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Original Article / Özgün Makale

The effects of posture and relaxation training on sleep, dyspnea, pain and, quality of life in the short-term after cardiac surgery: a pilot study

Kalp cerrahisi sonrası erken dönemde postür ve relaksasyon eğitiminin uyku, dispne, ağrı ve yaşam kalitesi üzerine etkisi: Pilot çalışma

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ABSTRACT

Background: This study aims to evaluate the effects of a two-week posture and relaxation training program on sleep quality, daytime sleepiness, dyspnea, pain, and quality of life in patients undergoing cardiac surgery.

Methods: Twenty-four patients were randomly assigned to the control (n=12) or posture and relaxation training group (n=12). Sleep quality, daytime sleepiness, dyspnea, quality of life, and pain were assessed using the Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale, Modified Medical Research Council Dyspnea Scale, Euro Quality of Life-5D, and visual analog scale, respectively. The control group received a standard postoperative rehabilitation program, while the training group underwent an additional posture and relaxation training program. Both groups continued their rehabilitation program for one week at the hospital and one week at home.

Results: After treatment, there were statistically significant differences in the Pittsburgh Sleep Quality Index sum scores, subjective sleep quality, sleep medication use, sleep disturbance, and visual analog scale pain scores between the groups ($p<0.05$). The posture and relaxation training group showed a significant improvement in the Modified Medical Research Council scores, but not in Pittsburgh Sleep Quality Index sum scores. After treatment, a significantly higher number of patients showed improvements in the quality of life in the posture and relaxation training group ($p<0.05$). The Pittsburgh Sleep Quality Index, subjective sleep, and sleep medication use subgroup scores showed significant improvements in the posture and relaxation training group after treatment ($p<0.05$).

Conclusion: Posture and relaxation training has beneficial effects for maintaining sleep quality, reducing sleep medication use, alleviating dyspnea and pain, and increasing quality of life in cardiac surgery patients.

Keywords: Cardiac surgery; dyspnea; pain; posture; relaxation; sleep.

ÖZ

Amaç: Bu çalışmada kalp cerrahisi geçirmiş hastalarda iki haftalık postür ve relaksasyon eğitim programının, uyku kalitesi, gündüz uyku hali, dispne, ağrı ve yaşam kalitesi üzerine etkileri değerlendirildi.

Çalışma planı: Yirmi dört hasta randomize olarak kontrol (n=12) ve postür ve relaksasyon eğitim grubuna (n=12) ayrıldı. Uyku kalitesi, gündüz uyku hali, dispne, yaşam kalitesi ve ağrı sırasıyla Pittsburgh Uyku Kalitesi İndeksi, Epworth Uykululuk Ölçeği, Modifiye Tıbbi Araştırma Konseyi Dispne Ölçeği, Euro Yaşam Kalitesi-5D ve görsel analog ölçeği ile değerlendirildi. Kontrol grubuna ameliyat sonrası standart bir rehabilitasyon programı uygulanırken, eğitim grubuna ek olarak postür ve relaksasyon eğitim programı uygulandı. Her iki grup da rehabilitasyon programlarına bir hafta hastanede ve bir hafta evde devam etti.

Bulgular: Tedavi sonrası Pittsburgh Uyku Kalitesi İndeksi toplam skorları, sübjektif uyku kalitesi, uyku ilacı kullanımı, uyku bozukluğu ve görsel analog ölçeği ağrı skorlarında gruplar arasında istatistiksel olarak anlamlı bir fark vardı ($p<0.05$). Postür ve relaksasyon eğitim grubunun Pittsburgh Uyku Kalitesi İndeksi toplam skorunda iyileşme gözlenmezken, modifiye Tıbbi Araştırma Konseyi skorlarında anlamlı bir iyileşme gözlendi. Tedavi sonrasında postür ve relaksasyon eğitim grubunda anlamlı düzeyde daha fazla sayıda hastada yaşam kalitesinde iyileşme görüldü ($p<0.05$). Tedavi sonrasında Pittsburgh Uyku Kalitesi İndeksi toplam skoru, subjektif uyku ve uyku ilacı kullanım alt grup skorlarında postür ve relaksasyon eğitim grubunda anlamlı iyileşmeler kaydedildi ($p<0.05$).

