Effect of Progressive Muscle Relaxation Technique on Post-Operative Pain and Quality of Recovery among Patients with Abdominal Surgeries

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Abstract

Background: Abdominal surgery is considered one of the most painful surgical procedures as the site's proximity to the diaphragm and extensive cross-innervations in the area increasing the post-operative pain. Progressive Muscle Relaxation (PMR) is a promising intervention for these complains. **Aim of the study** was to determine the effectiveness of progressive muscle relaxation technique on post-operative pain and postoperative quality of recovery. **Research design:** A quasi experimental research design with a pretest-posttest control group was utilized. **Setting:** at surgical departments at Damanhour National Medical Institute. **Subjects:** A purposive samples of 80 adult patients who are undergoing abdominal surgery were selected according to eligibility criteria. They were divided into two equal groups 40 in each study group and control group. **Tools of data collection:** four tools were used for data collection: Demographic and clinical Data Structured Interview Schedule, Visual Analogue Pain Scale, A modified Behavioral Pain Scale and Post-Operative Quality of Recovery Score. **Results:** After the intervention, PMR significantly decreased pain severity among study group compared to the control group. The severe pain intensity significantly absent from the entire study group, while it was significantly present among 42.5% of the control group. All of the study subjects had a good post-operative quality of recovery compared to only7. 5% of subjects in the control group. **Conclusion:** PMR significantly decreased post-operative pain and improve post-operative quality of recovery among patients after abdominal surgeries. **Recommendation:** PMR should be incorporated in post-operative nursing intervention protocols.

Keywords: Post- operative pain, Progressive Muscle Relaxation, Post -operative quality of recovery, Abdominal surgery

Introduction

Abdominal surgery is considered one of the most painful surgical procedures as the site's proximity to the diaphragm and extensive cross-innervations in the area increasing the post-operative pain experienced by patients and that should be alleviated as soon and as effective as possible to reduce suffering, to promote the healing process and to prevent complications. Every day, worldwide, high numbers of patients undergo abdominal surgeries. In United States between 2009 and 2013, there were nearly 10 million discharges associated with an open abdominal surgery **(Martin et al.; 2017)**. Pain and recovery are essential parts of the surgical patients' experience. Pain is difficult to define because of the complexity of its anatomical and physiological foundations, the individuality of its experience and its social and culture meanings. The International Association for the Study of Pain defines pain as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage'. Most patients undergoing abdominal surgeries experience post-operative pain which results in increasing stress responses and accelerate tissue breakdown. Inadequate post-operative pain control leads to post-operative complications including: impaired respiration, disrupted sleep, prolonged hospitalization, decreased patient satisfaction, increased treatment costs and delayed recovery **(Wanxia, Ren, Chen J and Yuman2019)**.

The postoperative quality of recovery has become an important endpoint in many clinical trials. It is congregation and includes various turning points in the return to normality and wholeness. It is commonly used term but it has not a clear definition. Postoperative recovery can be defined as an ongoing process that include three phases: first phase (early recovery) as the patient emerges from anesthesia; second phase (intermediate recovery) when the patient achieves criteria for discharge and the third phase (late recovery) when the patient returns to their preoperative physiological state. It is often associated with discharge from hospital as an outcome criterion for factors associated with the length of hospitalization. Several scales have been developed to measure different phases of postoperative quality of recovery. Postoperative recovery is an energy requiring approach that has four dimensions includes: physiological, psychological, social and habitual recovery **(Wanxia, Ren, Chen J and Yuman 2019)**.

Technology advancements and researchers are nowadays striving to achieve optimal pain control and enhancing postoperative recovery. Continuous intravenous infusion and the intra-spinal application of opioids for pain control remains a major challenge. Post-operative patients are under the constant nursing intervention which is essential in this area and must take a proactive role in assisting the patient to find measures that may ease and relieve their pain sensation. Relieving postoperative pain and enhancing post-operative recovery are considered specialized nursing care. The nurses also are responsible for assessing the need and type of pain relief as the administration of analgesics is an important part of nursing practice. Pharmacological measures for pain relieve are expensive and usually associated with many complications so recent studies focused on non-pharmacological interventions for the reduction of post-operative pain including relaxation training techniques **(Rejeh N., Karimooi M., Vaismoradi M and Jasper M., 2013).**

Progressive relaxation techniques were first applied in 1920's by Jacobson and then used in the technical science community by Hebert Benson. After many studies, progressive relaxation was accepted to be an effective method in the control of muscular rigidity and relieve pain. As early as 1930, Dr. Edmund Jacobson had developed the PMR technique. He revealed that, a muscle could be relaxed by first contract it for a few seconds and then releasing it. Patients are asked to intentionally tense muscle and hold the tension after that they release all contraction and focus on relaxation. Each muscle or muscle grouping is tensed for 5-7 seconds and after that they relaxed for 20-30 seconds. During each time, the individual focuses on the difference in sensations between the two sensations. The awareness of the relaxing sensation is one of the most gains realized with progressive muscle relaxation **(Cooke 2013).**

