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EFFECT OF PERIOPERATIVE EXERCISES ON KINESIOPHOBIA AND QUALITY OF LIFE IN PATIENTS UNDERGOING OPEN HEART SURGERY WITH FORWARD HEAD POSTURE

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ABSTRACT
Open heart surgery is a major procedure that can significantly impact quality of life (QoL). Forward head posture (FHP) is a prevalent condition that also adversely affects QoL. Objective was to compare the effect of perioperative exercises on kinesiophobia and quality of life in persons undergoing open heart surgery (OHS) with forward head posture. This prospective, parallel-group, randomized controlled trial included 32 patients undergoing open heart surgery via median sternotomy with FHP, recruited from Rawalpindi Institute of Cardiology, Pakistan. Participants were randomized into two groups: 1) standard cardiac rehabilitation (CR) protocol, 2) CR protocol with therapeutic exercises for FHP. The intervention included a combination of stretching and strengthening exercises. Outcomes assessed were Health-related QoL (SF-36) and Tampa scale for Kinesiophobia (TSK); assessed at 4 weeks before surgery (T1), one day before surgery (T2), day of discharge (T3) & 4 weeks post-discharge (T4). One-way ANOVA and Repeated measures ANOVA were used to test hypotheses and evaluate changes from baseline to various time points. The between-group comparison indicated significant differences in TSK scores at all time points T1 ($p = 0.029$), T2 ($p = 0.008$), T3 ($p = 0.001$), and T4 ($p = 0.022$) while all domains of SF-36 showed no significant differences ($p>0.05$) at all time points. The study concludes that both standard CR and CR + therapeutic exercise for FHP showed equal effects on QoL of patients while kinesiophobia was greater in the group performing exercises for FHP.

Keywords: Forward head posture; Open heart surgery; Quality of life; Tempa Scale of Kinesiophobia; Strengthening; Stretching.

INTRODUCTION
Cardiac surgery, specifically the open-heart technique, is a delicate and essential procedure, which is

performed to treat conditions like coronary artery disease, valvular diseases, and congenital heart disorders. Although the surgery is effective in the management of these conditions, open heart surgery has a negative effect on the QoL of the patient after the surgery because of the physical and psychological challenges incurred in the surgery and the subsequent recovery period [1]. This is because issues such as pain, limited mobility and postoperative psychological issues are normal and may lead to a long and painful rehabilitation phase [2].

FHP is one of the most frequently observed postural abnormalities which is described as the position of the head in front of the vertical line through the rest of the trunk and leads to the increased stress on the cervical muscles [3]. It is a well-established fact that FHP is associated with several musculoskeletal diseases including chronic neck pain and headaches. FHP has been on the rise in the recent past particularly among those people who are more inclined to a sedentary lifestyle and those who spend most of their time working on computers and other digital gadgets such as smart phones [4]. Consequently, the problems resulting from FHP can only add to the challenges of patients who are already dealing with open heart surgery, with their pain and overall QoL being negatively impacted.

The present study has followed the observation made in previous studies that open heart surgery and FHP separately have a negative impact on QoL. Patients who have undergone open heart surgery are always in severe pain and great extent of disability which leads to kinesiophobia, which means the fear of movement which in turn slows down the rehabilitation process [5]. Likewise, FHP patients experience general pain and disability, which worsen their QoL [6]. However, little is known about the combined impact of these conditions on patients who have been subjected to open heart surgery. This study seeks to address this gap by assessing the moderating effect of FHP on the effects of open-heart surgery on QoL and fear beliefs. The justification for this study is grounded on the following premise that, therapeutic exercises directed to FHP can help to ameliorate the negative impact on QoL and the fear of movement associated with pain in patients who have undergone open heart surgery. Strengthening exercises of the cervical and thoracic paravertebral muscles, as well as performing postural stretches, have been found to increase the postural stability and decrease pain [7].

METHODOLOGY

Study Design: This study is a parallel-group, allocation-concealment, randomized controlled trial (Trial number: NCT05967780) of patient and assessor intention-to-treat with a prospective design. This trial was carried out at Rawalpindi Institute of Cardiology, located in Rawalpindi, Pakistan for a time duration of 5 months (from August 2023 to December, 2023). The study was initiated after getting permission from the Rawalpindi Institute of Cardiology's Institutional Review Board and Ethics Committee (IRB # RIC/RERC/40/23). The participants in the study were informed of the study and signed a consent form before the study. Participants were randomly assigned to either the standard cardiac rehabilitation group or the therapeutic exercise intervention group.