Sonuç: Postür ve relaksasyon eğitiminin kalp cerrahisi hastalarında uyku kalitesini sürdürme, uyku ilacı kullanımını azaltma, dispne ve ağrıyı hafifletme ve yaşam kalitesini artırmada yararlı etkileri vardır.

Anahtar sözcükler: Kalp cerrahisi; dispne; ağrı; postür; relaksasyon; uyku.

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Patients with cardiovascular disease (CVD) may experience abnormalities in sleep duration and suffer from sleep disorders.[1-3] Cardiac surgery is associated with postoperative complaints such as pain, respiratory problems, anxiety, sleep disturbance, and decreased quality of life (QoL).[4-7] Sleep is also crucial for proper postoperative healing both physically and emotionally. However, sleep is particularly poor during the first week postoperatively and it takes approximately two months to return to the preoperative sleep level.[8] Poor sleep quality in the postoperative period may be due to several factors including pain from the surgical incision, the presence of a thoracic drain, pain caused by a prolonged time in bed, muscle spasm, or high anxiety levels.[9] Sleep disturbances may also result in delayed recovery, poor QoL, and increased complication rates.[5]

Many studies have addressed different intervention strategies in the recovery periods to improve the sleep quality patterns.[10-13] Short-term cardiac rehabilitation programs, massage therapy, sleep hygiene education, and compact disc (CD)-based rehabilitation programs may have beneficial effects on the sleep quality in patients with several cardiac problems. Additionally, the application of different relaxation techniques has been demonstrated to improve the physiological and psychological effects of chronic health conditions such as hypertension, coronary artery disease, and heart failure.[14-17] In addition to relaxation training, the application of posture exercises under the supervision of a physiotherapist has been performed safely in current practice following cardiac surgery.[18]

In the literature, no study has evaluated the efficiency of a posture and relaxation training (PRT) program on the sleep quality in patients after cardiac surgery. Although sleep quality is a major determinant of QoL and overall well-being, the current literature data have primarily focused on the QoL of cardiac surgery patients, but not on their actual sleep. Furthermore, studies have provided data on the long-term improvements in the postoperative QoL at one to three months.[10,13,14] Therefore, in this study, we aimed to evaluate the short-term effects of a two-week PRT program on sleep quality, daytime sleepiness, dyspnea, QoL, and pain in patients following cardiac surgery.

PATIENTS AND METHODS

At the beginning of this randomized and controlled single-blind prospective study, we performed a power analysis to determine the necessary sample size using the Rao Soft System (Raosoft, Inc. free online software 2004, Seattle, WA, USA). By using the minimal percentage of clinically meaningful differences from the study by Buysse et al.[19] (3 of 21, or 7%), we estimated that a sample size of 25 patients was required to detect a statistically significant difference between the PRT and control groups with a power of 95% confidence level.

Thirty-two patients aged 40 to 80 years who were scheduled for elective cardiac surgery were prospectively analyzed between October 2013 and January 2014. The inclusion criteria were as follows: *(i)* patients undergoing coronary artery bypass grafting (CABG), *(ii)* aortic valve replacement (AVR), *(iii)* mitral valve replacement (MVR), or *(iv)* combined surgeries such as MVR and AVR, as well as those with median sternotomy incisions, and *(v)* a Mini-Mental State Examination score >24. Exclusion criteria were as follows: *(i)* chronic use of hypnotics, *(ii)* previous diagnosis of sleep disorders, *(iii)* Epworth Sleepiness Scale (ESS) score ≥10, *(iv)* thoracic drain in their return to the ward, *(v)* an intensive care unit (ICU) stay of >4 days during the postoperative period, *(vi)* another surgery history within the last six months, and *(vii)* postoperative cooperation problems such as delirium. During the preoperative period, 32 cardiac surgery patients were invited to participate in the study. Four patients were excluded for the following reasons: a history of surgery within the past six months (n=1) and previous diagnosis of sleep disorders (n=3). Twenty-eight patients were randomly placed into the control (n=14) or training (n=14) groups. Two patients from the training group were subsequently excluded due to an ICU stay of >5 days, while two patients were excluded from the control group for the following reasons: spontaneous withdrawal from the study (n=1) and postoperative delirium (n=1). All analyses were performed on the remaining 24 patients (Figure 1).