Progressive Muscle Relaxation (PMR) technique is one of the easiest techniques to be learnt and practice. This technique is safe, effective, self- induced by the patient, evidence base, inexpensive and free from side effects. It is a systematic technique through which tension and relaxation of muscles by unprompted, regularly and consecutively way until all body is relaxed and attain a deep state of relaxation through endorphins release, decrease sympathetic nervous system activities and increase parasympathetic nervous system **(Payne and Donaghy, 2010)**. Its benefits include: decreasing heart rate, controlling blood pressure, slowing breathing rate, decreasing oxygen need, slows down metabolic rate, enhancing peripheral dilatation and increasing peripheral heat, increasing blood flow to big muscles, reducing muscular rigidity, stress, fatigue and pain, inducing comfortable sleep and increasing body's immunity and sense of well-being**.** Ultimately, an improvement in adaptive functioning may be realized **(Özveren 2011).**

Significance of the study

Reducing post-operative pain and enhancing quality of recovery after surgery reduce the physiological burden of surgery, improve outcomes, improve post-operative quality of life, decrease hospital length of stay and decreasing costs **(El-Shakhs 2015)**. Progressive muscle relaxation which based on sound research findings with greater efficacy and less risk of adverse effects can aid in post-

operative pain relief and improve post-operative quality of recovery for achieving the pervious mentioned benefits. PMR generates more energy and provides more productivity in daily life activities as it induces deep rest, great refreshment and almost a sense of rebirth. Since 30 years nursing researchers used PMR in some chronic disease problems, relieving side effects of chemotherapy and hemodialysis, decrease postoperative pain and decrease the anxiety level of psychiatry patients and cardiac rehabilitation patients **(Eliopoulos 2014)**. Relying on these results, this study was carried out to determine the effectiveness of progressive muscle relaxation technique on post-operative pain and post-operative quality of recovery among patients with abdominal surgeries.

Aim of this study

The aim of this study was to determine the effect of progressive muscle relaxation technique on postoperative pain and quality of recovery among patients with abdominal surgeries

Hypothesis:

H_0: Post-operative patients who practice PMR technique have the same pain and postoperative quality of recovery as those who do not practice it.

H_1: Post-operative patients who practice PMR technique have lower pain intensity than those who do not practice it.

H_2: Post-operative patients who practice PMR technique have higher quality of recovery than those who do not practice it.

Operational definition:

Progressive muscle relaxation is a systemic contraction of each muscle group accompanied by inhalation and holding breath for 2-10 seconds (according to patient tolerance) followed by deep relaxation of the same muscle group accompanied by slow exhalation through pursed lips within 4-10 seconds (according to patient tolerance).

Materials and Method

Materials

Research design

A quasi experimental research design with a pretest-posttest control group was utilized

Setting:

This study carried out at surgical departments at Damanhour National Medical institute allied to ministry of health/ Elbehira governorate. The surgical departments consist of two floors, each floor contains five rooms and each room has four beds. This hospital is the largest governmental hospital that serves Damanhour and the surrounding areas.

Sample:

A purposive sample of 80 adult patients undergoing abdominal surgery who were available at the time of data collection was recruited from the above mentioned setting. The patients were selected by using the non-probability sampling technique according to the following inclusion criteria:

The inclusion criteria included:

- Aged 20-60 years
- Accept to participate in the study
- Free from heart disease, diabetes mellitus and respiratory disease
- Had no complication during the operation

The selected patients were then divided into two equal subgroups of 40 patients in each (study and control)

The sample size was estimated based on the Epi-Info 7 program using the following parameters:

- Target population 360 per 3 months
- Expected frequency p = 50%
- Acceptable error = 10%
- Confidence coefficient = 95%
- Sample size = 80

Tools:

Four tools were used for data collection.

Tool I: Demographic and clinical data structured interview schedule

This tool was developed by the researchers to collect basic data. It contains two parts. **The First part** included demographic data as age, level of education, occupation, marital status and current residence. **The second part** concerned with medical data such as surgical history, type of surgery and name of current surgery.

Tool II: Visual Analogue Pain Scale (VAS):

This tool was originally developed by **Melzack and Katz (1994).** It is a self-report device used for assessing and measuring pain intensity. It was adopted and translated into the Arabic language to suit the Egyptian culture. It consists of a horizontal line used for subjective estimation of the patient's pain. It comprises a 10 point numerical rating scale corresponding to the degree of pain in which zero representing no pain and 10 representing the worst degree of pain. In between these two opposite ends, words as mild, moderate, severe and unbearable are assigned. The patient was asked to select from that 10 points numerical continuum the number that corresponds to his perceived pain intensity.

