

[ORIGINAL ARTICLE]

Short-term Changes in Self-rating Depression Scale Scores after Smoking Cessation in Neurotic Patients

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Abstract:

Objective The psychological status is a key factor in smoking continuance. However, details on short-term changes in mild depressive states after smoking cessation (SC) are still unknown. The purpose of the present study was to investigate these short-term changes.

Methods A total of 989 patients who visited our SC Clinic were assessed using the Zung Self-Rating-Depression-Scale (SDS), an official instrument to measure depressive tendencies. The participants were classified into normal and neurotic groups based on their SDS scores during their initial visit; they were assessed again 2, 4, 8, and 12 weeks thereafter.

Results The majority of patients in the neurotic group were women. These patients were also younger, with a higher nicotine dependence, and presented with a lower successful SC rate than the patients in the normal group. A decrease in SDS scores after starting the SC treatment was observed only in the neurotic group, especially during the first two weeks. In patients who continued to smoke, no improvement in depressive tendencies was noted in this period.

Conclusion Depressive tendencies of patients with neurosis improve in the initial stages of the SC treatment (i.e., within two weeks after starting the treatment). This finding fills the mentioned knowledge gap regarding the effects of SC on mild depressive states in the short term.

Key words: smoking cessation, smoking, nicotine dependence, depression

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Introduction

Smoking is an important risk factor for non-commutable diseases, such as cancer, chronic obstructive pulmonary disease, diabetes mellitus, cerebral infarction, and myocardial infarction. Advising smokers to quit smoking is critical for reducing the risk of these diseases and thus crucial for all physicians involved in internal medicine. However, smokers in a depressive state have difficulty quitting smoking. Furthermore, smoking and depression form a vicious cycle based on close inter-relationships, synergistically raising the risk of non-commutable diseases.

The number of individuals suffering from depression is increasing annually, which is a major social issue (1). There is a clear correlation between smoking and depression. Individuals with depressive tendencies are, in fact, twice as likely to be smokers (often heavy smokers) (2, 3). The majority (85%) of smokers believe that smoking relieves stress (4). However, smokers feel calm simply because the symptoms of their nicotine withdrawal have temporarily abated (5). In fact, prolonged smoking increases the likelihood of developing psychiatric disorders, such as panic disorders, anxiety disorders, and major depression (6, 7). Furthermore, individuals with high depressive tendencies are more likely to start smoking than others (8).

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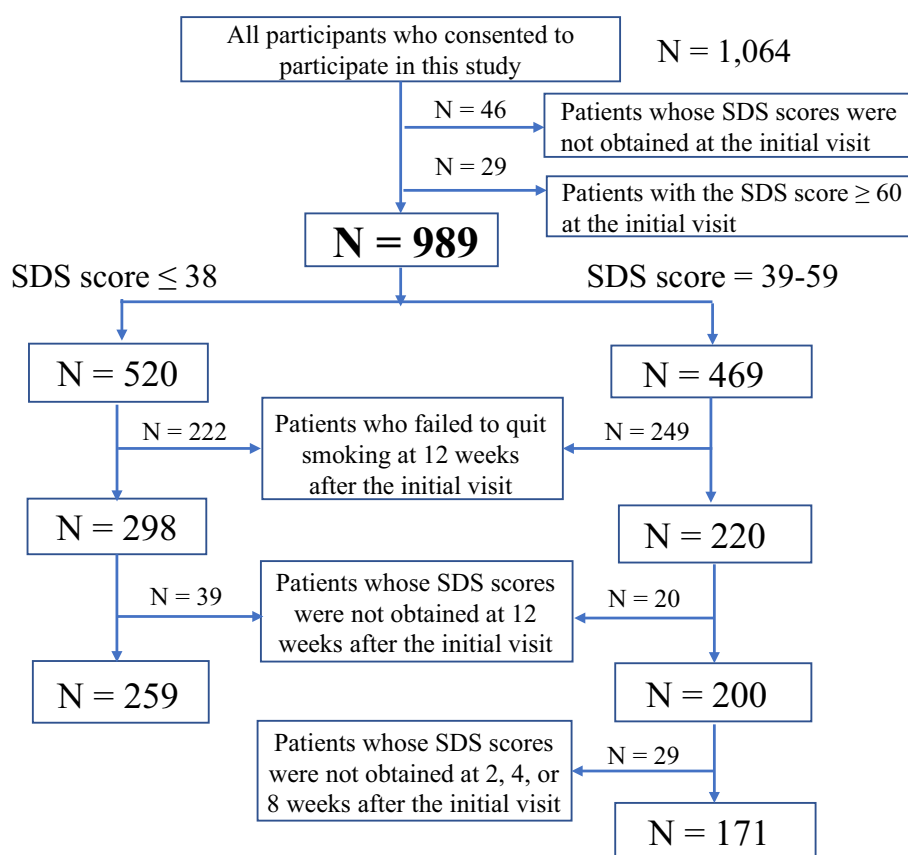


Figure. Flow chart of study participants.