Participants: A total number of n = 32 participants (calculated using G*Power Version 3.1.9.4) who met the inclusion criteria were recruited in this study through block random sampling. Patients included in the study were male, aged between 30-60 years, who were candidates for first-time, elective median sternotomy (CABG or valve replacement), and had been extubated in the first 6 postoperative hours. Patients were excluded if they had previous surgeries or musculoskeletal injuries, lung diseases, neurological disorders or would need reoperation. The recruitment of participants took place in the inpatient ward.

Randomization: There was 1:1 allocation ratio of the participants by online software-generated random sequence numbers. Participants were assigned to one of the two groups using sealed, double layered, numbered envelopes. After baseline assessment, assignment to study group was occurred by opening of envelope by staff member of physiotherapy department who was not involved in the study. The member of staff then informed the physiotherapist who was treating about the group allocation.

Intervention: The control group underwent a standard CR program that follows the American Association of Cardiovascular and Pulmonary Rehabilitation guidelines (n=16). The intervention group performed standard CR program as control group and additional therapeutic exercises for FHP (n=16), which included both stretching and strengthening exercises (sternocleidomastoid & pectoralis stretch, the supine chin tuck, and scapular retraction) in addition to the routine rehabilitation program [8,9]. The participants worn a supportive vest while performing exercises post-operatively to ensure safety. All participants performed a total of 32 sessions (four weeks before the surgery and four weeks post discharge from hospital), 4 days in a week, 3 sets daily, 12 repetitions in each set as strengthening exercises, and two stretching exercises each held for 30 seconds for 3 repetitions in each set. Therapeutic exercises were provided in physical, verbal and written formats to every participant separately with a flyer to ensure standardization.

Table 1: Detail description of exercise programme

Exercise	Muscle	Description
Static Sternocleidomastoid stretch	Sternocleidomastoid	The participant was positioned in optimal posture and asked to place left arm behind the body and depress the shoulder, tuck chin and slowly draw her right ear to the right shoulder, also was asked to rotate her neck upward toward the ceiling until a slight stretch is felt on the left side; he held this position for 30 seconds then relaxed and repeated it for the opposite side.
One-sided unilateral self-stretch exercise	Pectoralis minor	The participant's forearm was stabilized by a vertical plane before the trunk was rotated in the opposite direction. Therefore, the arm on the involved side was externally rotated and abducted to 90°. Repeated it for the opposite side.
Supine chin tuck	Longus colli Longus capitis	The participant was asked to chin tuck in the supine position with the head in contact with the floor, kept the head straight and held it for 4 seconds and relaxed, then repeated the exercise.
Scapular retraction	Trapezius Rhomboids Latissimus dorsi	This exercise was done in the standing position by using a band pulling the shoulders back. The participant was instructed to retract and pinch scapula together without elevation or extension in the shoulders and held this position for 2 seconds and then relaxed.

Outcome measures: Health-related quality of life (HRQoL) was assessed using the SF-36, a widely used instrument that evaluates eight domains: physical component, physical role, emotional role, mental health, energy/fatigue, social roles, pain, and overall health. The scores of each domain are from 0 to 100 where the higher scores are related to higher QoL. The test-retest reliability of the SF-36 has been proven to be satisfactory, with Cronbach's α values ranging from 0. 65 to 0. 96 for all subscales and was able to detect the difference in health status over time in post CABG patients [10-12]. Tampa Scale for Kinesiophobia (TSK-11) is a valid and reliable tool that measures pain-related fears of movement and re-injury. This 11-item tool, which is a modified version of the 17-item version of the questionnaire, employs a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree) and has good internal consistency and reliability based on Cronbach's α of 0. 80. [12-14]. These were measured at 4 weeks pre-operatively (±3 days) (T1), at one day before surgery (±1 day) (T2) and after surgery before discharge from the hospital (7th post-operative day ±1 day) (T3), were take place in the inpatient setting. The last follow-up 4 weeks post-discharge testing (±3 days) (T4) was conducted in the outpatient physiotherapy department of the hospital.

Statistics: The normality of data was checked by using Shapiro-Wilk test and according to this test almost all the variables were normally distributed hence parametric test was run on the variables. For

within-group analysis, repeated measure ANOVA with the help of pairwise comparison was also used. For between group analysis the method used was one-way ANOVA. Hypothesis testing was conducted with the help of the level of significance which was set at p<0. 05, while the data analysis was done using the Statistical Package for Social Sciences (SPSS) version 26.