All patients were randomly assigned to either the training group who received the usual care and PRT, or the control group who the usual care alone. Randomization was performed using the following equation in Microsoft Excel program (Microsoft Inc., Redmond, WA, USA) [RAND function; =IF (RAND ≤0.5; PRT group; control group)]. We used concealed allocation in the randomization. Twenty-eight patients were randomized into either the control (n=14) or the training (n=14) group. All measurements were performed prior to surgery and two weeks after surgery. The selector who did not perform any assessments was aware of the randomization scheme. The assessor was blinded to the randomization and applied a standard procedure to both groups.

The physical therapist who treated the patients was also blinded to the assessments.

An informed consent was obtained from each patient. The study protocol was approved by the Institutional Review Board (No: PR-1432/ Date: September 15, 2013). The study was conducted in accordance with the principles of the Helsinki Declaration.

The preoperative clinical assessment consisted of obtaining data on demographic and personal characteristics of the patients. The primary outcome measures were the Pittsburgh Sleep Quality Index (PSQI) and ESS. The secondary outcome measures were the modified Medical Research Council (mMRC) dyspnea scale, Euro Quality of Life-5D, and visual analog scale (VAS) for chest, neck, and upper back pain.

The PSQI is a questionnaire used to evaluate the quality of sleep in patients according to seven components (subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, sleep medication usage, and daytime function) within the past month.[19] The final scores were interpreted as follows: 0-4 indicated good sleep quality, 5-10 indicated poor sleep quality, and >10 indicated the presence of a sleep disorder. The patients were instructed to reply to the validated version of this questionnaire[20] according to their sleep habits within the past month before the preoperative period and during the last two weeks of the postoperative period.

The ESS is a scale used to evaluate excessive daytime sleepiness in patients.[21] A total score >10 indicates the presence of excessive daytime sleepiness. The validated version of this scale was used in the study.[22]

The mMRC dyspnea scale is used to assess how dyspnea limits the patients' activities of daily living (ADL) performance, according to five items.[23] The patients reported their subjective degree of dyspnea by choosing a value from 0 (experiencing shortness of

