



Research Article

EFFECTS OF SHOULDER PROPRIOCEPTIVE EXERCISES ON NON SPECIFIC NECK PAIN WITH FORWARD HEAD POSTURE: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background: One of the most commonly noted postural abnormality seen in day to day life is the forward head posture. Nowadays forward head posture is becoming increasingly common because of increased use of computers and smart phones.

Material and Methodology: 30 participants with nonspecific neck pain with forward head posture were selected and were allocated in two groups, group A and group B each consisting of 15 participants. Group A was given conventional treatment using hot moist pack, neck muscle strengthening exercises and TENS and Group B was given conventional treatment and proprioceptive exercises. Shoulder proprioception using active limb distraction test, forward head posture assessment using photographic technique, neck disability index, neck pain assessment using visual analogue scale were the four outcome measure used in this study and pre and post treatment readings were recorded.

Results: The study demonstrated difference in the outcome measures pre and post treatment. Both the groups showed significant improvement in term of outcome measures. Comparatively there was higher improvement in group B.

Conclusion: The present study provided evidence to prove that proprioceptive exercises along with conventional physiotherapy exercises are equally effective in treating upper extremities problems.

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INTRODUCTION

One of the most commonly noted postural abnormality seen in day to day life is the forward head posture. Among 66% to 90 % of the patient population, forward head posture is commonly prevalent postural deformity¹.

Forward head posture is defined as forward inclination of the head in relation to the theoretical plumb line which is perpendicular to the body center of the gravity. Nowadays forward head posture is becoming increasingly common because of increased use of computers and smart phones. In forward head posture the anterior cervical muscles become lengthened and weak and there is shortening of the posterior cervical musculature. If this imbalance between the anterior and the posterior cervical muscles due to postural abnormalities persist for prolonged period of time the joints and muscles are subjected to excessive load which make problems caused by forward head posture even more worse. Thus forward head posture can be the consequence of neck and shoulder pain²

Neck pain can be defined as the pain which is experienced from the base of the skull (occiput) to upper part of the back

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and extending laterally to the outer and superior bounds of the scapula.³

Approximately 70% of people in some point of their life are affected with neck pain. It is noted that head posture abnormality are associated with the development of neck pain. The most common head posture abnormality is perhaps the Forward Head Posture. Proprioception can be defined as joint position sense, the conscious and unconscious perception of the joint movement and joint position. Studies also have proven that Forward Head Posture is responsible for the altered proprioception of the shoulder in subjects with forward head posture.⁴

Proprioception can be improved by performing proprioceptive exercise or training. Proprioceptive exercises are defined as exercises which help to recover the perception of joint position. It includes open chain as well as closed chain exercises.⁵

There is gap of knowledge concerning about the possible effects of shoulder proprioceptive exercise on forward head posture from the previous studies, so this study may provide a base line rehabilitation program for subjects with forward head posture. The purpose of the study is to determine and provide physiotherapists with a scientific updated knowledge concerning the effects of shoulder proprioceptive exercises on subjects with forward head posture with nonspecific neck pain.

Procedure

Ethical clearance will be obtained from the institutional ethical committee.

After meeting the inclusion and exclusion criteria, written informed consent will be obtained from the participants. All the subjects included in the study will be screened based on demographic data i.e. Age, height, weight and Body Mass Index.

Subjects will be randomly allocated into 2 groups namely Group A and Group B. Baseline outcome measure will be taken pretreatment on the 1st day and post treatment on the 12th day of treatment.

MATERIALS & METHODOLOGY

Research type: Experimental

Research Study design: Randomized Controlled Trial

Sampling Design: convenience sampling

Sampling method: allocated via envelop method

Sample size: 30, 15 in each group.

Outcomes

1. Shoulder Proprioception With Active Limb Distraction Test:
2. Forward Head Posture Assessment Using Photographic Technique:
3. Neck Disability Index (NDI):
4. Neck Pain Assessment Using Visual Analogue Scale

Intervention

Group A: Conventional treatment was given using Hot Moist Pack, Neck muscle strengthening exercises and TENS. Hot Moist Pack was given when patient was made to sit on a chair with head resting on a pillow. Hot Moist Pack was applied around the cervical segment for 15mins⁶.

Neck Muscle strengthening exercises 20⁷

Patient was positioned in Supine, Prone and Sitting position. Neck muscle strengthening exercises in supine lying position. Subjects was asked to flex the neck and manual resistance was applied to the forehead.

In prone position subjects was asked to extend their neck avoiding lifting of their shoulders and resistance was applied to the posterior part of the head.