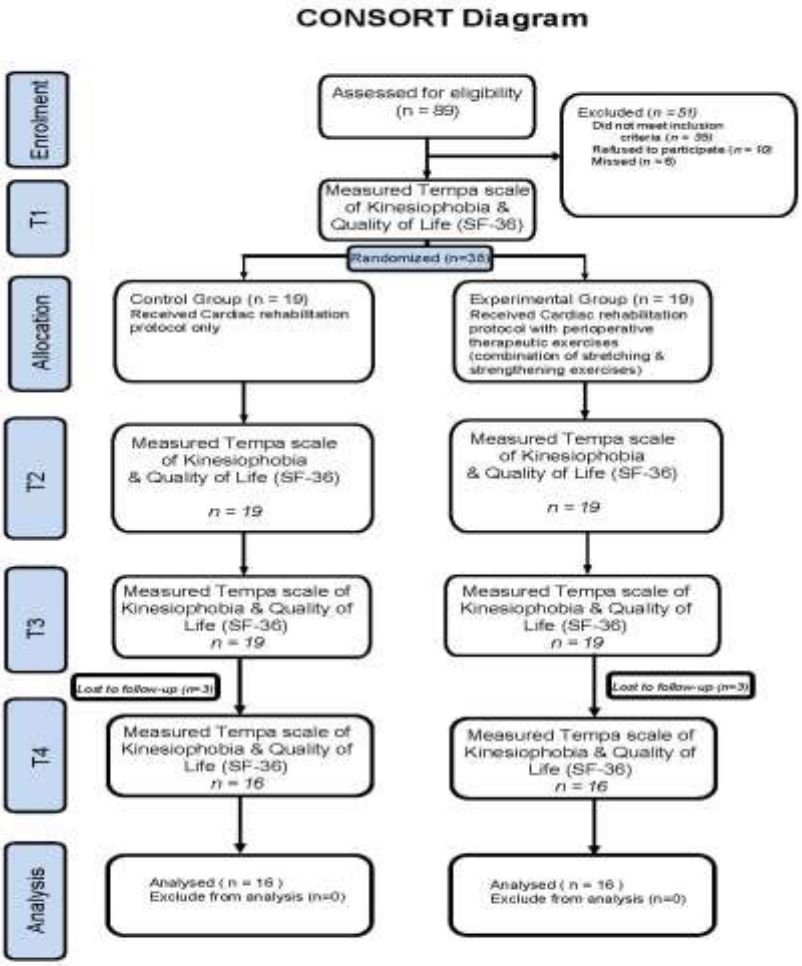

Figure 1: CONSORT Diagram

RESULTS

The mean age (SD) of participants of control group is 52.93 ± 4.86, while of experimental group is 53.62 ± 3.40. The results of the within-group comparison of the control and experimental groups based on the repeated measures ANOVA showed changes in the outcome measures of the study, especially the TSK and the domain scores of the SF-36 QoL. The TSK scores at T3 were significantly higher than the scores at T2 in the control group with p < 0. 019, then dropped significantly at T4 with p < 0. 001. Likewise, the experimental group revealed elevation from T1 to T3 with p < 0. 001, and a subsequent decrease at T4 with p < 0. 001, it also shows the fear of movement to do exercises right after the surgery and the fear of movement decreasing with time.

