on the calculation of standard error, refer to Aiken and West, 1999). The coefficients at the medium level of symptom experience were statistically different from zero: when mood disturbance increased by one unit at this level of symptom experience, attentional function decreased by 0.081 units. However, the coefficients did not differ significantly from zero when symptom experience was low or high, indicating that mood disturbance and symptom experience were not related to attentional function when the level of symptom experience was low or high.

DISCUSSION

In the present study the mean score of attentional function (57.84, SD = 16.23) was similar to the score of 57.0 (SD = 16.0) in a study of 32 women who underwent surgery for localized breast cancer (Cimprich, 1992). However, these scores were lower than the scores of 63.7 (Cimprich, 1999) and 67.3 (Letho & Cimprich, 1999) reported for studies with women awaiting breast cancer surgery. It may therefore be conjectured that attentional function is lower in women who have undergone or who are undergoing treatments for breast cancer than in women awaiting treatment for the disease.

In this study participants experienced moderately low level of symptoms. This is consistent with studies involving 301 Korean cancer patients (Hur et al., 2002) and American breast cancer patients undergoing chemotherapy (Burger, 1998). Participants in the present study also had a low-to-moderate level of mood disturbance, similar to a study with American women undergoing radiotherapy for breast cancer (Irvine et al., 1998).

In this study, women who experienced a higher level of symptoms had a lower level of attentional function. This finding is similar to a previous study (Cimprich, 1999) in which the number of symptoms was negatively correlated with attentional function. Also, the women in the present study with higher level of mood disturbance had a lower level of attentional function. This is consistent with the notion of that mood disturbance in cancer patients tends to affect attentional function (Brezden et al., 2000), and with empirical studies involving patients with breast cancer (Cimprich, 1993; 1999). Thus, effectively restoring the attentional function of patients with cancer requires the levels of symptoms and mood disturbance to be considered as directly related factors.

This study showed that the relationship of mood disturbance to attentional function was moderated by symptom experience: mood disturbance was negatively related to attentional function when the level of symptom experience was at medium, but not when it was either low or high. This is congruent with the notion that the relationship between mood and cognitive function, particularly attentional function, depends on moderating variables (Letho & Cimprich, 1999). Testing a potential moderator effect is clinically important since a moderator effect leads to the identification of subgroups that are either more resilient or more vulnerable under certain conditions (Lewis & Kliewer, 1996). In the present study, women with a higher level of mood disturbance were at a higher risk of impaired attentional function when they experience medium level of symptoms. Clinically, this indicates that oncology nurses should consider the level of symptom experience when applying interventions - such as reduction of distraction or environmental intervention (Cimprich, 1993; Letho & Cimprich, 1999) - to decrease the impact of mood disturbance on attentional function for women undergoing chemotherapy for breast cancer.

While a moderator variable specifies when or under what conditions a predictor variable influences a dependent variable, a mediator variable shows the mechanism between an independent variable and a dependent variable (Baron & Kenny, 1986). In the present study, symptom experience did not function as a mediator between mood disturbance and attentional function - the demonstration of a mediation effect requires a strong relationship between a mediating variable and a criterion variable (Baron & Kenny, 1986). However, in this study there was a weak correlation between symptom experience and attentional function (r = 0.20), which may be attributable to the conservative deletion of those items of concentration from the SES that conceptually overlap with the AFI. The strength of the relationship between symptom experience and attentional function needs further investigation.

The present study has some limitations. First, the SES and AFI were developed for American patients with cancer, but were used here with Korean patients with cancer after translation into Korean using a back translation technique. Although the values of Cronbach's alpha

for the measurements with Korean women with cancer were high in this study, the validity of the measurements was not tested with Korean patients with cancer and hence the internal validity of this study design has not been verified. Second, in this study attentional function was measured using a self-rated measurement, the AFI. Some studies have reported a weak relationship between the results of objective tests and the subjective reports of patients about their cognitive functioning (Cull et al., 1995; van Dam et al., 1998). This discrepancy might be attributable to the use of a self-reporting cognitive function measurement, such as the cognitive subdomain of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30; Aaronson et al., 1993) developed to measure quality of life of patients with cancer (Cull et al., 1995), thereby preventing coverage of the full range of concept of cognitive function. It is therefore recommended that future studies use both subjective and objective instruments to measure attentional function.

In summary, this study shows that each mood disturbance and symptom experience is directly related to the attentional function of women undergoing chemotherapy for breast cancer. Symptom experience did not act as a mediator between mood disturbance and attentional function, but it did act as a moderator between mood disturbance and attentional function: patients with a higher level of mood disturbance exhibited a lower level of attentional function when experiencing symptoms at the level of medium, but not when their symptoms were either high or low. This suggests that clinical interventions for attenuating the influence of mood disturbance on attentional function may be effective only in women experiencing symptoms at the medium level.

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