Quitting smoking is known to improve the quality of life and support positive emotions while reducing depression, anxiety, and stress (4, 5, 9). Quitting smoking can also reduce the risk of developing depressive symptoms to the same level found in non-smokers (10). Most of the studies regarding the effects of quitting smoking on depression have examined an improvement over a relatively extended period of several months to several years (4, 5). When mentally unstable patients with depression quit smoking, their depression is known to temporarily worsen soon after quitting, regardless of the type of nicotine replacement used [a nicotine patch or varenicline (11)]. The authors previously found that over half of patients initially visiting the Smoking Cessation Clinic had neurosis (mild depressive state) but no history of a psychiatric disorder (12). How depressive states change soon after the start of smoking cessation (SC) treatment and the detailed course of these changes over time are unclear for patients with neurosis.

Thus, the present study examined the short-term changes in depressive state (in the order of weeks) after patients with neurosis quit smoking while visiting the Smoking Cessation Clinic to receive drug therapy. Our initial hypothesis was that depressive tendencies would temporarily worsen due to nicotine withdrawal soon after SC and then gradually improve over time.

Materials and Methods

Subjects

This prospective study was carried out at the National Hospital Organization, Kyoto Medical Center between May 2007 and February 2016.

Participants were 1,064 patients who visited Kyoto Medical Center's Smoking Cessation Clinic to receive treatment and consented to participate in this study. SC is not recommended for patients whose psychiatric condition is unstable. In fact, to achieve SC in such patients, we would need support from psychiatrists during SC therapy. However, a psychiatric intervention would modify the natural course of changes in Self-Rating Depression Scale (SDS) scores. Therefore, patients with extreme depressive tendencies (29 patients: 60 points or higher) were excluded from the present study. Patients whose initial SDS scores were unavailable (46 patients) were also excluded. As a result, we included 989 participants in our study (Figure).

Procedures

Anti-smoking treatment was administered according to the Standard Procedures for Anti-Smoking Treatment (originally issued in March 2006 by the Japanese Circulation Society, Japan Lung Cancer Society, and Japanese Cancer Association). The patients were examined on their first visit and 2,

4, 8, and 12 weeks (three months) thereafter while being treated with transdermal nicotine patches or oral varenicline. On repeated visits, continuity in SC was checked, and specific advice regarding the continuation of the cessation treatment was provided by a nurse and a doctor.

At the end of the three-month anti-smoking treatment period, we assessed whether or not SC had been maintained. A patient was judged to have succeeded in quitting smoking when presenting with an expiratory carbon monoxide (CO) concentration of ≤ 7 parts per million (ppm) and reporting that they had not smoked for more than 1 week since starting the treatment. An attempt to quit smoking was considered unsuccessful when the patient stopped visiting during the treatment period or continued visiting but failed to quit smoking.

Various parameters were evaluated in these patients at the time of their initial consultation and after SC treatment completion (at 12 weeks after the initial consultation). At each visit, a nurse measured the expiratory CO concentration using the EC50 Micro Smokerlyzer[®] (Bedfont Scientific, Kent, UK), which measures the end-tidal CO electrochemically, with a reported precision rate of $< 2\%$ (13). On the initial consultation, nicotine dependence was assessed using the Fagerström Test for Nicotine Dependence (FTND), a global standard test for assessing physical nicotine dependence (14-16). Scores range from 0 to 10, with higher scores indicating more severe nicotine dependence. The number of cigarettes smoked per day was determined by asking the smoker, "On average, in the past month, how many cigarettes did you smoke per day?" The Brinkman index was calculated as the daily number of cigarettes multiplied by smoking years.

To assess the severity of depressive states, we used the Zung SDS, an official instrument to measure depressive tendencies, in the form of a self-report questionnaire. The SDS has proven to be a useful tool for tracking changes in depression over time in research studies or in the clinical course following treatment (17, 18). In particular, we used the Japanese version, which has also proven to be reliable, as the test-retest correlation was 0.85, the split-half correlation was 0.73, and Cronbach's alpha was 0.82 (19, 20). During each visit, a member of the study staff reviewed the questionnaires after they had been completed by the patients themselves. If any omissions or mistakes were found, the patients were asked to fill out the questionnaire again (12, 21). A higher score indicated a more severe depressive state.