Table 2: Within-group comparison

		Control Group			Experimental Group		
		Mean	**SD**	**p-value**	**Mean**	**SD**	**p-value**
Tempa scale of Kinesiophobia	T1	19.75	2.79	[a]0.290	22.75	2.81	[a]0.00***
	T2	20.18	2.80	[b]0.019	23.68	2.84	[b]0.00***
	T3	22.31	1.77	[c]0.00***	26.56	2.85	[c]0.00***
	T4	17.93	2.32	[d]0.00***	21.12	2.96	[d]0.00***
Physical functioning (QoL)	T1	46.87	28.04	[a]0.001**	47.50	30.76	[a]0.003
	T2	50.93	30.17	[b]0.00***	55.00	31.83	[b]0.009
	T3	43.43	27.79	[c]0.00***	47.50	27.92	[c]<0.001
	T4	49.68	29.18	[d]0.01*	55.31	29.74	[d]0.004**
Role limitations due to physical health (QoL)	T1	15.62	35.20	[a]1.000	17.18	35.02	[a]0.623
	T2	17.18	37.32	[b]1.000	23.43	38.15	[b]1.000
	T3	15.62	35.20	[c]1.000	21.87	37.50	[c]0.983
	T4	17.18	37.32	[d]1.000	25.00	39.79	[d]1.000
Role limitations due to emotional problems (QoL)	T1	14.58	34.35	[a]1.000	14.58	34.35	[a]1.000
	T2	14.58	34.35	[b]1.000	22.91	39.84	[b]1.000
	T3	14.58	34.35	[c]1.000	14.58	34.35	[c]1.000
	T4	14.58	34.35	[d]1.000	14.58	34.35	[d]1.000
Energy/fatigue (QoL)	T1	63.75	14.54	[a]0.333	63.75	21.09	[a]0.019*
	T2	65.31	12.97	[b]0.118	67.50	19.74	[b]0.118
	T3	63.75	14.08	[c]1.000	64.37	20.64	[c]0.495
	T4	64.06	13.93	[d]1.000	65.31	19.87	[d]0.118
Emotional Well-being (QoL)	T1	70.50	10.72	[a]0.118	71.00	18.44	[a]0.009**
	T2	71.75	10.77	[b]0.246	74.25	17.82	[b]0.009**
	T3	70.75	10.80	[c]1.000	71.25	18.31	[c]0.495
	T4	71.00	10.58	[d]0.983	72.00	17.52	[d]0.246
Social functioning (QoL)	T1	50.78	16.11	[a]1.000	50.00	18.81	[a]0.039*
	T2	52.34	14.59	[b]1.000	56.25	18.81	[b]0.023*
	T3	50.78	16.11	[c]1.000	50.78	16.75	[c]1.000
	T4	50.78	16.11	[d]1.000	50.78	16.75	[d]1.000
Pain (QoL)	T1	65.93	19.03	[a]0.253	67.34	28.84	[a]0.045*
	T2	68.59	17.70	[b]1.000	73.28	30.21	[b]0.116
	T3	67.18	17.46	[c]1.000	68.12	28.65	[c]1.000
	T4	67.18	17.46	[d]0.983	68.75	28.75	[d]1.000
General health (QoL)	T1	60.31	11.75	[a]0.118	63.43	13.99	[a]0.019*
	T2	61.87	11.08	[b]0.001***	67.18	14.25	[b]0.040*
	T3	56.56	11.06	[c]0.023*	60.31	14.07	[c]0.006**
	T4	58.75	11.76	[d]0.577	63.43	15.02	[d]1.000

Significance Level: p<0.05*, p<0.01**, p<0.001***
[a] T1 to T2, [b] T2 to T3, [c] T3 to T4, [d] T1 to T4
QoL=Quality of Life

Table 3: Between-group comparison

		Control Group		Experimental Group		
		Mean	**SD**	**Mean**	**SD**	**p-value**
Tempa scale of Kinesiophobia	T1	19.75	2.79	22.75	2.81	0.029*
	T2	20.18	2.80	23.68	2.84	0.008**
	T3	22.31	1.77	26.56	2.85	0.001**
	T4	17.93	2.32	21.12	2.96	0.022*
Physical functioning (QoL)	T1	46.87	28.04	47.50	30.76	0.998
	T2	50.93	30.17	55.00	31.83	0.918

	T3	43.43	27.79	47.50	27.92	0.907
	T4	49.68	29.18	55.31	29.74	0.840
Role limitations due to physical health (QoL)	T1	15.62	35.20	17.18	35.02	0.992
	T2	17.18	37.32	23.43	38.15	0.901
	T3	15.62	35.20	21.87	37.50	0.897
	T4	17.18	37.32	25.00	39.79	0.854
Role limitations due to emotional problems (QoL)	T1	14.58	34.35	14.58	34.35	1.000
	T2	14.58	34.35	22.91	39.84	0.826
	T3	14.58	34.35	14.58	34.35	1.000
	T4	14.58	34.35	14.58	34.35	1.000
Energy/fatigue (QoL)	T1	63.75	14.54	63.75	21.09	1.000
	T2	65.31	12.97	67.50	19.74	0.920
	T3	63.75	14.08	64.37	20.64	0.994
	T4	64.06	13.93	65.31	19.87	0.974
Emotional Well-being (QoL)	T1	70.50	10.72	71.00	18.44	0.994
	T2	71.75	10.77	74.25	17.82	0.864
	T3	70.75	10.80	71.25	18.31	0.994
	T4	71.00	10.58	72.00	17.52	0.976
Social functioning (QoL)	T1	50.78	16.11	50.00	18.81	0.992
	T2	52.34	14.59	56.25	18.81	0.827
	T3	50.78	16.11	50.78	16.75	1.000
	T4	50.78	16.11	50.78	16.75	1.000
Pain (QoL)	T1	65.93	19.03	67.34	28.84	0.986
	T2	68.59	17.70	73.28	30.21	0.854
	T3	67.18	17.46	68.12	28.65	0.994
	T4	67.18	17.46	68.75	28.75	0.982
General health (QoL)	T1	60.31	11.75	63.43	13.99	0.727
	T2	61.87	11.08	67.18	14.25	0.388
	T3	56.56	11.06	60.31	14.07	0.606
	T4	58.75	11.76	63.43	15.02	0.512

