

The effectiveness of individual interventions on smoking cessation of chronic obstructive pulmonary disease patients

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Abstract

Context: Guided self-change (GSC) is theory-driven based on cognitive-behavioral change models such as transtheoretical model (TTM) and can be applied with nicotine replacement therapy (NRT) for behavioral change of smoking in chronic obstructive pulmonary disease (COPD) smokers.

Aims: This study aimed to investigate the individual GSC, NRT, and GSC-NRT on smoking cessation of COPD patients.

Settings and Design: This randomized clinical control trial study was carried out in Imam Khomeini Hospitals in Mazandaran province in 2016–2017.

Materials and Methods: Three- group block randomized controlled trial, comparing GSC ($n = 20$), NRT ($n = 20$), and GSC-NRT ($n = 20$) in smoking cessation and other related variables COPD smokers with follow-up to 29-week.

Statistical Analysis Used: Descriptive statistics, Chi-square, and repeated measures ANOVA test were used to analyze the data.

Results: The GEE model revealed that GSC reduced the odds of quitting smoking rate compared to the NRT group (odds ratio = 0.31, 95% confidence interval: 0.022–0.545, ES = 0.20). Furthermore, the TTM questionnaire, the Fagerstrom test for nicotine dependence, and spirometry variables were evaluated in the three groups. The recovery in nicotine dependency, the exhaled carbon monoxide and spirometry variables was more pronounced in the GSC and GSC-NRT groups than in the NRT over 29 weeks after the treatments. Cons (PV = 0.009, ES = 0.52), pros (PV = 0.04, ES = 0.12), experiential process (PV = 0.005, ES = 0.18), counterconditioning (PV = 0.04, ES = 0.12), stimulus control (PV = 0.004, ES = 0.19), environmental-reevaluation (PV = 0.0001, ES = 0.30), and habitual craving (PV = 0.004, ES = 0.19) were significant across the three groups.

Conclusion: The interventions in the GSC and combined GSC-NRT groups were significantly more effective than in the NRT group in TTM variables, and GSC and combined GSC-NRT were equally effective in smoking cessation rate.

Keywords: Chronic obstructive pulmonary disease, Nicotine replacement therapy, Smoking cessation, Transtheoretical model

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INTRODUCTION

Effective approaches to improvement of pulmonary function in chronic obstructive pulmonary disease (COPD) are involved in studies on tobacco control programs.^[1] Such approaches are theory driven and generally based on the behavioral change models.^[2] One of these models in quitting smoking is the transtheoretical model (TTM).^[3,4] TTM is a most framework used for quitting smoking.^[5,6] Numerous questionnaires were provided based on the TTM to assess what interventions could change people's behaviors.^[7] TTM improved using higher than 300 psychotherapy theories, and was validated and popularized behavior change over the last 20 years.^[8] The TTM comprises four structures, including stage of change, processes of change, decisional balance, and temptation.^[9] In fact, this model suggests a structure in which it is assumed that health behavior change contains five stages of change, ten processes of change, two decisional balance, and three temptation domains.^[2,10] The process of change is one of the main structures of the TTM and assess the improvements of behavior changes from the preparation stage to the action phase.^[10,11] Temptation refers to a psychological state that might encourage an individual to cigarette smoking if threatened with a challenging condition.^[12] As expected, the nine items of the temptation structure comprise three subscales of social situation, habitual craving, and negative affect situation.^[13] This model suggests that the three subscales should be considered for quitting smoking interventions.^[14,15] Meanwhile, decisional balance showed two subscales: pros and cons,^[16] that shows benefits and harms of decision-making for quitting smoking.^[14] The decisional balance of the TTM suggests that pros and cons are the main parts of the model.^[17] Based on the stages of change model, people are in various stages of smoking cessation behavior,^[17] including precontemplation, contemplation,^[18] preparation,^[19] action,^[20] and maintenance.^[21] Guided self-change (GSC) is a shortened cognitive-behavioral motivational treatment.^[22,23] Since individually GSC has not been applied in Iran yet, a randomized controlled clinical trial was carried out by the researchers to study the effectiveness of GSC for decreasing smoking in COPD patients in Imam Khomeini Hospital in Sari in northern Iran.