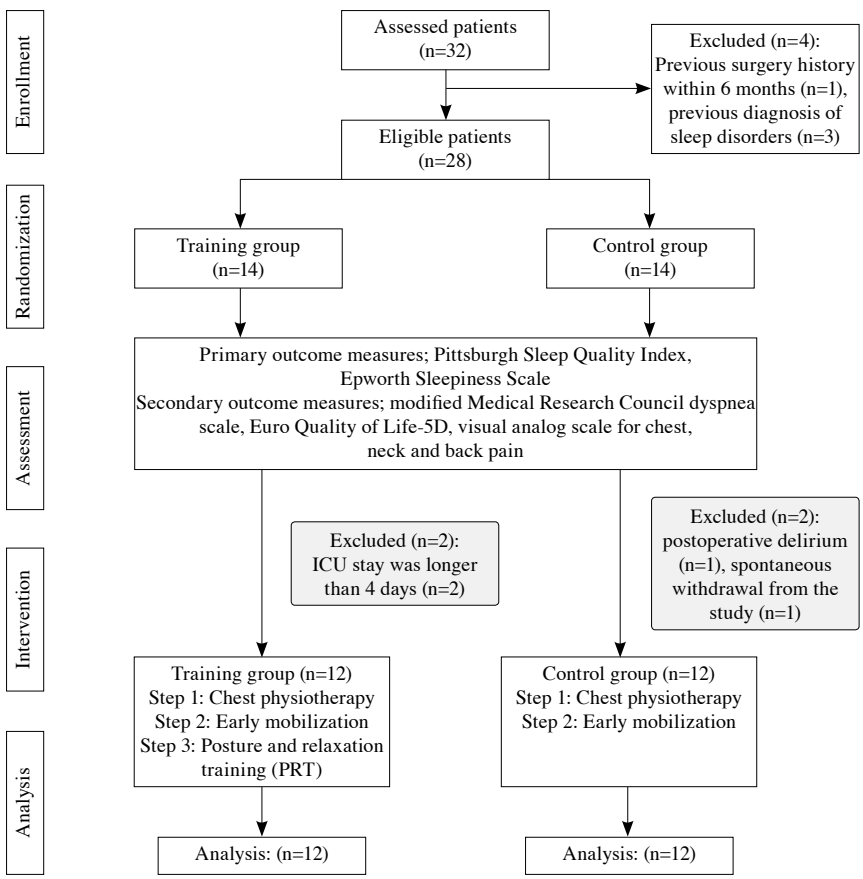

Figure 1. Patient flowchart through the trial phase.

breath only during vigorous exercise) to 4 (experiencing so much shortness of breath that they no longer leave the home or experiencing shortness of breath when getting dressed).

The EQ-5D is a questionnaire used to evaluate QoL which constitutes a preference-based measurement system comprised five domains (mobility, self-care, usual activities, pain and discomfort, and anxiety-depression) ranked along three levels ranging from -0.53 to 1.00, with 1.00 indicating perfect health.[24] The validated version of this scale was used in the study.[25]

The VAS indicates the intensity of pain on a scale from 0 to 10, with 0 corresponding to no pain and 10 to extreme pain.[26] It was used to evaluate neck, chest and upper back pain in our patients.

Assessments were made preoperatively and two weeks following surgery. All assessments were performed in an interview form on the afternoon and during the same session by the assessor who was blinded to the group affiliation of all patients. Each assessment took approximately 20 minutes.

The protocol for exercise training was performed twice per day in a 30 min session. Training was divided into three steps: *(i)* chest physiotherapy (modified postural drainage, incentive spirometer training, and assisted coughing techniques); *(ii)* early progressive mobilization (gradually increasing the walking distance in the hall, depending on patient tolerance); and *(iii)* posture and relaxation training (cervical and thoracic region mobility, terminal knee extension, distal extremity flexion-extension, progressive relaxation training, and deep abdominal and regional breathing exercises). We avoided >90º shoulder motions, pectoral muscle stretching, and the Valsalva maneuver during the exercises. All exercises in step three were performed 10 times each session. The patients in the PRT group were also instructed about the positions for reducing oxygen consumption.

On the other hand, the control group received the usual postoperative rehabilitation program including chest physiotherapy (step one) and early progressive mobilization (step two) twice per day in a 30 min session. All patients were treated twice per day with one session under the supervision of a physical therapist and the other without supervision for one week. After discharge, both groups continued their rehabilitation program at home without supervision for another week. At the beginning of the treatment, exercise sheets which illustrated the program of an each group were given to both groups to serve as a reminder for their unsupervised sessions. The patients were instructed to perform their second treatment session before sleeping. A rest period was allowed between all steps and also during the steps, if necessary. The rate of perceived exertion was measured using the 6 to 20 point Borg Rating.[27] The patients were instructed to exercise within a perceived-exertion range between 9 and 13, where 9 was considered fairly light and 13 was considered somewhat difficult. Furthermore, they performed the exercises without pain and the number of repetitions of the exercises was adjusted according to their tolerance. Blood pressure, heart rate, and oxygen saturation were monitored before and after the sessions during their hospital stay. All patients were discharged without any of the side effects which can sometimes occur due to the rehabilitation program. To assess the compliance during unsupervised sessions, an exercise diary was required and subjective symptoms were reported by the patients to be evaluated by the physical therapist in the second week of training before the second set of measurements.

All patients included in the study completed the entire training program.