Scoring system

- 0 indicates no pain
- 1 - 3 indicates mild pain
- 4 - 6 indicates moderate pain
- 7 - 9 indicate severe pain
- 10 indicate the worst unbearable pain .

Tool (III): A modified Behavioral Pain Scale (BPS)

It was developed by **Mateo O and Krenzischeck D (1992)**. It was used to measure the behavioral responses to pain. It includes four dimensions: posture, gross motor activity, facial expression and verbalization. For each of these four major behavioral responses one of a three alternative choices were elicited by the researcher. For posture, the choice is between relaxed or guarded or tense posture. For gross motor activity, the choose is very restless, slightly restless and quiet. For facial expression the choice is between no frowning, some frowning and constant frowning or grimacing. Finally, parturient verbalization varied between normal no sound, groans/moans and cries/sobs.

Each of the 12 alternatives is scored as either (0) absent or (1) present. The total scores range from 0-12. Statistically, this score was translated to the corresponding pain intensity as follows:

- (0): No behavioral responses to pain
- (< 4): Mild behavioral responses to pain
- (4-6): Moderate behavioral responses to pain
- (7-10): Severe behavioral responses to pain
- (≥ 11): Unbearable behavioral responses to pain

Tool (IV): Postoperative Quality of Recovery Score: the (QoR-40)

This tool was adopted from **Myles et al (2000)** and it was used to evaluate the patient's quality of postoperative recovery after 72 hours post-operative. It consisted of 40 items, the QoR-40 checklist items measure five general domains: first domain; comfort (12 items), second domain; emotions (9 items), third domain; physical independence (5 items), forth domain; patient support (7 items) and five domain pain (7 items). It was evaluated using a Likert-5 point scale. It was scored as follow: from "1= none of the time, 2=some of the time, 3= usually,4=most of time and 5=all of the time. Each patient completed the same questionnaire at three times; the day before surgery (baseline), in the morning of postoperative day 1 (POD1) and in the post-operative day 3 (POD3).

Scoring system

The minimal score is 40 and the highest score is 200, higher scores indicate better quality of recovery. Total score for checklist items was calculated and the level of patient's physical functioning was presented as follows:

- <67: Poor post-operative quality of recovery
- 67-≤132: Fair post-operative quality of recovery
- > 132-200 : Good post-operative quality of recovery

Methods:

The study was accomplished according to the following steps:

Approval

- An official letter was obtained from Faculty of Nursing, Damanhour University was directed to the responsible authority in Damanhour National Medical institute to gain their permission to carry out the research after explanation of its purpose.

Tools

- Tool one was developed by the researchers after reviewing the related literatures. Tool two, three and four were adopted and translated into Arabic language by the researchers.
- The content validity of the tools was tested by a jury of 5 experts in the field of medical surgical nursing.
- The tools reliability was tested by test- retest method within two weeks interval on 8 patients on 2 weeks interval where Cronbach's alpha for the tool 2, tool 3 and tool 4 were r =0.79, r=0.84, r=0.86 respectively.

Pilot study

- A pilot study was conducted on 8 patients with abdominal surgery not included in the actual study to assess the clarity and applicability of the tools and to identify any difficulties that may be faced during the actual study. In addition, the time needed to answer the tools was also estimated. The tools proved to be clear and no modifications were needed.

Data collection

- Collection of data consumed 5 months (from the beginning of May 2018 until end of September).
- Each patient in the study and control groups was interviewed alone in complete privacy to explain the purpose of the study, take his/her consent to participate and ensure his /her right to refuse participation or withdraw from the study at any time without any consequences.

For the study group:

- The researchers interviewed each patient in the study group individually on the day before the operation for about 60 minutes. The researchers introduced themselves to the patient and explained the purpose of the study and then oral consent was obtained for participation in the study. During this interview tool 1(part 1 &part 2) and tool 5 was collected from the patient.
- The patient was asked to sit down on the bed in a comfortable position and to close his eyes and keep them closed (if possible) till the end of the technique. For the relaxation training, the researchers demonstrated each step of PMR technique then asked the patient to re-demonstrate it, as the following steps:
- The researchers instructed the patient to take deep breathing and inhale deeply through the nose and felt the abdomen rise as he/she fill his/her body with air. Then slowly exhale out through the mouth, the navel pulling in toward the spine as the patient expels air out. Repeat 3-5 cycles of deep breathing (as patient tolerance).
- The researchers instructed the patient to tense and release muscles. Starting with feet by clenching toes and pressing heels toward the ground. Squeeze tightly for a few breaths and then release. Then flex feet in, pointing toes up towards head, hold for 10 seconds and then slowly release while counting for 10.
- Continue to tense and then release each muscle group. Working way up to right leg by (squeeze thigh muscles while doing above, holding for 10 seconds and then slowly release while counting for 10) repeat for the left leg, for buttocks (tensing by pulling buttocks together, holding for 10 seconds and then slowly release while counting for 10), abdomen (suck abdomen in, holding for 10 seconds and then slowly release while counting for 10), chest (tensing by taking a deep breath, holding for 10 seconds and then slowly release while counting for 10), for hands (clench fist, holding for 10 seconds and then slowly release while counting for 10), right arm (tighten biceps by drawing forearm up towards shoulder and make a muscle, while clenching fist, holding for 10 seconds and then slowly release while counting for 10) repeat on the left arm, for neck and shoulders muscle (raise shoulders up to touch ears, holding for 10 seconds and then slowly release while counting for 10), mouth (open mouth wide enough to stretch the hinges of jaw, holding for 10 seconds and then slowly release while counting for 10),

as for eyes (clench eyelids tightly shut, holding for 10 seconds and then slowly release while counting for 10) and finally for forehead (raise eyebrows as far as he/she can, holding for 10 seconds and then slowly release while counting for 10).

- The patient ends the technique by taking a deep breath and noting how much calmer and relaxed he/she felt.
- The researchers carried re-demonstration according to patient's needs. Also, the researchers corrected the wrong practice of the technique from the patient. After the completion of the explanation, the patient was asked to re-demonstrate PMR technique until he/she can master it.
- The researchers instructed every patient in the study group to practice this technique four hours postoperatively after the effect of anesthesia is lost and patient become conscious for thirty minutes every 8 hours along the day.
- Four hour post-operative tool 2 and tool 3 were applied as pre-test. Then the patient was instructed to demonstrate PMR technique for 30 minutes and repeated it 3 times per day in morning, evening and night shifts with supervision of the researchers.
- Every patient practiced this technique 1 to 2 sessions during the zero day postoperatively, 3 sessions in the first postoperative day, 3 sessions in the second postoperative day and 9th session of PMR technique at the morning of the third post-operative day.
- Second assessment of pain and postoperative quality of recovery for every patient's in the study group was done after 6 sessions (in second postoperative day) and third assessment after 9 sessions (in third postoperative day) as posttest.

For the control group:

- The patients in the control group were left for hospital routine care. In the day before the operation the researchers interviewed each patient individually for about 15 minutes; the researchers introduced themselves to the patient and explained the purpose of the study as well as oral consent was obtained then tool 1(part 1 and 2) and tool 4 was collected from the patient. Then researchers interviewed the patient after the operation by four hours to apply tool 2 and tool 3 and as pre-test. At the evening of the second day and third day post-operative the tool 2, tool 3 and tool 4 were re-administered as post–test.

Ethical Consideration:

- Each patient in both groups was interviewed alone in privacy to explain the purpose of the study, take his/her oral informed consent to participate in the study. The confidentiality and anonymity of patients" responses were assured; volunteer participation and the right to refuse to participate in the study were emphasized to the patients. Also their right to withdraw from the study was ensured at any time.

Statistical Analysis:

- After data collection was completed, it was feed to SPSS to be analyzed. Data was coded and categorized, number, percentage, mean and stander deviation were used to describe the basic data.

The used tests were:

1 - Chi-square test

For categorical variables to compare between different groups

2 - Fisher's Exact or Monte Carlo correction

Correction for chi-square when more than 20% of the cells have expected count less than 5

3 - Student t-test

For normally distributed quantitative variables to compare between two studied groups

4 - Friedman test

For abnormally distributed quantitative variables, to compare between more than two periods or stages and **Post Hoc Test** (**Dunn**'s**)** for pairwise comparisons.

Results

Table (1): Distribution of the study subjects according to their demographic and clinical data