MATERIALS AND METHODS

Based on the previous study and considering the mean and standard deviation (SD) of the difference between the reduction in the number of cigarettes equal to 1 and 0.8 cigarettes after GSC intervention, moreover, considering the power of study equal to 80% and the probability of the first type error equal to 0.01, A sample size of 60

participants was calculated (conferring 80% power to detect an absolute difference of 10% in cessation rates across the three groups) and 20 patients considered for each group.^[24] Furthermore, according to the study of Sharifirad *et al.*, and considering the ratio of smoking stopped people in the intervention and nonintervention groups equal to 46% and 4%, and considering the power of study equal to 80% and the probability of the first type error equal to 0.05, respectively, the sample size is calculated as 15 in each group.^[25] Increasing the power of the study, we assigned 20 participants in each group that one patient in each group, discontinued the study, after allocation.

Block randomization with a block size of 6 and 9 was used for the assignments [Figure 1]. The randomization was conducted through SPSS software (version 16, SPSS Inc., Chicago, IL, USA), by an independent investigator with no contact with the patients or researchers. The number of the participants and the type of intervention were packed in a closed packet, and then they were disclosed by visiting the patient and after a primary assessment for inclusion criteria.

The nicotine cartridges included 2 mg nicotine/ml. First, the participants were randomly allocated to nicotine replacement therapy (NRT), GSC, and combined groups. Following randomization, baseline information, including education, smoking and abstinence history, medical disease, and other correlated data were collected. Constant smoking abstinence (self-reported abstinence during the whole period of follow-up), every 3 weeks' following the quitting day, was evaluated, and TTM evaluations were carried out 12 and 29 weeks' following treatments.

First, the patients were explained on the purpose and method of the study, and NRT's potential side-effects. The patients were asked to complete a consent form. All the patients completed personal information and Fagerstrom test for nicotine dependence (FTND) questionnaire before the commencement of the intervention. Then, the interventions were performed by an expert psychotherapist in five individual sessions for the GSC and combined groups. Furthermore, nicotine was used to NRT and combined groups for 6 weeks.

The inclusion criteria included the age over 45 years, COPD, and cigarette smoking. The participants had persistent airway obstruction and referral by a pulmonologist.

Exclusion criteria included the presence of other systemic medical diseases such as diabetes, normal spirometry, respiratory failure, and contraindications for nicotine gum use (allergy, active heart disease, dangerous arrhythmias,