Statistical analysis

Statistical analysis was performed using the PASW version 18.0 for Windows (SPSS, Inc., Chicago, IL, USA) software. Descriptive statistics were expressed in frequency, mean, and standard deviation. The Shapiro-Wilks test was used to analyze abnormally distributed data ($p<0.05$). An independent samples t-test was used to determine the differences in the demographic and clinical characteristics of the patients. The Mann-Whitney U test was used to evaluate the effects of the training program. An intra-group comparison was performed using the Wilcoxon signed-rank test, while an inter-group comparison was performed using the Mann-Whitney U test. A p value of <0.05 was considered statistically significant.

RESULTS

Patient demographics are shown in Table 1. There were no statistically significant differences ($p>0.05$) in age, sex, body mass index, type of surgery, number of grafts for CABG, comorbidities, cardiopulmonary bypass duration, time on mechanical ventilation, length of hospital stay, or length of ICU stay between the two groups. Total PSQI scores in the preoperative assessment were significantly higher in the training group ($p=0.044$) compared to the controls. There were no statistically significant preoperative differences in the subgroup scores of the PSQI, ESS, mMRC, EQ-5D, or VAS between the groups ($p>0.05$).

Table 1. Demographic and clinical characteristics of the patients

	Training group		Control group		
	n	Mean±SD	n	Mean±SD	*p*
Number of patients	12		12		1.000
Age (years)		64.2±7.2		62.4±8.5	0.593
Sex					0.217
Female	3		0		
Male	9		12		
Body mass index (kg/m^2)		28.3±4.2		27.9±4.2	0.848
Comorbidities					0.747
Hypertension	2		4		
Hyperlipidemia	1		1		
Diabetes mellitus	4		4		
Chronic obstructive pulmonary disease	2		2		
Type of surgery/number of graft					0.652
Coronary artery bypass graft surgery X1	3		0		
Coronary artery bypass graft surgery X2	1		2		
Coronary artery bypass graft surgery X3	5		5		
Coronary artery bypass graft surgery X4	2		3		
Aortic valve replacement + mitral valve replacement	1		2		
Cardiopulmonary bypass time (min.)		70.8±26.0		72.9±27.1	0.602
Time on mechanical ventilation (hrs)		6.8±4.2		6.8±3.7	0.959
Length of intensive care unit stay (days)		1.3±0.5		1.8±1.0	0.124
Length of hospital stay (days)		7.3±0.6		7.6±1.0	0.338

SD: Standard deviation.

Two-week intra- and inter-group changes from baseline are shown in Table 2. The intra-group analysis showed a statistically significant improvement in the mMRC scores (p=0.018), but no other changes from the preoperative state in the training group. The total PSQI, subjective sleep quality, sleep disturbance, sleep medication use, and VAS scores were significantly worsened in the control group (p=0.002, p=0.015, p=0.020, p=0.007, p=0.041, respectively). The patients in the treatment group showed significantly greater post-treatment improvement than the control group in terms of the total PSQI score, sleep medication use, and QoL (p=0.026, p=0.002, p=0.048, respectively).

The inter-group analysis showed a significant negative change in the total PSQI scores of the controls, compared to the training group (p=0.001).

Table 2. Primary and secondary outcome measurements before surgery and at two weeks after surgery

	Training group		Intra-group changes	Control group		Intra-group changes	Inter-group changes		
	Before treatment	After treatment		Before treatment	After treatment		BT	AT	Differences
	Mean±SD	Mean±SD	*p*	Mean±SD	Mean±SD	*p*	*p*	*p*	*p*
PSQI	5.9±2.5	5.0±3.5	0.562	4.0±3.3	9.2±4.7	0.002*	0.044*	0.026*	0.001*
Subjective sleep	1.4±0.7	1.2±1.1	0.429	0.8±0.9	1.6±0.9	0.015*	0.052	0.278	0.011*
Sleep latency	1.1±0.9	0.6±0.7	0.222	0.8±0.8	1.3±1.3	0.167	0.519	0.176	0.074
Sleep duration	1.1±1.3	0.9±1.0	0.671	0.4±0.9	1.1±1.3	0.071	0.171	0.927	0.183
Sleep efficiency	0.9±0.8	0.7±0.9	0.317	0.7±1.2	1.3±1.3	0.102	0.234	0.309	0.094
Sleep medication	0.1±0.3	0.2±0.6	0.655	0.2±0.4	1.5±1.2	0.007*	0.546	0.002	0.002*
Daytime function	0.3±0.7	0.3±0.5	0.705	0.0±0.0	0.7±1.2	0.063	0.070	0.515	0.129
ESS	3.6±2.3	3.1±1.8	0.621	5.3±3.0	3.9±2.2	0.165	0.188	0.332	0.368
mMRC	1.7±1.4	0.6±0.5	0.018*	1.6±1.2	1.1±1.0	0.301	1.00	0.211	0.421
EQ-5D	0.7±0.2	0.8±0.1	0.326	0.6±0.3	0.6±0.4	0.724	0.375	0.048*	0.418
Pain VAS (cm)	0.5±1.7	0.8±1.2	0.498	0.9±2.2	2.5±2.4	0.041*	0.547	0.082	0.307