Demographic and clinical data	Study group (n = 40)		Control group (n = 40)		F / χ^2 (P)
	N	%	N	%	
Age (years):					
• 20-<30	9	22.5	8	20.0	0.204 (0.903)
• 30- < 40	9	22.5	10	25.0	
• 40- < 50	9	22.5	10	25.5	
• 50-≤60	13	32.5	12	30.0	
Gender					4.266 (0.079)
• Female	16	40.0	11	27.5	
• Male	24	60.0	29	72.5	
level of Education:					5.246 (0.387)
• Can't read and write	12	30.0	8	20.0	
• Primary &Preparatory	14	35.0	12	30.0	
• Secondary	4	10.0	9	22.5	
• High education	10	25.0	11	27.5	
Marital status					2.244 (0.523)
• Single	9	22.5	10	25.0	
• Married	24	60.0	26	65.0	
• Divorced	2	5.0	0	0.0	
• Widow	5	12.5	4	10.0	
Occupation:					3.762 (0.152)
• Manual	7	10.0	10	25.0	
• Employee	6	15.0	8	20.0	
• House wife	16	40.0	8	12.5	
• Not work	11	27.5	14	35.0	
Residence					0.051 (0.822)
• Urban	17	42.5	18	45.0	
• Rural	23	57.5	22	55.0	
Surgical history					2.262 0.683
• Cholecystectomy	10	25.0	11	27.5	
• Gastrointestinal surgery	7	17.5	5	12.5	
• Pancreatic surgery	4	10.0	8	20.0	
• Multiple surgeries	4	10.0	7	17.5	
• No surgical history	15	37.5	9	22.5	
Type of surgery					0.278 0.598
• Elective abdominal surgery	15	37.5	17	42.5	
• Emergency abdominal surgery	25	62.5	23	57.5	
Name of current surgery					1.700 0.427
• Rupture appendicitis	7	17.5	10	25.0	
• Strangulated abdominal hernia	16	40.0	12	30.0	
• Exploration	17	42.5	18	45.0	

X2: Chi square test. * P < 0.05 (significant)

Table (1): Shows that, around one third (32.5% and 30.0%) in the study and control groups respectively were in the age between 50 - 60 years. As regards sex, most of the study subjects (60.0% and 72.5%) in the study and control group respectively were male. In relation to patients' education, it was found that 35.0%and 30.0% in both the study and control groups respectively were completed primary and preparatory education. Regarding marital status, more than half (60.0% and 65.0%) in both the study and control groups respectively were married. Concerning occupation, it was found that 40.0% and 35.0% in both the study and control groups respectively were house wife and not work. Regarding residence it was found that, more than half (57.5% and 55.0%) in both the study and control groups respectively were from rural areas. As for surgical history 25.0% and 27.5 in both the study and control groups respectively were had cholecystectomy. Regarding type of surgery more than have (62.5% and 57.5%) in both the study and control groups respectively were had emergent abdominal surgery. Finally, more than two fifths (42.5% and 45.0%) in both the study and control groups respectively were had exploration surgery. No statistical significance differences were found between both groups in relation to their demographic and clinical data which indicated proper matching between study and control groups in these variables.

Table (2): Number and percent distribution of the study subjects according to their intensity of pain using Visual Analogue Scale (VAS) before and after the intervention

Intensity of pain by VAS	Study group No =40						Control group No =40						MC (P) Before intervention	χ^2 (P) 1st day after intervention	χ^2 (P) 3rd day after intervention
	before intervention		1st day after intervention		3rd day after intervention		before intervention		1st day after intervention		3rd day after intervention				
	No	%	No	%	No	%	No	%	No	%	No	%			
None	0	00.0	15	37.5	23	57.5	0	00.0	0	00.0	0	00.0			
Mild (1-3)	2	05.0	12	30.0	8	20.0	0	00.0	4	10.0	7	17.5			
Moderate (4-6)	16	40.0	9	22.5	9	22.5	18	45.0	12	30.0	16	40.0	2.343	33.89	42.747
Severe (7-9)	20	50.0	4	10.0	0	00.0	19	47.5	22	55.0	17	42.5	$^{MC}p = (0.673)$	(0.000)*	(0.000)*
Unbearable ≥10	2	05.0	0	٠0.0	0	00.0	3	07.5	2	05.0	0	00.0			
MC (P)	63.318 (0.000)*						11.40 (0.180)								

χ^2 (P): Chi-Square Test & P for χ^2 Test - MC (P): **Monte Carlo** & P for MC Test - *: Significant at P ≤0.05

Table (2): It was observed that 50.0% of the study group had severe pain before the intervention while none of them had such pain intensity in the 3rd day after intervention. This is compared with 47.5% and 42.5% of the control group who had experienced such severe pain before and in the 3rd day after the intervention respectively. The difference between the intensity of pain according to the VAS scoring system among the study group before and after the intervention was statistically significant (P=0.000). Whereas the same difference among the control group was not statistically significant. (P=. (0.180). The difference between the two groups after the intervention was statistically significant (P=0.000).