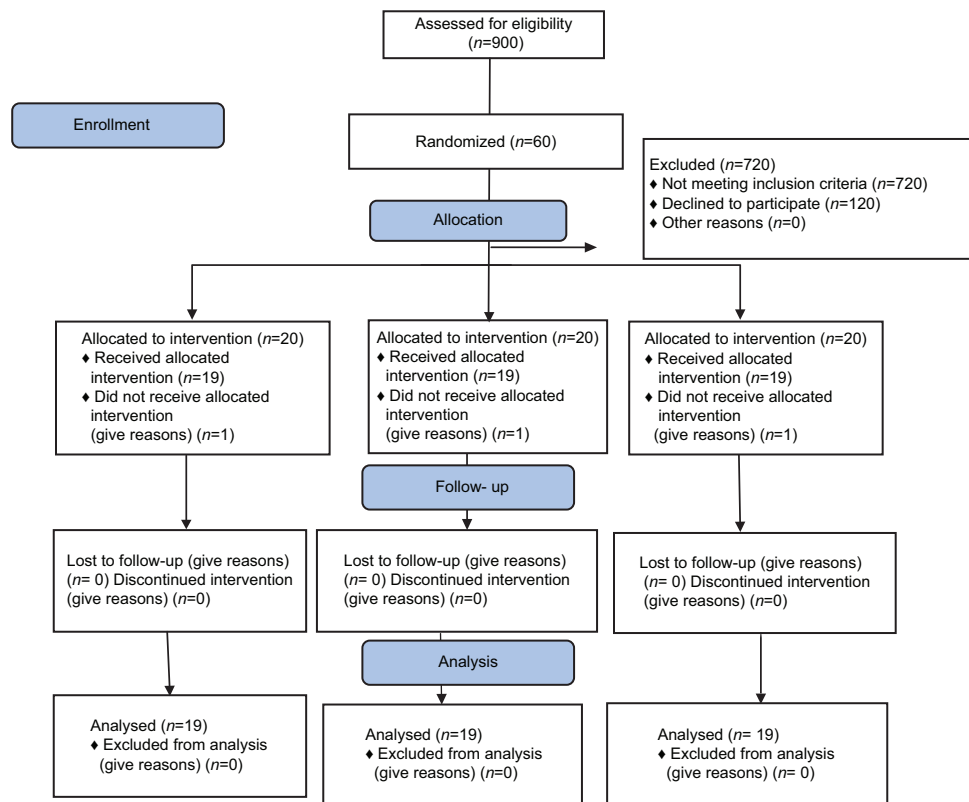


Figure 1: CONSORT diagram of patients' randomization, intervention, and analysis

severe angina, hyperthyroidism, insulin-dependent diabetes, active peptic ulcers, pregnancy, and lactation), severe psychiatric disorders history such as psychosis and severe depression, and anxiety with the patient report history, and the GSC psychotherapist and psychiatrist diagnosis.

Ethics Committee of Mazandaran University of Medical Sciences (IR. MAZUMS. REC.95.2137) accepted the trial procedure. The trial procedure was registered at the Iranian Registry of Clinical Trials (IRCT201609271457N11; www.irct.ir) and carried out based on the Declaration of Helsinki and its following revisions. The research was conducted between December 2016 and November 2017. The statistical population contained all COPD subjects referring from pulmonologist to Imam Khomeini Hospital of Sari in Mazandaran Province of Iran.

Transtheoretical model questionnaires

TTM questionnaire was validated for quitting cigarette smoking, and suggested it in two versions: the original questionnaire including 83 items, and the short one containing 38 items. In this study, we used the short form comprising of 4 constructs ^[26] as follows:

The stage of change

It assesses the current smoking behaviors of individuals and whether they wish to leave cigarette smoking or not.

This theory has five stages, including precontemplation, contemplation, preparation, action, and maintenance. In the current research, if a smoker decided to quit smoking over the next month, he was identified as being in the preparation stage.^[27]

The processes of change scale

It assesses 10 processes of change in two key groups: experiential process and behavioral actions to change their cigarette smoking behaviors. It comprises 10 experiential statements and 10 behavioral procedures statements.^[28]

Temptation scale

It evaluates situational temptation. We used three subparameters of temptation in our research. This structure contains nine items on social conditions, craving situations, and negative affect situations.^[29]

Decisional balance scale

It determines the attitude of smoker toward quitting. This structure contains six items, including items on pros and cons. The statements use a five-point Likert-type scale.^[30]

In Western countries, TTM questionnaire has been evaluated in several researches.^[31] In Iran, the Cronbach's alpha is in the range of 0.60–0.84, representing an acceptable outcome. Moreover, internal correlation

corresponding to coefficient in the range of 0.61–0.83 is a suitable outcome.^[32]

Guided self-change treatment

The GSC model for the treatment of alcohol-related problems was developed by Sobell and Sobell.^[33] This model is based on cognitive-behavioral therapy (CBT) and motivational interview, and it consists of one initial assessment session and four treatment sessions, plus two follow-up telephone calls. Participants were guided by the motivation enhancement principles and a self-help manual. The self-help manual was discussed during the treatment sessions. All treatments in three groups were delivered by the same therapist, a trained CBT counselor with more than 15 years of experience in psychotherapy. This counselor was trained to give GSC treatment by a psychiatrist and a psychologist at a 3-day workshop and subsequently treated five participants before the study. The treatment sessions in the GSC arm of the study were tape-recorded to ensure treatment fidelity.

Guided self-change intervention protocol

The GSC intervention protocol was applied in 5 1-h sessions for 5 weeks^[34] (see attached protocol).

Statistical analysis

The sample size of 60 participants (20 in all groups) conferred 80% power, with two-sided $P = 0.05$, for detecting a total difference of 10% among the three groups in terms of rates of quitting. The Shapiro–Wilk test was utilized to test the normality of the data distribution. Descriptive baseline characteristics corresponding to comparisons of the groups were arranged as mean (SD), median (interquartile range), or percentages. The initial efficacy information on smoking quitting was examined with intention-to-treat analysis. The comparison of the results between the three groups was performed with repeated measures ANOVA test using the General Linear Model. The time of assessment and intervention state (start of treatment, follow-up of 12 and 29 weeks of treatment) was considered the within-subject factor and the between-subject factor, respectively. The time groups (interaction term) were regarded as group differences (between groups). Mauchly's sphericity test was applied for the compound symmetry assumption. The data were analyzed using SPSS 16 and Stata for FTND and smoking cessation rate evaluations comparing three groups.