BT: Before treatment; AT: After treatment; SD: Standard deviation; PSQI: Pittsburgh sleep quality index; ESS: Epworth sleepiness scale; mMRC: Modified medical research council; EQ-5D: Euro quality of life-5 dimensions; VAS: Visual analog scale.

Additionally, subjective sleep quality as perceived by the patient significantly worsened in the control group (p=0.011). Finally, the use of sleep medication was significantly higher in the control group than in the training group (p=0.002).

DISCUSSION

Our study demonstrated that the addition of PRT to the usual rehabilitation protocol was more beneficial, in the short-term, for maintaining sleep quality perceived by the patient, and reducing sleep disorders and medication use in patients who underwent cardiac surgery. In addition, PRT is more effective at alleviating dyspnea and has a preventive effect on the perception of pain after cardiac surgery. The patients in the PRT group demonstrated a significantly better QoL than the control group.

Although the PSQI scores in the preoperative assessment were higher in the training group than the control group, the sleep quality of the patients in the training group did not deteriorate after two weeks of training. Previous studies have shown that patients with CVD may experience abnormalities in sleep duration and several other disorders.[1] Stress and anxiety are important factors which may cause sleep disorders in the preoperative term.[28] We found that several patients had a poor quality of sleep during the preoperative period in the training group. The findings of previous studies may explain the higher PSQI score (≥5) in the training group in our study. The favorable results of training in terms of PSQI scores after two weeks of surgery may be a result of reduced dyspnea and lower VAS pain scores, compared to the control group.

In addition, we found a significantly increased need for sleep medication in the control group compared to the training group after surgery. According to our experiences, in the postoperative term, sleep medication use may cause side effects such as respiratory depression, anxiety, cognitive impairments and weakness. This may also affect the compliance of the patient to the rehabilitation program. Therefore, the use of sleep medication is not commonly preferred during the first week after surgery, if possible. Previously, Wang et al.[17] showed that biofeedback-assisted relaxation training, both at night and in a morning-night combination, effectively enhanced the sleep quality and decreased the need for sleep medication in patients with coronary heart diseases. As a result, introduction of PRT techniques in clinical practice more profoundly may help preventing side effects and reducing the cost of treatment.

Obstructive sleep apnea syndrome (OSAS) is an independent factor for CVD and patients with CVD frequently have OSAS.[9] We excluded any patients with a previous diagnosis of sleep disorders and any possible OSAS patients (an score ESS ≥10) to understand the effect of PRT on sleep quality during the natural process of post-cardiac surgery. In this study, none of the patients reported daytime sleepiness (ESS ≥10) during either the preoperative or postoperative period. Therefore, our results are inconsistent with previous studies.[11,29]

Moreover, we found that PRT offered significant improvements in dyspnea severity in cardiac surgery patients. Although our results showed that dyspnea severity decreased in both groups two weeks postoperatively, the difference was only significant in the training group. Li et al.[30] used a systematic rehabilitation program which consisted of mobilization, upper-lower extremity exercises, breathing control, deep breathing exercises, and relaxation training and reported a significant improvement in dyspnea severity in patients undergoing lung resection. The similarity of their rehabilitation program and results shows that the possible reason for this improvement may be enhanced oxygen-carrying capacity of the patients.