The classification by SDS score in the present study was performed according to the classification of the Japanese version of the Zung SDS, which presents the SDS score as the raw score rather than the index (19). The mean \pm standard deviation of the SDS score in Japanese was 35 ± 12 points in the normal control group versus 49 ± 10 points in the neurotic patient group. Therefore, the ranges of the SDS score were 23-47 points in the normal control group and 39-59 points in the neurotic patient group. Based on these ranges

identified by Zung, the patients were divided into 2 groups: the normal (score ≤ 38) or neurotic (score = 39-59) group.

All statistical analyses were conducted by a professional statistician using the Statistical Package for Social Sciences (SPSS) software program, version 17.0 (SPSS, Chicago, USA). Normality was assessed using the Shapiro-Wilk test. Various data from initial visits to the clinic were compared using Fisher's exact test, an independent *t*-test, or a Mann-Whitney *U* test. The SDS scores of patients with neurosis and those of normal patients were compared. Changes in data were determined before and after quitting smoking. Data with a normal distribution were compared using a paired *t*-test, and data with a non-normal distribution were compared using Wilcoxon's signed-rank test. Overall, the changes in SDS scores were compared using a one-way analysis of variance, and changes at different time points were compared using a paired *t*-test (with Bonferroni's correction).

Ethical aspects

Informed written consent was obtained from all participants, who took part in this study on a voluntary basis. The study data were anonymized by excluding personal identifiers. The Ethical Review Board of the National Hospital Organization, Kyoto Medical Center approved the study protocol.

Results

Of the 989 participants in this study, 24 (2.4%) were on an anti-depressant at their initial visit to the Smoking Cessation Clinic, and 81 (8.2%) were on a tranquilizer or sleep aid.

We classified 520 patients (52.6%) into the normal group and 469 patients (47.4%) into the neurotic group. Items assessed during the initial visit were compared for patients with neurosis and those without, and the results of that comparison are shown in Table 1. A significantly greater number of patients with neurosis were women ($p=0.009$). The neurotic patients were younger ($p<0.001$), had smoked for less time (in years: $p<0.001$), and had higher Fagerström Test for Nicotine Dependence (FTND) scores ($p=0.008$) than those without neurosis at the initial visit.

To investigate changes in SDS scores after successful SC, individuals who continued to smoke 12 weeks after the start of SC treatment and individuals who decided to stop visiting the Smoking Cessation Clinic (222 patients without neurosis, 249 patients with neurosis) were excluded, including only individuals who successfully quit smoking. The rate at which individuals had successfully quit smoking by 12 weeks after the start of SC treatment was 68% (298/520) in the normal group and 55% (220/469) in the neurotic group. Patients in the neurotic group successfully quit smoking at a significantly lower rate than those in the normal group ($p<0.001$).

If the SDS scores before and after quitting smoking (dur-

Table 1. Patient Data before Smoking Cessation (n=989).

	normal group	neurotic group	p value	
Female	27.5% (143/520)	35.4% (166/469)	0.009	a
Age	60.2±12.0	55.7±13.7	<0.001	b
Daily cigarette consumption (n)	23.7±13.5	23.9±10.6	0.832	b
Duration of smoking (years)	38.9±11.5	35.2±12.7	<0.001	b
FTND score	6.7±2.3	7.0±2.0	0.008	b
SDS score	30.6±4.9	46.4±5.2	<0.001	b
CO (ppm)	13.0 [9.0, 21.0]	15.0 [9.0, 22.0]	0.078	c

Data are presented as the mean±standard deviation or median [interquartile range].

p value: a, Fisher's exact test; b, unpaired *t*-test; c, Mann-Whitney U test.

FTND score: Fagerström test for nicotine dependence score, SDS test score: self-rating depression scale test score, CO: carbon monoxide

Table 2. Patient Data before and after Successful SC.

Normal group (n=259)				
	Baseline	After three months	p value	
SDS score	30.7±4.7	31.3±7.7	0.132	a
CO	13.0 [9.0, 20.3]	2.0 [1.0, 3.0]	<0.001	b
Neurotic group (n=200)				
	Baseline	After three months	p value	
SDS score	46.4±5.2	42.4±8.6	<0.001	a
CO (ppm)	14.0 [9.0, 21.0]	2.0 [1.0, 3.0]	<0.001	b

Data are presented as the mean±standard deviation or median [interquartile range].

p value: a, paired *t*-test; b, Wilcoxon signed rank test.