Significance Level: $p<0.05$*, $p<0.01$**, $p<0.001$***
[a] T1 to T2, [b] T2 to T3, [c] T3 to T4, [d] T1 to T4
QoL=Quality of Life

In the SF-36 QoL domains, the control group physical functioning (PF) scores were statistically significant and increased from T1 to T2 with $p = 0.001$, and a subsequent increase at T4 with $p < 0.001$. The experimental group also had similar improvements in QOL from T1 to T2 with $p < 0.01$, a decline at T3 with $p < 0.01$ and an improvement at T4 with $p < 0.001$. In both groups, no statistically significant changes were observed in role limitations due to physical health and emotional problems. Energy/Fatigue (E/F) scores did not change significantly in the control group, but the experimental group improved significantly from T1 to T2 with $p < 0.019$. Emotional Well-being (EWB) scores showed no significant change in the control group, while the experimental group improved significantly from T1 to T2 with $p < 0.009$. Social Functioning (SF) did not change significantly in the control group, but the experimental group improved significantly from T1 to T2 with $p < 0.039$, and decrease at T3 with $p < 0.023$. Pain scores did not change significantly in the control group but improved significantly in the experimental group from T1 to T2 with $p < 0.045$. General Health (GH) scores decreased significantly in the control group from T2 to T3 with $p < 0.001$, increased at T3 to T4 with $p < 0.023$. The experimental group showed significant improvements from T1 to T2 with $p < 0.019$, and decrease significantly from T3 to T4 with $p < 0.006$.

The between-group comparison using one-way ANOVA indicated significant differences in TSK scores at all time points, with the experimental group showing consistently greater fear of pain due to

movement. Specifically, TSK scores were significantly different between the groups at T1 ($p = 0.029$), T2 ($p = 0.008$), T3 ($p = 0.001$), and T4 ($p = 0.022$).

For the SF-36 domains, there was no significant differences in physical functioning, role limitations due to physical health or emotional problems, energy/fatigue, emotional well-being, social functioning, pain and general health. These results suggest that the therapeutic exercises had no impact on the experimental group's QoL compared to the control group.

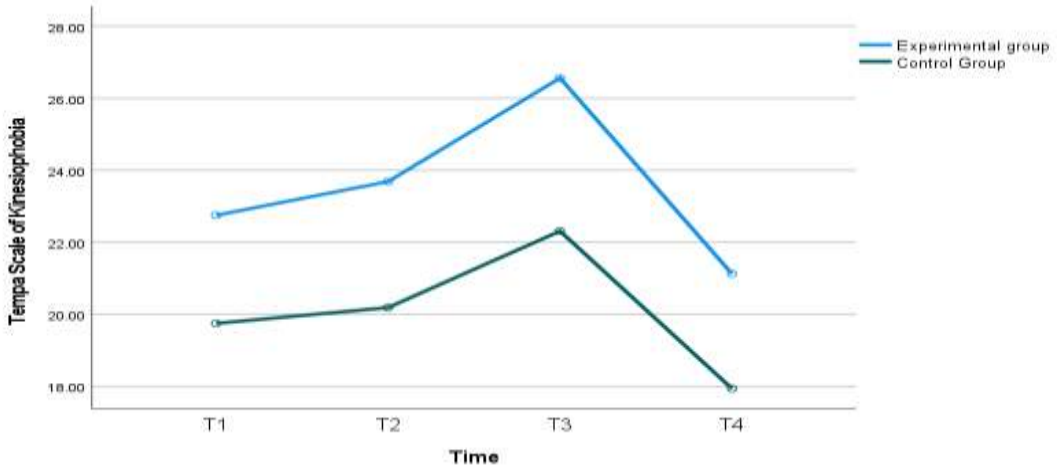

Figure 2: Interaction Effect Between Intervention and Time Factor for Tempa Scale of Kinesiophobia

DISCUSSION

The aim of this study was to examine the effects of PPE on kinesiophobia and QoL in patients who had OHS with FHP. The results provided valuable information about the application of therapeutic exercises in the perioperative period, including kinesiophobia and several domains of QoL.