RESULTS

As shown in Table 1, the observed differences between the study groups were not statistically significant with respect to marital status (PV = 0.36), occupation (PV = 0.51), motivation

for smoking cessation (PV = 0.62), importance of smoking cessation (PV = 0.61), the number of smoker friends (PV = 0.5), FTND (PV = 0.93), the number of daily cigarettes (PV = 0.71), and other related variables. In this study, 60 men 45–75 years of age with a mean age of 53.6 (± 8.43) were randomly assigned to three groups, 20 to the GSC, 20 to the NRT, and 20 to the combined GSC and NRT groups [Figure 1] and TTM variables changes in three groups was shown [Figures 2-5].

Smoking variables

The mean age of their initiation of smoking was 19.6, with a range of 8–34, and with a mean duration of smoking of 32.9 years, and a range of 9–59 years. The mean number of daily cigarettes smoked was 23, with a range of 5–60. The level of nicotine dependence with the FTND was more than 5 in 42.1% of participants and decreased over the baseline, 12 and 29 weeks [Figure 2]. The mean number of past quitting attempts was two times, with a range of 0–10, and the mean of the longest period of abstinence was 2.9 years, with a range of 0–10 years. The reason for the decision to quit in 28 (49%) of the participants was their current illness (COPD). Moreover, 53 (93%) participants smoked after a main meal and 13 (22.8%) participants regularly smoked after sex. A total of 39 (68.4%) of them smoked deeply into the lungs. The type of cigarettes smoked was high-nicotine in 8 (14.9%) of the participants. All of the participants were in the preparation stage of TTM. Self-reported daily cigarettes smoking declined steadily over the baseline, 12 and 29 weeks, from 23.2 (± 1.7) to 7.6 (± 1.0) and 6 (± 1.0) ($P = 0.001$), respectively. A total of 9 (47.4%) participants in the GSC and combined groups and 4 (21.1%) participants in the NRT group reported total abstinence from smoking by the end of 29 weeks. Moreover, The GEE model revealed that GSC reduced the odds of quitting smoking rate compared to the NRT group (odds ratio = 0.31, 95% confidence interval: 0.022–0.545, ES = 0.20).

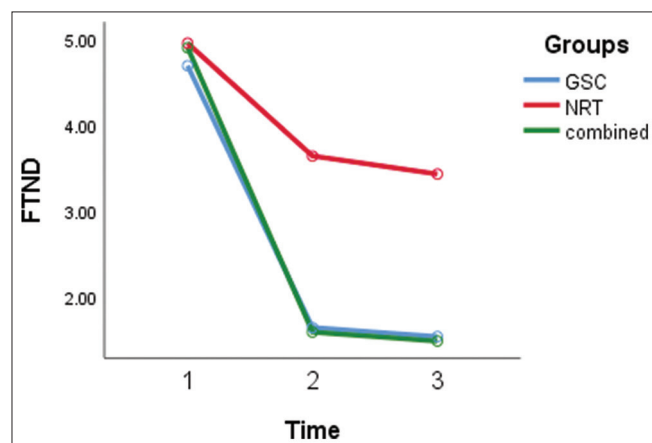
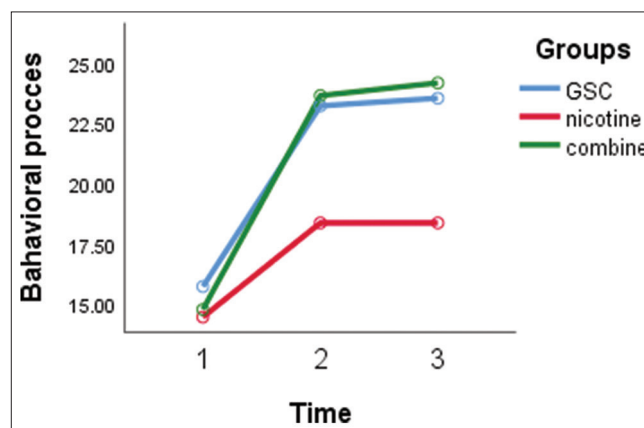
Transtheoretical model variables