In sitting position subjects was asked to rotate the neck without any lumbar rotation. Resistance was given on the lateral side of forehead

All these exercises was performed for 12 repetitions with 5 to 10 seconds/counts holds.

TENS (Transcutaneous Electrical Nerve stimulation)⁸

Conventional TENS of 5Hz, 300µs pulse width for the duration of 20 mins was applied around the cervical segment. 12 treatment sessions were given.

Group B: shoulder proprioceptive exercises and conventional treatment⁴

Wall Pushups: First the subjects was asked to stand against a wall. After this the subject was asked to lean against the wall and perform a press up drawing both the shoulder blades

together, then pushing them as far apart. Repetitions was done for 10 times.

GYM Ball Exercises: Subjects was sitting on a chair with both the hands resting on a gym ball in front of them. Subject was asked to roll the ball as far away from them as much as they can then rolling it back. Repetitions was done for 10 times.

Another exercise, subjects was sitting on a chair with one hand resting on a gym ball. Subject was asked to roll the ball as far away from them as much as they can then rolling it back. Subject was asked to repeat the same with the other hand. Repetitions was done for 10 times.

Medicine Ball Exercises: A medicine ball was placed on top of a table. Subject was asked to place his one hand on top of the ball with his shoulder at 90 degrees of flexion maintaining the arm in straight position. Subject was then asked to roll the ball in both clockwise and anticlockwise for 10 times. He was asked to repeat the same with the other hand.

Standing Weight Shifts: Subject was asked to stand from a sitting position with both the hands placed on the table. Subject was then asked to lean onto his arms and then slowly shift his weight from side to side. Repetitions was done for 10 times.

Quadruped Exercises: Subject was asked to come in a quadruped position. He was asked to first raise one arm up and then lowers it maintaining the balance with the other hand. He was asked to repeat the same with another hand. Repetitions was done for 10 times.

These proprioceptive exercises were given for one session per day for 6 days in a week for 2 weeks.

RESULTS

Statistical analysis

Statistical analysis for the present study was done manually as well as using the statistical package of social science (SPSS) version 16 as to verify the results obtained. For this purpose the data was entered into Microsoft Excel Sheet, tabulated and subjected to statistical analysis. Mean, standard deviation and parametric tests were applied. Normal data from patient's demographic data i.e. age, gender, BMI, height, weight distribution were analyzed using t- test. Comparison of pre and post intervention outcome measures of shoulder proprioception with active limb distraction test and Neck disability index was done using Mann-Whitney U test and comparison of pre and post intervention outcome measures of Forward head posture assessment using photographic technique and Neck pain assessment using visual analogue scale was done by using independent t test. Probability values less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant.

Demographic profile

Age distribution

Age of the participants in the present study was between 18 to 50 years. The distribution of participants on group A less than 25 years of age were 12 (66.6%), between 25 to 35 years were 2 (11.1%) and between 35 to 50 years were 1 (5.55%) with the mean age of 22.47±1.36. The distribution of participants of Group B less than 25 years of age were 9 (50%), between 25 to 35 years of age were 3 (16.66%) between 35 to 50 were 3

(16.66%) with the mean age of 21.07±1.79. The average age of the participants in Group A was 22.47±1.36 years and in Group B was 21.07±1.79 years. The difference in mean of age was statistically significant in both the groups. (p= 0.0226*, t=2.4134). (Table 1)

On comparing the age, height, weight and BMI between the participants by paired t tests, the results showed only significant difference in age. Which suggests that except age demographically the participants in each group were homogenous to each other's. (Table 1)

Table 1 Comparison of group A and group B with mean age and BMI by t test

Variable	Groups	Mean	SD	SE	t-value	p-value
Age in yrs	Group A	22.47	1.36	0.35	2.4134	0.0226*
	Group B	21.07	1.79	0.46		
Weight	Group A	60.00	9.11	2.35	0.9471	0.3517
	Group B	57.13	7.38	1.90		
Height	Group A	158.60	5.96	1.54	0.0532	0.9580
	Group B	158.47	7.67	1.98		
BMI	Group A	23.52	2.56	0.66	0.9714	0.3396
	Group B	22.45	3.43	0.89		

*p<0.05

Outcome Measurements

Shoulder Proprioception with Active Limb Distraction Test

Comparison of group A and group B with respect to pretest and posttest Flexion scores In the present study the mean shoulder proprioception for flexion scores at pretreatment in Group A was 9.20±6.53 and the mean score for post treatment was 3.60±4.72. While for Group B it was found 9.07±10.11 pretreatment and 5.00±8.02 post treatment.