Furthermore, it is well-established that sleep quality is a major determinant of QoL.[5] Pain, dyspnea, and anxiety are common causes of sleep difficulty in the initial weeks after heart surgery.[7,31,32] Poole et al.[33] reported that increased sleep complaints prior to surgery were associated with increased physical symptoms, poorer physical health related to QoL, and increased postoperative sensory pain. Despite higher preoperative PSQI scores, we found that patients in the training group had a statistically improved mean QoL scores at two weeks after surgery, compared to the control group. Similarly, Johansson et al.[12] demonstrated that a CD-based relaxation program improved QoL in patients with congestive heart failure. Duarte Freitas et al.[10] also showed significant improvements in physical and mental short-form health survey scores with a four-week cardiac rehabilitation program in cardiac patients. Opasich et al.[34] reported that an elderly-centered, personalized, physiotherapy program was a safe approach to improve QoL. A recent study by Li et al.[30] also showed that a systematic rehabilitation program, similar to our program, increased QoL and functional scores and decreased symptom scores in patients undergoing lung resection, compared to the controls. In our study, pain reduction in the training group may have caused the

improved QoL. In consistent with our results, Dehdari et al.[35] showed that progressive muscular relaxation training may be an effective therapy for improving QoL in anxious heart patients.

In the present study, pain remained stable in the training group throughout the therapy. In the control group, however, pain severity significantly increased during this period. In the literature, we only found one study which included a postoperative pain assessment in relation to the sleep quality. Nerbass et al.[11] measured the pain scores of patients three days following surgery and showed that the scores decreased in a similar manner in both the control and massage therapy group over those three days. In our study, active involvement in the treatment may have helped to prevent pain severity in patients in the training group.

Different rehabilitation methods such as massage therapy, biofeedback-assisted relaxation, cardiac rehabilitation programs, and CD-based rehabilitation programs can improve sleep quality in those with different cardiac problems; however, negative aspects of these methods include the requirement of equipment, increased physiotherapist work force, and an increased cost of treatment.[10-13,17] The protocol, as described by the PRT in this study, was a safe and well-tolerated method which was not dependent on any equipment or device. Additionally, our results showed that non-supervised PRT performed effectively by patients after proper repetition with a physiotherapist provided beneficial results without any side effects. According to our clinical observations, the inclusion of PRT with the usual rehabilitation program can enhance the mobility of patients and improve their recovery from cardiac surgery. It also allows patients to perform their routine daily activities and physiotherapy treatment.

The present study has important strengths. All surgeries were performed by a single surgeon at a single center and all patients were treated with a standard medical procedure and clinical care map. Thus, confounding factors from different sources were able to be eliminated. To the best of our knowledge, this is the first study investigating the effects of addition of PRT to the usual care on the sleep quality and other related factors in a postcardiac surgery population. Additionally, we evaluated all factors related to the sleep quality, such as daytime sleepiness, dyspnea, QoL, and pain with valid outcome measurements.

Nonetheless, this study also has some limitations. Firstly, the sample size was small. Secondly, we evaluated sleep quality using subjective methods and did not perform objective measurements such as polysomnography to assess the effects of PRT. If we were able to apply this assessment, we would collect improved data to support the observed improvements from the current study. Thirdly, the short follow-up period may be considered another limitation. However, our focus was to assess the short-term effects. Due to the outline of our training program, the follow-up assessment at three months may not provide realistic or reliable evidence. Lastly, the patients were referred to our outpatient physical activity counselling; therefore, it might be difficult to assess the efficiency of our programs separately from this outpatient care.

In conclusion, the results of the study showed that PRT has a preventive effect on sleep disturbances and reduces the need for sleep medication after cardiac surgeries. In addition, PRT is recommended to alleviate dyspnea and pain symptoms and to increase QoL after cardiac surgery. However, further large-scale studies are needed to investigate the effects of physiological factors such as physical activity level, functional level, fatigue, and cardiac function on the sleep quality to improve treatment strategies in this patient population.

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