As shown in Tables 2-4 and the Figures 3-6, in cons (PV = 0.05) and temptation (PV = 0.05), reinforcement-management (PV = 0.4), self-liberation (PV = 0.13), environmental-reevaluation (PV = 0.05), self-reevaluation (PV = 0.05), social-liberation (PV = 0.05), consciousness-raising (PV = 0.05), socio-positive situation (PV = 0.05), negative-affect situation (PV = 0.05), and habitual craving (PV = 0.13), no significant changes were seen in the NRT group, while these variables were statistically different in the GSC and combined GSC-NRT groups. Moreover, cons (PV = 0.009, ES = 0.19), pros (PV = 0.04, ES = 0.12), experiential process (PV = 0.005, ES = 0.18), counterconditioning (PV = 0.04, ES = 0.12), stimulus control (PV = 0.004, ES = 0.19), environmental

Table 1: Basic demographic and clinical characteristics of patients in three groups (n=19)

Variable	Group			PV
	GSC	NRT	Combined	
Age, mean±SD	50±6	56±10	54±8	0.08
Marital status, n (%)				0.36
Married	15 (31)	16 (32)	18 (37)	
Single/divorced/widowed	4 (50)	3 (38)	1 (13)	
Job, n (%)				0.51
Self-employee	14 (39)	11 (31)	11 (31)	
Employed	5 (24)	8 (38)	8 (38)	
Motivation of quitting, n (%)				0.62
Desperate and unwilling	1 (50)	0	1 (50)	
Hopeful and very hopeful to giving up	18 (33)	19 (35)	18 (33)	
Importance of smoking cessation, n (%)				0.61
Trivial and somewhat	1 (50)	0	1 (50)	
Very much and too much	18 (33)	19 (35)	18 (33)	
Smoker friends, n (%)				0.50
None of them and a bit	13 (36)	13 (36)	10 (28)	
Half and the most	6 (29)	6 (29)	9 (43)	
Craving (mean±SD)	22±8	23±6	26±8	0.21
HSI (mean±SD)	1.8±1	2±1	1.7±1	0.74
FTND score (mean±SD)				0.93
FTND was >5 in 42.1% of patients	4.7±2	4.9±3	4.9±2	
Daily cigarette (mean±SD)				0.71
5-60 (mean=23) cigarettes in a day	24±13	26±18	20±7	
FEV1 act	2.39±0.57	1.94±0.74	1.91±0.7	0.62
FVC act	3.68±0.71	3.18±1.02	3.41±0.83	0.82

Data are expressed as the mean or as n (%). GSC: Guided self-change, NRT: Nicotine replacement therapy, SD: Standard deviation, HSI: Heaviness of smoking index, FTND: Fagerstrom test for nicotine dependence, FEV1: Forced expiratory volume in the first second, FVC: Forced vital capacity

**Figure 2:** Fagerstrom test of nicotine dependency trends over the time**Figure 3:** Behavioral process trends over the time

reevaluation (PV = 0.0001, ES = 0.30), and habitual craving (PV = 0.004, ES = 0.19) were statistically significant across the three groups and these variables improved in the GSC and combined GSC-NRT groups more than in the NRT group in the 29-week follow-up. Furthermore, interaction effects in temptation (PV = 0.02), socio-positive situation (PV = 0.02), and negative affect-situation (PV = 0.01) were statically significant among three groups.

DISCUSSION

We examined GSC with NRT in behavioral change of smoking in COPD smokers. Several studies were conducted on TTM applying in smoking cessation as follows:

In a randomized clinical trial in Iran, the experimental group received the individual counseling and NRT and telephone follow-ups. Total abstinence without relapse was 46% in the experimental group and 3.3% in the control group. All of the variables at change stages, including quitting smoking, experimental and behavioral process, and temptation revealed a significant difference between the two groups. There was a significant difference in FTND test at the beginning and end of the intervention in the experimental group, with no significant difference in the control group.^[25] Meanwhile, in our study, significant differences in the experimental and behavioral process were found in GSC and combined group compared. Moreover,

Table 2: Repeated measure analyses of variance (group effect and interaction effect) for transtheoretical model variable transtheoretical model constructs groups baseline, 12 weeks and 29 weeks