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of change in Group A was 60.87%, p=0.0159* and for Group B it was 44.85%, p=0.0300*. Group A showed better results with respect to Group B. (Table 2)

Table 2 Comparison of group A and group B with respect to pretest and posttest Flexion scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference		
	Mean	SD	Mean	SD	Mean	SD	
Group A	9.20	6.53	3.60	4.72	5.60	7.47	
Group B	9.07	10.11	5.00	8.02	4.07	6.33	
% of change in A						60.87%#	
						p=0.0159*	
% of change in B						44.85%#	
						p=0.0300*	
Z-value	-0.9333		-0.2489		-0.8918		
p-value	0.3507		0.8035		0.3725		

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Comparison of group A and group B with respect to pretest and posttest extension scores The mean shoulder proprioception for extension scores at pretreatment in Group A was 10.27±5.93 and the mean score for post treatment was 4.20±5.77. While for Group B it was found 8.13±12.97 pretreatment and 0.33±0.72post treatment.

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of change in Group A was 59.09%, p= 0.0033*and for Group B it

was 95.90%, p=0.0080*. Group B showed better results with respect to Group A.(Table 3)

Table 3 Comparison of group A and group B with respect to pretest and posttest extension scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference		
	Mean	SD	Mean	SD	Mean	SD	
Group A	10.27	5.93	4.20	5.77	6.07	5.23	
Group B	8.13	12.97	0.33	0.72	7.80	12.97	
% of change in A						59.09%#	
						p=0.0033*	
% of change in B						95.90%#	
						p=0.0080*	
Z-value	-1.5762		-1.9595		-0.3526		
p-value	0.1150		0.0500*		0.7244		

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Comparison of group A and group B with respect to pretest and posttest Abduction scores. The mean shoulder proprioception for Abduction scores at pretreatment in Group A was 10.33±12.15 and the mean score for post treatment was 3.27±4.06. While for Group B it was found 8.60±8.58 pretreatment and 4.07±6.05 post treatment.

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of change in Group A was 68.39%, p= 0.0207*and for Group B it was 52.71%, p=0.0180*. Group A showed better results with respect to Group B. (Table 4) Comparison of group A and group B with respect to pretest and posttest adduction scores The mean shoulder proprioception for Adduction scores at pretreatment in Group A was 7.53±4.19 and the mean score for post treatment was 1.07±2.71. While for Group B it was found 10.33±6.76 pretreatment and 2.60±4.03post treatment.

Table 3 Comparison of group A and group B with respect to pretest and posttest extension scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference		
	Mean	SD	Mean	SD	Mean	SD	
Group A	10.27	5.93	4.20	5.77	6.07	5.23	
Group B	8.13	12.97	0.33	0.72	7.80	12.97	
% of change in A						59.09%#	
						p=0.0033*	
% of change in B						95.90%#	
						p=0.0080*	
Z-value	-1.5762		-1.9595		-0.3526		
p-value	0.1150		0.0500*		0.7244		

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of change in Group A was 85.84%, p= 0.0058*and for Group B it was 74.84%, p=0.0024*. Group A showed better results with respect to Group B. (Table 5)

Table 5 Comparison of group A and group B with respect to pretest and posttest adduction scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference		
	Mean	SD	Mean	SD	Mean	SD	
Group A	7.53	4.19	1.07	2.71	6.47	6.27	
Group B	10.33	6.76	2.60	4.03	7.73	7.24	
% of change in A						85.84%#	
						p=0.0058*	
% of change in B						74.84%#	
						p=0.0024*	
Z-value	-0.3940		-0.7466		-0.3111		
p-value	0.6936		0.4553		0.7557		

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Comparison of group A and group B with respect to pretest and posttest internal rotation scores. The mean shoulder proprioception for internal rotation scores at pretreatment in Group A was 6.93±4.01 and the mean score for post treatment was 2.20±3.99. While for Group B it was found 3.87±5.78 pretreatment and 0.80±2.60 post treatment.

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of change in Group A was 68.27%, p= 0.0054*and for Group B it was 79.31%, p=0.0630*. Group B showed better results with respect to Group A. (Table 6)

Table 6 Comparison of group A and group B with respect to pretest and posttest internal rotation scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference	
	Mean	SD	Mean	SD	Mean	SD
Group A	6.93	4.01	2.20	3.99	4.73	4.48
Group B	3.87	5.78	0.80	2.60	3.07	6.36
% of change in A					68.27%#,	
					p=0.0054*	
% of change in B					79.31%#,	
					p=0.0630	
Z-value	-2.0117		-0.9540		-1.1406	
p-value	0.0443		0.3401		0.2540	

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Comparison of group A and group B with respect to pretest and posttest external rotation scores The mean shoulder proprioception for external rotation scores at pretreatment in Group A was 9.20±3.67 and the mean score for post treatment was 1.67±3.62. While for Group B it was found 5.47±6.90 pretreatment and 0.87±2.64 post treatment.