SC: smoking cessation, SDS score: self-rating depression scale score, CO: carbon monoxide

ing the initial visit and 12 weeks after the start of SC treatment) were unavailable for individuals who successfully quit smoking, those individuals were excluded. The SDS scores before and after quitting smoking were available for 259 patients without neurosis and 200 patients with neurosis (Figure). The items assessed during the initial visit were compared for these patients before and after they quit smoking, and the results of that comparison are shown in Table 2. Concentrations of exhaled CO had decreased significantly. After quitting smoking, the SDS scores of patients without neurosis did not show significant changes compared to the baseline. In contrast, a significant improvement (decrease) in the SDS scores of patients with neurosis was noted.

If data from two, four, or eight weeks after the start of SC treatment were unavailable for patients with neurosis who successfully quit smoking, the patients were excluded. The SDS scores from 5 visits to the Smoking Cessation Clinic (initial visit and two, four, eight, and twelve weeks later) were available for 171 patients (Figure). Changes in the SDS scores for these patients were examined over time, the results of which are shown in Table 3. After quitting smoking, subjects' SDS scores improved (decreased) significantly over time compared to the baseline. This improve-

ment was already evident two weeks after the start of SC treatment ($p<0.001$).

The SDS scores for 2 visits to the Smoking Cessation Clinic - an initial visit and a visit 2 weeks after the start of SC treatment - were available for 48 patients with neurosis who continued to smoke. Table 4 presents the baseline data of these patients in comparison with neurotic patients who succeeded in SC (Table 3, $n=171$). The daily cigarette consumption, SDS score, and respiratory CO concentration were higher in neurotic patients who failed to stop smoking than in those who succeeded with cessation (Table 4). However, the SDS scores were similar between the two patient groups. In contrast to the significant decrease in the SDS scores in the successful neurotic patient group (Table 3), those in the failure group did not significantly decrease (SDS-2wks: 43.8 ± 8.1 points $p=0.185$).

Discussion

Characteristics of highly depressed smokers

In the current study, about half of the participants were smokers with highly depressive tendencies (i.e., patients

Table 3. Changes in SDS Scores of Patients with Neurosis Three Months after Successfully Quitting Smoking (n=171).

	Data	p value				
		among group	vs. 0M	vs. 2wks	vs. 1M	vs. 2M
		<0.001				a
SDS_0M	46.7±5.3		-	-	-	-
SDS_2wks	44.5±7.5		0.001	-	-	-
SDS_1M	43.7±8.1		<0.001	>0.999	-	-
SDS_2M	43.2±8.6		<0.001	0.323	>0.999	-
SDS_3M	42.6±8.7		<0.001	0.016	0.301	>0.999

Data are presented as the mean±standard deviation.

p value: a, one-way analysis of variance; b, a paired *t*-test (with a Bonferroni correction).

SDS score: self-rating depression scale score, 0M: baseline, 2wks: two weeks, 1M: one month, 2M: two months, 3M: three months

Table 4. Baseline Data of Neurotic Patients Who Succeeded Smoking Cessation (n=171) and Those Failed to the Cessation (n=48).

	successful group	failure group	p value	
Female	33.3% (57/171)	41.7% (20/48)	0.308	a
Age	56.4±14.1	56.8±12.2	<0.884	b
Daily cigarette consumption (n)	23.1±10.6	27.0±12.4	0.033	
Duration of smoking (years)	35.3±12.6	37.3±11.6	0.331	b
FTND score	6.6±2.1	7.5±1.9	0.014	b
SDS score	46.7±5.3	45.1±4.6	0.067	b
CO (ppm)	14.0 [9.0, 21.0]	17.5 [11.0, 31.0]	0.004	c

Data are presented as the mean±standard deviation or median [interquartile range].

p value: a, Fisher's exact test; b, unpaired *t*-test; c, Mann-Whitney U test.