Variables	Time			Between effect	Group effect	Interaction effect	Effect size	F statistic
	Baseline	Follow-up after 12 weeks	Follow-up after 29 weeks					
Cons								
GSC	7 (5-11)	5 (3-10)	5 (3-10)	0.001	0.009	0.65	0.19	0.52
Nicotine	11 (9-14)	11 (7-14)	11 (7-14)	0.05				
Combine	7 (6-11)	3 (3-7)	4 (3-6)	0.001				
Pros								
GSC	11 (7-11)	15 (11-15)	15 (11-15)	0.001	0.04	0.07	0.12	4.74
Nicotine	11 (9-11)	11 (10-15)	11 (10-15)	0.02				
Combine	11 (9-11)	11 (10-15)	11 (10-15)	0.001				
Temptation								
GSC	21 (16-28)	8 (0-20)	7 (0-19)	0.0001	0.08	0.02	0.09	2.63
Nicotine	24 (19-26)	24 (17-26)	24 (17-26)	0.05				
Combine	28 (21-32)	8 (0-23)	8 (0-23)	0.0001				
Behavioral-process								
GSC	14 (11-20)	30 (12-32)	32 (12-32)	0.0001	0.18	0.2	0.06	1.75
Nicotine	15 (10-19)	16 (10-25)	16 (10-25)	0.02				
Combine	14 (10-18)	28 (14-32)	28 (16-32)	0.0001				
Experiential-process								
GSC	31 (22-36)	40 (31-48)	48 (36-48)	0.0001	0.005	0.06	0.18	5.91
Nicotine	26 (20-34)	28 (20-39)	28 (20-39)	0.02				
Combine	31 (23-35)	46 (34-48)	47 (34-48)	0.0001				

Data are expressed as the median (IQR). IQR: Inter-quartile range, GSC: Guided self-change

Table 3: Repeated measure analyses of variance (group effect and interaction effect) for transtheoretical model the processes of change (behavioral processes) groups baseline, 12 weeks and 29 weeks

Variables	Time			Between effect	Group effect	Interaction effect	Effect size	F statistic
	Baseline	Follow-up after 12 weeks	Follow-up after 29 weeks					
The processes of change (behavioral processes)								
Counterconditioning								
GSC	3 (0-4)	8 (3-8)	8 (3-8)	0.001	0.04	0.07	0.12	3.50
Nicotine	2 (0-3)	2 (0-4)	2 (0-4)	0.02				
Combine	2 (0-3)	7 (2-8)	7 (3-8)	0.001				
Self-liberation								
GSC	7 (4-8)	8 (8-8)	8 (8-8)	0.001	0.09	0.085	0.08	2.47
Nicotine	6 (4-8)	6 (4-8)	6 (4-8)	0.13				
Combine	7 (4-8)	8 (7-8)	8 (7-8)	0.002				
Reinforcement-management								
GSC	7 (4-8)	8 (6-8)	8 (6-8)	0.02	0.6	0.6	0.02	0.57
Nicotine	8 (6-8)	8 (8-8)	8 (8-8)	0.4				
Combine	8 (4-8)	8 (8-8)	8 (8-8)	0.007				
Stimulus-control								
GSC	3 (0-5)	8 (2-8)	8 (3-8)	0.0001	0.004	0.17	0.19	6.15
Nicotine	0 (0-2)	0 (0-5)	0 (0-5)	0.02				
Combine	0 (0-4)	7 (2-8)	7 (3-8)	0.0001				
Helping-relationship								
GSC	4 (0-8)	8 (2-8)	8 (2-8)	0.018	0.9	0.5	0.01	0.15
Nicotine	4 (1-8)	8 (2-8)	8 (2-8)	0.018				
Combine	4 (0-8)	8 (4-8)	8 (4-8)	0.0001				

Data are expressed as the median (IQR). IQR: Inter-quartile range, GSC: Guided self-change

FTND decreased significantly in the three groups. In addition, this variable had a significant difference in the three groups, and the decreased rate in the combined and GSC groups was higher than the NRT group. In another study,^[35] the results clearly showed the effectiveness of both methods, TTM and CBT, on the self-efficacy in drug use abstinence in adolescents. Otherwise, in one study, 2471 smokers were randomized to either control or TTM-based self-help program and followed up 12 months after the intervention. Smokers in the TTM group were

had a positive move in stage, but that was not significant. The TTM-based intervention was not more effective for the smokers in precontemplation or contemplation than for participants in the preparation stage.^[36] TTM may be useful in understanding the stages in smokers for quitting smoking.