Kinesiophobia which is the fear of movement because of pain was significantly higher in the experimental group (performing therapeutic exercises for FHP as an intervention) at all time points compared to the control group (standard cardiac rehabilitation). The TSK scores demonstrated a significant trend where the experimental group had an increased fear of movement shortly after surgery and this gradually decreased but was still higher than the control group at all the tested time points ($p < 0.05$ at all-time points). The increased fear in the experimental group can be explained by the focus on pain and possible injury that comes with vigorous physical activity after surgery [5]. These findings are in accordance with the previous research that has stated that kinesiophobia is enhanced by physical activity, especially during the early recovery period due to increased pain sensitivity and fear of re-injury [13,16].

There was no statistical difference found in the QoL of the two groups based on the SF-36 in all the eight domains: physical functioning, role limitations due to physical health, role limitations due to emotional problems, vitality, social functioning, pain, general health perceptions, and mental health. This means that although therapeutic exercises for FHP may increase kinesiophobia, they do not impair the QoL of participants compared to those in the standard CR only group.

Physical Functioning: Both groups also demonstrated changes from T1 to T2 followed by a decrease in scores at T3 and an increase at T 4. This pattern can be attributed to the immediate positive effects of rehabilitation, a decline in the first days of surgery because of the physical load, and gradual improvement over the following days as patients adjust to their postoperative treatment plan [1]. Role Limitations: There was no change in the role limitation due to physical health or emotional problems before and after the intervention in both the groups, implying that the therapeutic exercises did not worsen or improve the situation. Energy/Fatigue and Emotional Well-being: As for the comparison between T1 and T2, the experimental group had the improvements in the energy/fatigue and emotional well-being as in the previous study by Lee et al., 2015 the physical activity helps to increase

the vitality and mood. However, these improvements were not maintained at T3 suggesting that it might be a transient effect which needs to be studied further for long-term effectiveness. Social Functioning: The experimental group had a significant increase in social functioning from T1 to T2, which can be attributed to improved physical health and less pain leading to better interaction and participation in social activities [6]. Pain: The results of pain scores also increased from T1 to T2 in the experimental group but was not significantly different from the control group at the later time point. This means that the therapeutic exercises can help alleviate pain in the short term but the benefits are similar to those seen in standard CR [9].

That there was a marked decrease in kinesiophobia from T3 to T4 in both groups indicates that fear of movement decreases as the patient moves through the postoperative period of rehabilitation. This reduction may be explained by a gradual adaptation to exercise and the decrease in early postoperative pain. This goes a long way in supporting the hypothesis that patient education and gradual return to physical activities are significant in the recovery process [7].

In a patient care model, the findings underscore the value of an integrated approach to recovery after an operation. It is advantageous to address FHP through therapeutic exercises since it helps in correcting postural abnormalities and avoiding eventual musculoskeletal disorders. Nonetheless, it should be noted that it is essential to control the frequency and the extent of these interventions to prevent kinesiophobia worsening. They should incorporate counselling and then gradually increase patients' physical activity so that they gain the best results in their recovery process [12].

Subsequent investigations should ascertain the overall outcomes of merging the therapeutic exercises for FHP with the standard CR regarding the musculoskeletal status and QoL in the long-term. Further, examining the implementation of patient education and psychological intercessions to reduce kinesiophobia might offer more extensive rehabilitation approaches. Furthermore, increased sample size and diverse patient population would increase the generalizability of these findings [15].

CONCLUSION

This study therefore posits that although therapeutic exercises promoting FHP in patients who are undergoing OHS leads to short term kinesiophobia, the overall QoL is not greatly impacted as compared to standard CR alone. One can infer that addressing FHP does not bring any extra QoL benefits in the perioperative period because both the kinds of rehabilitation lead to quite similar enhancements in QoL. These outcomes underscore the importance of enrolling intensive and comprehensive programs of rehabilitation that address both the physical and the psychological aspect of the patient after OHS.