Table (3): Number and percent distribution of the study subjects according to their Behavioral response to Pain before and after the intervention

Behavioral responses to pain	Study group No =40						Control group No =(40)						χ^2 (P) Before intervention	χ^2 (P) 1st day after intervention	χ^2 (P) 3rd day after intervention
	before intervention		1st day after intervention		3rd day after intervention		before intervention		1st day after intervention		3rd day after intervention				
	No	%	No	%	No	%	No	%	No	%	No	%			
Posture															
• Relaxed muscles	10	25.0	19	47.5	30	75.0	16	40.0	9	22.5	15	37.5	2.099 (0.350)	10.496 (0.005*)	11.905 (0.003*)
• Guarded position	7	17.5	12	30.0	5	12.5	5	12.5	8	20.0	9	22.5			
• Tense posture	23	57.5	9	22.5	5	12.5	19	22.5	23	57.5	16	40.0			
Gross motor															
• Very restlessness	14	35.0	10	25.0	6	15.0	13	32.5	20	50.0	16	40.0	0.228 (0.892)	6.613 (0.037*)	8.486 (0.014*)
• Slightly restless	12	30.0	13	32.5	13	32.5	14	35.0	12	30.0	14	35.0			
• Quiet	14	35.0	17	42.5	21	52.5	13	32.5	8	20.0	10	25.0			
Facial expression															
• No frowning	10	25.0	20	50.0	29	72.5	10	25.0	9	22.5	7	17.5	1.714 (0.424)	6.557 (0.038*)	24.649 (0.000*)
• Some frowning	15	37.5	10	25.0	5	20.0	20	50.0	15	37.5	18	45.0			
• Constant frowning	15	37.5	10	25.0	6	7.5	10	25.0	16	40.0	15	37.5			
Verbalization															
• Making normal sound	6	15.0	18	45.0	34	85.0	6	15.0	8	20.0	10	25.0	0.236 (0.889)	6.679 (0.036*)	29.091 (0.000*)
• Groans/moan	17	42.5	10	25.0	4	10.0	19	47.5	19	47.5	20	50.0			
• Cry out or sobs	17	42.5	12	30.0	2	5.0	15	37.5	13	32.5	10	25.0			

χ^2 (P): Chi-Square Test & P for χ^2 Test *: Significant at P ≤0.05

Table (3): Illustrates that, more than half 57.5% in both the study and control groups had tense posture before intervention, after intervention 75.0% in the study group had relaxed muscles comparing to 37.5% in the control group. In relation to gross motor, the table shows that 35.0% and 32.5% were quiet in the study and control groups respectively before intervention, after intervention the percent increased to 52.5% in the study group while, in the control group the percent decrease to 25.0%. Regarding facial expression, before intervention 37.5% and 40.0% were having constant frowning in the study and control groups respectively, after intervention; most (72.5%) in the study group had no frowning comparing to only (17.5%) in the control group. As for verbalization, more than two fifths (42.5% and 47.5%) in both the study and control groups respectively were having groans/mom sound before intervention while, after intervention the majority(85.0%) in the study group making normal sound comparing to 25.0% in the control group. There was no statistical significant difference between both groups before intervention in all behavioral responses items. The difference between the behavioral response to pain among the study and control groups after the intervention in the third day regarding posture, gross motor, facial expression and verbalization was statistically significant where (P=0.003, 0.014, 0.00, 0.00)respectively.

Table (4): Frequency distribution and significance of differences according to postoperative quality of recovery items among the study and control groups before and after intervention

Postoperative quality of recovery items	Pre-operative assessment (before intervention)		1st day after intervention		3rd day after intervention	
	Study group n=40	Control group n=40	Study group n=40	Control group n=40	Study group n=40	Control group n=40
Emotional state Min-Max	18-35	15-30	30 -40	18 -37	30-43	18 -37
Mean±SD	22.9± 4.5	21.5± 3.5	37.3± 3.1	27.7± 8.2	38.2±3.4	27.9 ±7.9
	t= 1.547 P=0.126		t= 6.875 P=0.000*		t=7.426 P=0.000*	
Physical comfort Min-Max	12 -36	12 - 36	36 -50	12 - 40	36 -55	12 - 40
Mean±SD	22.4±6.5	22.0± 6.9	45.9±3.8	23.8± 8.0	47.5± 4.3	23.9±7.8
	t=- .266 P=0.791		t= 15.749 P=0.005*		t=16.711 P=0.001*	
Psychological support Min-Max	7 -21	7 -21	21 -30	7 -21	28 -33	8 -21
Mean±SD	13.9±3.3	14.3±3.8	28.1 ± 3.2	13.5 ± 3.8	29.1 ± 1.9	13.8±3.3
	t= -0.411 P=0.682		t=18.817 P=0.002*		t=24.02 P=0.001*	
Physical independence Min-Max	7 -15	7-15	18 -20	5 -15	18 -22	7 -15
Mean±SD	10.3 ± 1.9	10.7 ± 2.4	19.3 ± 1.0	10.3 ± 2.2	19.9 ± 0.8	11.4 ± 2.6
	t=3.250 P=0.188		t=16.365 P=0.000*		t=19.561 P=0.000*	
Pain Min-Max	7 -17	7 -18	21 -30	7 -21	21 -30	8 -21
Mean±SD	11.3 ± 2.6	11.4± 2.9	27.5 ± 3.4	12.5 ± 4.5	29.2 ± 1.6	13.2 ± 3.9
	t= -0.235 P=0.815		t=16.8 P=0.021*		t=23.751 P=0.000*	