Moreover, another descriptive study was conducted using the convenient sampling method ($n = 578$). Approximately 75% of the smokers were in the precontemplation and

Table 4: Repeated measure analyses of variance (group effect and interaction effect) for transtheoretical model the processes of change (experiential processes) and temptation groups baseline, 12 weeks and 29 weeks

Variables	Time			Between effect	Group effect	Interaction effect	Effect size	F statistic
	Baseline	Follow-up after 12 weeks	Follow-up after 29 weeks					
The processes of change (experiential process)								
Environmental-reevaluation								
GSC	4 (4-8)	8 (4-8)	8 (8-8)	0.0001	0.0001	0.2	0.30	11.55
Nicotine	4 (0-4)	4 (0-8)	4 (0-8)	0.05				
Combine	4 (4-8)	8 (4-8)	8 (4-8)	0.001				
Dramatic-relief								
GSC	4 (3-6)	6 (4-8)	8 (4-8)	0.001	0.08	0.2	0.09	2.61
Nicotine	4 (2-4)	4 (2-6)	4 (2-6)	0.02				
Combine	4 (2-4)	7 (4-8)	7 (4-8)	0.001				
Self-reevaluation								
GSC	5 (4-8)	8 (4-8)	8 (5-8)	0.001	0.07	0.07	0.09	2.8
Nicotine	5 (2-6)	5 (2-8)	5 (2-8)	0.05				
Combine	4 (3-8)	8 (6-8)	8 (6-8)	0.0001				
Social-liberation								
GSC	4 (4-0)	4 (1-4)	4 (1-4)	0.002	0.4	0.1	0.03	0.94
Nicotine	2 (2-4)	4 (1-4)	4 (1-4)	0.05				
Combine	4 (1-4)	4 (4-4)	4 (4-4)	0.001				
Consciousness-raising								
GSC	7 (4-8)	8 (7-8)	8 (7-8)	0.007	0.18	0.4	0.06	1.8
Nicotine	5 (4-8)	7 (4-8)	7 (4-8)	0.05				
Combine	6 (3-8)	8 (7-8)	8 (7-8)	0.001				
Temptation								
Socio-positive situation								
GSC	7 (5-12)	1 (0-5)	1 (0-5)	0.0001	0.06	0.02	0.1	3
Nicotine	8 (7-8)	8 (4-8)	8 (4-8)	0.05				
Combine	8 (5-10)	1 (0-8)	1 (0-6)	0.0001				
Negative affect-situation								
GSC	10 (8-15)	2 (0-12)	2 (0-12)	0.0001	0.9	0.01	0.04	0.01
Nicotine	6 (6-6)	6 (6-6)	6 (6-6)	0.05				
Combine	12 (9-12)	4 (0-12)	4 (0-11)	0.0001				
Habitual-craving								
GSC	4 (3-6)	0 (0-5)	0 (0-5)	0.0001	0.004	0.058	0.19	6.24
Nicotine	11 (5-12)	10 (3-12)	10 (3-12)	0.13				
Combine	10 (5-12)	3 (0-10)	1 (0-10)	0.0001				

Data are expressed as the median (IQR). IQR: Interquartile range, GSC: Guided self-change

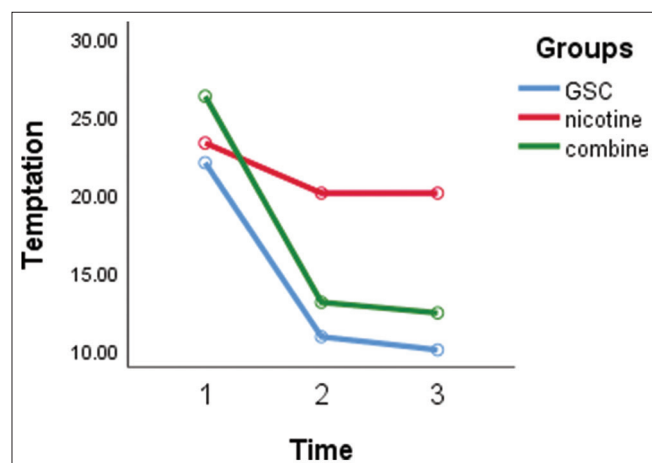


Figure 4: Temptation trends over the time

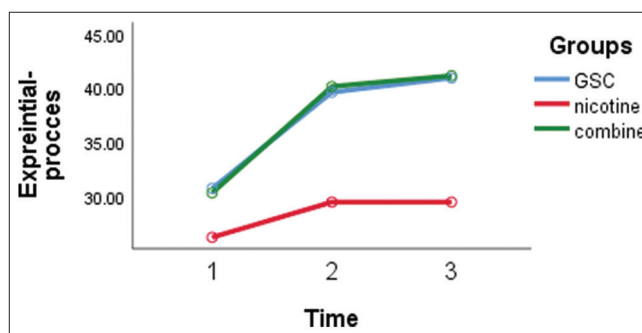


Figure 5: Experiential process trends over the time

17.8% in the preparation stage.^[21] In our study, all of the participants were in the preparation stage. Furthermore, in a population-based descriptive study consisting of 357 smokers in Tennessee, US, 56% of the participants