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of change in Group A was 81.88%, p= 0.0022*and for Group B it was 84.15%, p=0.0300*. Group B showed better results with respect to Group A. (Table 7)

Table 7 Comparison of group A and group B with respect to pretest and posttest external rotation scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference	
	Mean	SD	Mean	SD	Mean	SD
Group A	9.20	3.67	1.67	3.62	7.53	4.72
Group B	5.47	6.90	0.87	2.64	4.60	7.15
% of change in A					81.88%#,	
					p=0.0022*	
% of change in B					84.15%#,	
					p=0.0300*	
Z-value	-2.1983		-0.3526		-1.6591	
p-value	0.0279		0.7244		0.0971	

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Neck Disability Index

Comparison of group A and group B with respect to pretest and posttest Neck Disability Index scores. The mean Neck Disability index scores at pretreatment in Group A was 0.27±0.17 and the mean score for post treatment was 0.07±0.09. While for Group B it was found 5.67±13.57 pretreatment and 2.03±5.59 post treatment.

Pair wise comparison for both the groups was done using Wilcoxon matched pairs test. The results found that both the groups showed significant difference with percentage of

change in Group A was 75.43%, p= 0.0007*and for Group B it was 64.16%, p=0.0015*. Group A showed better results with respect to Group B. (Table 8)

Table 8 Comparison of group A and group B with respect to pretest and posttest Neck Disability Index scores by Mann-Whitney U test

Groups	Pretest		Posttest		Difference	
	Mean	SD	Mean	SD	Mean	SD
Group A	0.27	0.17	0.07	0.09	0.20	0.17
Group B	5.67	13.57	2.03	5.59	3.64	8.63
% of change in A					75.43%#,	
					p=0.0007*	
% of change in B					64.16%#,	
					p=0.0015*	
Z-value	-0.5185		-0.5807		-1.0162	
p-value	0.6041		0.5615		0.3095	

*p<0.05 indicates significant, # applied Wilcoxon matched pairs test

Visual analogue scale

Comparison of group A and group B with respect to pretest and posttest VAS scores. The mean VAS scores at pretreatment in Group A was 4.71±1.93 and the mean score for post treatment was 1.05±1.33. While for Group B it was found 3.43±1.71 pretreatment and 0.50±0.60 post treatment.

Pair wise comparison for both the groups was done using applied paired t test. The results found that both the groups showed significant difference with percentage of change in Group A was 77.65%, p= 0.0001* and for Group B it was 85.41%, p=0.0001*. Group B showed better results with respect to Group A. (Table 9)

Table 9 Comparison of group A and group B with respect to pretest and posttest VAS scores by independent t test

Groups	Pretest		Posttest		Difference	
	Mean	SD	Mean	SD	Mean	SD
Group A	4.71	1.93	1.05	1.33	3.66	1.71
Group B	3.43	1.71	0.50	0.60	2.93	1.66
% of change in A					77.65%#,	
					p=0.0001*	
% of change in B					85.41%#,	
					p=0.0001*	
t-value	1.9303		1.4675		1.1945	
p-value	0.0638		0.1534		0.2423	

*p<0.05 indicates significant, # applied paired t test

Cranio vertebral angle

Comparison of group A and group B with respect to pretest and posttest Cranio Vertebral angle scores. The mean VAS scores at pretreatment in Group A was 40.33±3.64 and the mean score for post treatment was 44.53±3.07. While for Group B it was found 36.80±6.76 pretreatment and 44.80±3.71 post treatment.

Pair wise comparison for both the groups was done using applied paired t test.

Table 10 Comparison of group A and group B with respect to pretest and posttest Cranio Vertebral angle scores by independent t test

Groups	Pretest		Posttest		Difference	
	Mean	SD	Mean	SD	Mean	SD
Group A	40.33	3.64	44.53	3.07	-4.20	5.12
Group B	36.80	6.76	44.80	3.71	-8.00	6.96
% of change in A					-10.41%#,	
					p=0.0067*	
% of change in B					-21.74%#,	
					p=0.0005*	

t-value	1.7819	-0.2146	1.7040
p-value	0.0856	0.8316	0.0995

*p<0.05 indicates significant, # applied paired t test

The results found that both the groups showed significant difference with percentage of change in Group A was -10.41%, p= 0.0067* and for Group B it was -21.74%, p=0.0005*. Group B showed better results with respect to Group A. (Table 10)

DISCUSSION

The present randomized controlled trial was aimed to find out the effects of shoulder proprioceptive exercises on nonspecific neck pain with forward head posture given for 6 sessions in a week for 2 week in terms of increasing shoulder proprioception, improving range of motion, decreasing pain and improving functional abilities.