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REFERENCES

1. Noyez L, de Jager MJ, Markou AL. Quality of life after cardiac surgery: underresearched research. Interact Cardiovasc Thorac Surg. 2011;13(5):511-514. doi:10.1510/icvts.2011.276311.
2. Nishimura RA, Otto CM, Bonow RO, et al. 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines [published correction appears in Circulation. 2014 Jun 10;129(23):e650]. Circulation. 2014;129(23):2440-2492. doi:10.1161/CIR.0000000000000029

3. Nejati P, Lotfian S, Moezy A, Moezy A, Nejati M. The relationship of forward head posture and rounded shoulders with neck pain in Iranian office workers. Med J Islam Repub Iran. 2014 May 3;28:26. PMID: 25250268; PMCID: PMC4154278.
4. Lee KJ, Han HY, Cheon SH, Park SH, Yong MS. The effect of forward head posture on muscle activity during neck protraction and retraction. J Phys Ther Sci. 2015 Mar;27(3):977-9. doi: 10.1589/jpts.27.977. Epub 2015 Mar 31. PMID: 25931773; PMCID: PMC4395757.
5. Kori, S. H., Miller, R. P., & Todd, D. D. (1990). Kinesiophobia: a new view of chronic pain behavior. Pain Management, 3(1), 35-43.
6. Kim SY, Kim NS, Jung JH, Jo MR. Effect of Forward Head Posture on Respiratory Function in Young Adults. J Kor Phys Ther 2013;25:311-315.
7. Titcomb DA, Melton BF, Miyashita T, Bland HW. Evidence-Based Corrective Exercise Intervention for Forward Head Posture in Adolescents and Young Adults Without Musculoskeletal Pathology: A Critically Appraised Topic. J Sport Rehabil. 2022;31(5):640-644. Published 2022 Feb 16. doi:10.1123/jsr.2021-0381
8. Abdollahzade Z, Shadmehr A, Malmir K, Ghotbi N. Research Paper: Effects of 4 Week Postural Corrective Exercise on Correcting Forward Head Posture. jmr. 2017;11(2):85-92.
9. Ruivo RM, Pezarat-Correia P, Carita AI. Effects of a Resistance and Stretching Training Program on Forward Head and Protracted Shoulder Posture in Adolescents. J Manipulative Physiol Ther. 2017;40(1):1-10. doi:10.1016/j.jmpt.2016.10.005
10. Falcoz, P. E., chocron, S., stoica, L., kaili, D.,et al. 2003. Open heart surgery: one-year self-assessment of quality of life and functional outcome. Ann Thorac Surg, 76, 1598-604; discussion 1604.
11. Morone NE, Weiner DK, Belnap BH, et al. The impact of pain and depression on recovery after coronary artery bypass grafting. Psychosom Med. 2010;72(7):620-625. doi:10.1097/PSY.0b013e3181e6df90
12. Katijjahbe MA, Denehy L, Granger CL, et al. The Sternal Management Accelerated Recovery Trial (S.M.A.R.T) - standard restrictive versus an intervention of modified sternal precautions following cardiac surgery via median sternotomy: study protocol for a randomised controlled trial. Trials. 2017;18(1):290. Published 2017 Jun 23. doi:10.1186/s13063-017-1974-8
13. Woby SR, Roach NK, Urmston M, Watson PJ. Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. Pain. 2005 Sep;117(1-2):137-144. DOI: 10.1016/j.pain.2005.05.029. PMID: 16055269.
14. Tkachuk, G. A. & Harris, C. A. 2012. Psychometric properties of the Tampa Scale for Kinesiophobia-11 (TSK-11). J Pain, 13, 970-7.
15. Sanders, J., Bowden, T., Woolfe-Loftus, N. et al. Predictors of health-related quality of life after cardiac surgery: a systematic review. Health Qual Life Outcomes 20, 79 (2022). https://doi.org/10.1186/s12955-022-01980-4
16. Tissot, Liam-Pierre Mathieua; Evans, David Williamb; Kirby, Edwardc; Liew, Bernard Xian Weia,*. Tampa Scale of Kinesiophobia may underestimate task-specific fear of movement in people with and without low back pain. PAIN Reports 8(4):p e1081, July/August 2023. | DOI: 10.1097/PR9.0000000000001081