- *****level of significance p = ≤0.05 - t: t-test

Table (4): it was observed that there was no statistically significant difference between the study and control groups in all items of postoperative quality of recovery scale before progressive relaxation technique. While, there was statistically significant difference in all items of post-operative quality of recovery including: emotional state, physical comfort, psychological support, physical independence and pain after 1st day of progressive relaxation intervention where p value= (P= 0.00*, 0.005*, 0.002*, 0.000* and 0.021*). Moreover, there was statistically significant difference in all items of postoperative quality of recovery scale after 3rd day progressive relaxation intervention. (0.000*, 0.001*, 0.001*, 0.000* and 0.000*)

Table (5): Frequency distribution and significance of differences according to total postoperative quality of recovery score among the study and control groups before and after intervention

Total Postoperative quality of recovery Score	**Study group (n=40)**		**Control group (n=40)**		**Significance level**
Pre-operative assessment (before intervention)					
• **Poor**	15	37.5%	13	32.5%	χ^2=0.220 P=0.639
• **Fair**	25	62.5%	27	67.5%	
• **Good**	0	0.0%	0	0.0%	
1st day after intervention					
• **Poor**	0	0.0%	14	35.0%	χ^2=42.345 P=0.000*
• **Fair**	11	27.5%	24	60.0%	
• **Good**	29	72.5%	2	5.0%	
3rd day after intervention					
• **Poor**	0	0.0%	12	30.0%	χ^2=68.837 P=0.0‥*
• **Fair**	0	0.0%	25	62.5%	
• **Good**	40	100.0%	3	7.5%	

- ***level of significance p = ≤0.05 -χ^2: Chi square test

Table (5): it was noticed that more than half (62.5% and 67.5%) of study and control groups were had fair quality of recovery preoperatively respectively and there was no statistical significant difference between both groups where p=(0.639). After 1st day of practicing progressive relaxation technique 72.5% of the study group had good quality of recovery postoperatively while the control group 60.0% had fair quality of recovery postoperatively, there was statistically significant difference (P=0.000*) between both groups in the 1st day . After 3rd day of practicing progressive relaxation technique intervention all of them the study group had good quality of recovery postoperatively compared to only 7.5% the control group. There was statistically significant difference between both the study and control groups.in the 3rd post-operative day where (P=0.000*).

Discussion

Postoperative quality of recovery is commonly used as an outcome of surgery for millions of patients all over the world undergo surgical operations. Defining recovery from a holistic nursing approach including: emotional state, physical comfort, psychological support, physical independence and pain. Which is essential for providing high quality postoperative nursing care **(Allvin et al.; 2007)**. Most of patients undergoing surgical procedures experience acute postoperative pain, this necessity the finding of effective and safe measures that can help those patients to reassume their ordinary life rapidly. Many preoperative, intraoperative and postoperative pain management strategies are available. The American Pain Society (APS), with input from the American Society of Anesthesiologists (ASA), commissioned a guideline on management of postoperative pain to promote evidence-based, effective and safer postoperative pain management in children and adults, addressing areas that include preoperative education, perioperative pain management planning, use of different pharmacological and non-pharmacological modalities **(Debra 2017)**.

Among non-pharmacological modalities, the progressive muscle relaxation technique is the easiest one to be learnt and applied. It is inexpensive, available, self -induced by the patient and has no side effects **(Krupinska and Kulmatycki, 2014)**. Thus, progressive muscle relaxation technique was believed to decrease postoperative pain and enhance postoperative quality of recovery. The results of the present study revealed that there were no statistically significant differences between patients' demographic characteristics and clinical data between the study and control groups which included age, gender, level of education, marital status, occupation, residence, surgical history, type of surgery and name of surgery. These findings roll out the extraneous factors that might confuse effect of progressive muscle relaxation technique on postoperative pain and postoperative quality of recovery among patients undergoing abdominal surgeries.