FTND score: Fagerström test for nicotine dependence score, SDS test score: self-rating depression scale test score, CO: carbon monoxide

with neurosis). This finding is consistent with the results of a previous study by the authors, which found that a mild depressive state was ubiquitous among patients visiting the Smoking Cessation Clinic (12). In the present study, the majority of patients with neurosis were women, and they had higher nicotine dependence (FTND score) than patients without neurosis. A study has reported that women typically present with more severe depressive tendencies than men do and have a depression rate twice that found in men (22, 23). In addition, other studies have indicated that the severity of depressive symptoms is positively correlated with the degree of nicotine dependence (2, 23). The results of this study are consistent with those findings. Our findings are also consistent with the results of other previous studies, which have reported that depressed or neurotic smokers typically continue to smoke (21, 24, 25).

Depressive states improved after SC

After quitting smoking, depression, anxiety, and stress typically improve over the long term (5, 21). A study has reported that quitting smoking results in greater improvement in individuals with psychiatric disorders than in those without (5). Furthermore, the extent to which it improves depression is comparable to or greater than the extent to which

drug therapy (i.e., an antidepressant) alleviates a mood or anxiety disorder (5). Nevertheless, a study has reported that trying to quit smoking when one is mentally unstable results in a worsening (albeit temporary) of one's mental state in the short term. In contrast, it was not known how depressive states change after patients with mild depressive tendencies quit smoking. In the present study, no significant improvement in depressive states was noted in patients without neurosis 12 weeks after the start of the SC treatment. In contrast, a significant improvement was noted in patients with neurosis. Mentally unstable patients (SDS score of ≥ 60 points) were excluded from this study, and 98% of the participants were not on an anti-depressant. Thus, we believe this study is the first to find that quitting smoking improves depressive tendencies in patients with neurosis.

Changes in depression levels soon after quitting smoking

Numerous studies have found that depression improves after quitting smoking, but most of those studies have examined changes over the long term (e.g., several months to several years after SC) (5, 26). A study reported that depressive symptoms improve one month after quitting smoking in patients with psychiatric disorders (27). The current study

examined the course of depressive states in patients with neurosis in the first few weeks of a SC treatment, while they continued to visit the Smoking Cessation Clinic to receive drug therapy. The results suggest that depressive states in patients with neurosis may improve in the initial stages of quitting smoking (i.e., just two weeks after the start of the SC treatment). Depressive states continued to gradually improve afterwards, but the highest improvement rate was observed in the first two weeks.

No significant improvement was noted in the SDS scores of patients with neurosis who continued to smoke two weeks after the start of the SC treatment. This suggests that the success or failure of SC treatment for highly depressed smokers might be predictable based on whether or not depressive tendencies improve two weeks after quitting smoking. Smokers whose depressive tendencies did not improve soon after SC treatment began might need additional intervention, such as psychiatric support.

The results of this study have demonstrated that the depressive tendency improves in the initial stages after quitting smoking (i.e., just two weeks after the start of SC treatment). This finding contradicts our initial hypothesis that depressive tendencies should temporarily worsen, due to nicotine withdrawal, soon after SC and then gradually improve over time.

Limitations

This study was a single center trial in Japan and showed that two weeks of SC significantly reduced SDS scores in neurotic patients. Whether this reduction serves as a predictor of successful SC or occurs as a result of SC for two weeks is currently unclear. The cause-effect relationship should be clarified by further studies. Typically, half of smokers who continue to smoke decide to stop visiting the Smoking Cessation Clinic. The current study was unable to obtain data on changes in the SDS scores of smokers once they decided to stop visiting the Smoking Cessation Clinic. In other words, whether or not depressive tendencies may temporarily worsen during SC treatment could not be determined for patients who decided to stop visiting the Smoking Cessation Clinic. The severity of depressive tendencies is strongly associated with smoking continuance, so most of these patients are likely to continue smoking. Nevertheless, the possibility that patients who decide to stop visiting the clinic due to temporary worsening of depressive tendencies may successfully quit smoking cannot be ruled out. Thus, whether individuals who decide to stop visiting the clinic are able or unable to quit smoking and changes in depressive states after quitting smoking are topics that need to be studied further in the future.

Conclusion

In patients with neurosis who benefited from SC treatment, an improvement in the depressive status was noted as soon as two weeks after the beginning of SC treatment. The

depression levels continued to gradually improve over time, but the highest extent of improvement was observed in the first two weeks. In patients who did not benefit from the SC treatment or who decided to stop visiting the Smoking Cessation Clinic after four weeks, an improvement in depressive tendencies was not noted two weeks after beginning the SC treatment. Thus, the ability or inability of patients with neurosis to quit smoking might be predictable based on whether or not their depressive tendencies improve two weeks after the start of SC treatment.

The authors state that they have no Conflict of Interest (COI).

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