were in the precontemplation stage, as compared to the previous finding of 40% in the national samples. The participants' scores for the pros of smoking were similar to the stages of change in our sample, and although the scores for the cons differed significantly across the stages in the sample, *post hoc* analysis indicated that the only significant change occurred between the precontemplation and contemplation stages. The scores for temptation to smoke

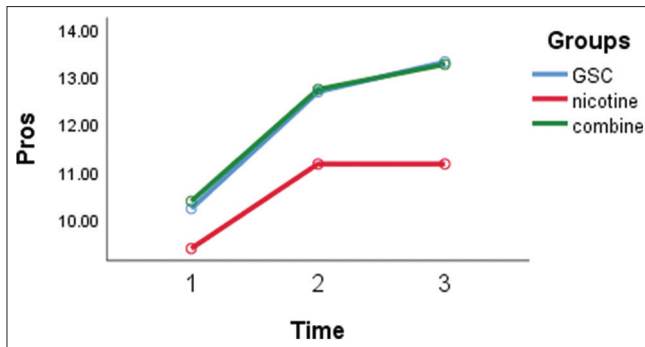


Figure 6: Pros trends over the time

did not differ significantly across the stages of change in this sample.^[17] The cons and pros in our study, after follow-up, had significant differences across the three groups.

In another study,^[9] it was stated that their intervention resulted in greater pros of quitting over time, but, in contrast to our study, their participants reported fewer cons of quitting at the follow-up. Our study indicated significant associations in the three intervention groups in temptation, pros and cons, and behavioral and experiential processes of TTM. These results also demonstrate that participants who quit are more likely to benefit from the behavioral process than smokers.^[37] Moreover, in contrast to TTM, former smokers reported more consciousness risings and social liberation than smokers.^[38] Glanz *et al.*^[39] reported that social liberation was unclearly associated with the stages. In line with consciousness raising, it could be explained that smokers who quit may have increased awareness of the costs of smoking.^[40-42] In this regard, a randomized controlled trial was conducted in Konya, Turkey, on a group of females that divided by precontemplation, contemplation, and preparation stages and age. The study was completed with an intervention group consisting of 38 participants and a control group of 39 participants. The intervention group was interviewed five times and was given counseling and training in the first three interviews. The TTM scales were evaluated for both groups at the beginning and at 2- and 6-month follow-up. In the 6-month follow-up, smoking cessation rate and progress rate were found to be higher in the intervention group than in the control group. All the variables had differences except for the cognitive processes, and the pros of change in the intervention group over time,^[29] being consistent with the results of our study in the cognitive process. In another study,^[43] using a convenience sample of 123 smokers, the results of the study demonstrated the role of temptation, increase in the cons, decrease in the pros, and nicotine dependence. In our study, the motivation for cessation was high in COPD participants, and all of the groups showed

decrease in temptation, increase in the cons, decrease in the pros, and nicotine dependence.

CONCLUSION

The GSC and combined GSC-NRT groups were significantly more effective than the NRT group in TTM variables, and GSC and combined GSC-NRT were equally effective in smoking cessation rate. The interventions showed decrease in temptation, increase in the cons, decrease in the pros, and nicotine dependence. TTM may be useful in understanding the stages of changes in COPD smokers in deciding on the appropriate intervention for smoking cessation.

Conflicts of interest

There are no conflicts of interest.

Authors' contributions

MZ developed the original idea for the trial and attracted funding. FT, SS and MZ and ASH were responsible for the design of the study protocol. FT conducted the GSC and performed the required follow-ups. AA performed the statistical analyses. Clinical interpretations were conducted by MZ, SS and SA. The first draft of the paper was developed by FT and revised for important intellectual content by MZ, AA, SA, SS and ASH. All authors read and approved the final version.

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