In the present study there is no significant difference between both groups regarding pain intensity, behavioral response to pain before progressive muscle relaxation technique in the first assessment 4 hours postoperatively. This may be attributed to the fact that patients on both groups are relatively similar due to type and name of surgery. Moreover, patients' highest percentage in both groups had moderate to severe pain this may be attributed to, nerves injury during surgery as abdominal surgery is considered to be one of the most painful surgical procedures and wound inflammatory process postoperatively **(Esther, Schug and Stephan, 2017; Topcu and Findik ,2012)**. The result of the present study is in the line with the study conducted by **(Apfelbaum et al.; 2013)** who stated that, more than 80% of patients who undergo surgical procedures suffering from acute postoperative pain. Another study conducted by **(Gan et al., 2014)** in which their results concluded that (75%) of patients with postoperative pain report the severity of pain as moderate, severe, or extreme.

In the present study it was observed that, the intensity of pain and behavioral response to pain had significantly decreased among the study group after practicing progressive relaxation technique post-operative. At the same time, such decrease was not found among the control group after the implementation of routine hospital care and receiving postoperative analgesia. This result suggests a possible positive effect of progressive relaxation technique on treating acute postoperative pain among patients with abdominal surgery. This result may be attributed to the fact that, progressive relaxation exercise enhances pain relief by decreasing muscle tension, lowering anxiety level and distracting attention. Moreover, it improves pain relief through the gate control theory of pain postulates that changes pain impulses being transmitted from the peripheral nerve receptors to the brain can result in little or no pain perception **(Roykulcharoen and Good 2014)**.

The results of the current study are also similar to the results of **(Topcu and Findik, 2012)** who found that patients practicing progressive relaxation techniques

experienced a statistically significant reduction in pain, as compared to patients receiving usual nursing interventions. Also the results are in accordance with **(Varghese, 2014)** who concluded that progressive muscle relaxation was effective postoperative pain management and improving physical, behavioral, social and psychosocial wellbeing of postoperative patients than routine hospital interventions. The results were similar to the findings of the study done by **(Wanxia et al.; 2019)** regarding the pain prevalence, severity, assessment in Canadian teaching hospital among postoperative patients who stated that implementation progressive muscle relaxation reduce pain and discomforts among postoperative patients. Also in line with the study conducted by **Paula et al.; (2012)** who concluded that PMR significantly decreased pain perception among study group compared to control group. They further recommended that health care team should prepare their patients to apply PMR during the preoperative period to be used as a pain control method during the post-operative period.

In conclusion a very recent meta-analysis conducted by **Wang et al.; (2018)** about "Perioperative psychotherapy for persistent postsurgical pain and physical impairment" reported similar result with the current study. They reviewed many studies and concluded that moderate quality evidence supported the hypothesis that perioperative psychotherapy including PMR significantly decreased pain during post-operative period. The result of the present study also revealed that, postoperative quality of recovery improved in all items including: emotional state, physical comfort, psychological support, physical independence and pain, after 1st day and 3rd day postoperatively. Moreover, most patients in the study group had good quality of recovery in the third day compared to fair quality of recovery in the control group. This is may be clarified by positive effect of progressive relaxation technique on decreasing postoperative pain and improving postoperative quality of recovery.

These findings are in line with **(Devmurari and Nagrale, 2018)** whose results recommend that; progressive muscle relaxation techniques can be implemented as an adjunct therapy along with postoperative pain medications to improve functional activity and to enhance early post-operative recovery. Also these findings were supported by **(Essa, Ismail and Hassan, 2017)** who reported in thier study that; implementation of nine sessions progressive muscle relaxation techniques minimize stress, anxiety, depression and improve postoperative recovery. Also in accordance with study done by **(Xiong et al.; 2020)** who revealed that; the application of helps to stabilize the perioperative physical condition of patients, narrow the fluctuation range of physical indicators and ensure the smoothness and safety of the surgery PMR training in surgical care can significantly reduce the adverse emotions of postoperative patients with increasing quality of postoperative recovery.

Finally, the findings of this study clarify the fact that progressive muscle relaxation technique can be used to decrease postoperative pain and improve postoperative quality of recovery among patients with abdominal surgery which can be achieved through educating those patients progressive muscle relaxation technique preoperatively.

Conclusion

In the light of the results of the present study, it was concluded that; post-operative patients who practice PMR technique have lower pain intensity and higher postoperative quality of recovery than those who received only the routine nursing care. So, PMR with no need to expensive and highly morbid procedures may be enrolled as routine post-operative care.

Recommendations

Based on the findings of the current study, the following recommendations can be suggested:

- PMR is a technique that is inexpensive, effective, and easy to apply during the hospitalization period. Therefore, the nurses should incorporate such practices in post-operative nursing care.
- Patient's education about PMR technique should be implemented with all post-operative patients to help in relieving pain

and enhance post-operative quality of recovery.

- Replication of the present study under different circumstances (sampling, setting and duration of management) is recommended to validate and greater generalization of the results.

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