In the present study, the age group inclusion criteria were between 19-50 years. A study done reported adolescents or patients with neck pain have more Forward neck posture, thus a smaller craniovertebral angle. Prevalence of neck pain in adolescents with FHP was more than adolescents without FHP (29.8% vs 8.4%)⁹.

A survey done in 2008 on Chinese adolescents reported with forward head posture as high as 25%¹⁰. In the present study, the mean age in group A and in group B is 22.47±1.36 and 21.07±1.79 respectively, which is valid according to the above study as well.

In the present study, percentage of including male subjects in Group A and in Group B was 13.33% and 26.67% respectively whereas percentage of female subjects in Group A and in Group B was 86.67% and 73.33% respectively. McLean et.al, reviewed 14 prospective cohort studies systematically and revealed factor like female sex was linked to the onset of neck pain¹¹. Some studies observed more prevalence of forward head posture in females as compared to males^{10,12}, while other study showed no gender difference in prevalence of FHP¹³. Study done by Rodrigo M. Ruivoet. al, showed resting CV angles lower in females than boys¹⁴. Study done on standing cervical habitual posture in adolescents by Hakala *et al*, found females had 2-3° more neck flexion than males¹⁵. Two studies with small sample size done in contrary to the present study reported no gender differences for cervical habitual posture in adolescents and pre-adolescents^{16,17}.

A comparative study between DCF strengthening exercises and McKenzie neck exercises done by Eun-Young Kim et. al, on Forward Head Posture due to use of smartphones, showed no significant differences between the two groups, but both groups showed statistically significant changes after the experiment. As in the present study significant changes were seen in the both the groups using neck strengthening exercises after the intervention. Subjects maintained static contraction for 10 seconds with a rest of 5 seconds hold, considered as 1 set. 1 set consisted of 10 times exercise¹⁸. Each day total 5 sets were done whereas in present study, 12 repetitions of neck muscle strengthening exercises were given for 6 sessions with 5 to 10 seconds/counts or holds.

A study reported by Mi-Young Lee et la., Examined the position- reposition error of cervical region in order to investigate whether forward head posture affects joint position

sense. Higher errors rates were shown by the groups with forward head posture compared to the groups without forward head posture¹⁹.

Another study conducted by Esraa A. Anwar *et al*. showed that there is affection in shoulder proprioception if the degree of forward head posture is higher²⁰. Similarly in the present study position reposition error of the shoulder is examined to investigate whether there is affection in shoulder proprioception if the degree of forward head posture is higher. The study showed positive results that there is significant reduction in the shoulder proprioception if the degree of forward head posture is higher.

Forward head posture is the most common abnormality which is associated with neck pain. A cross sectional study done by ParisaNejati *et al*. reported that forward head posture and thoracic kyphosis were accompanied with neck pain²¹. Similarly our results supports that there is presence of neck pain if the patients have forward head posture.

Studies have shown that specific exercise programs plays an important role in improving the proprioception in cases of lower extremities injuries, which involves a decrease in kinesthetic and joint position sense^{22,23}. A study done by A Heggannavar *et al*. reported that proprioceptive exercises are effective in decreasing pain, improving functional ability and increasing knee ROM². Similarly another study done by Nilaysahin *et al*. concluded that proprioception exercises cause decrease in pain and improvement of functional status in BJHS group²⁴. In this study proprioceptive exercises combined with conventional physiotherapy used for upper extremities dysfunctions, showed improvement not only in kinesthesia but in the sense of repositioning and also in pain and functional abilities. Thus suggesting that proprioceptive exercises can also be effectively given for upper extremities injuries.

As per the review of literature no study has compared the effects of shoulder proprioceptive exercises on nonspecific neck pain with forward head posture. The present study showed positive results in both the groups by reducing pain, improving proprioception, improving posture and improving functional ability. Clinically, both the techniques are equally effective. But when comparison was done in two groups, statistically, group B showed significant improvement.

CONCLUSION

The present study provided evidence to prove that proprioceptive exercises along with conventional physiotherapy exercises are equally effective in treating upper extremities problems.

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