

Effect of a Corrective Exercise Program Using Proprioceptive Neuromuscular Facilitation on Forward Head and Rounded Shoulders with Ergonomic Intervention in Adolescent Age Group

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ABSTRACT

Background: Due to the current lifestyle of adolescents; their bodies have adapted faulty postures that have caused musculoskeletal changes in the body creating symptomatic problems like pain in neck and upper part of back. The static forward bent posture causes deformity like rounded shoulders and forward head posture. This needs to be corrected as early as possible by stretching and strengthening the muscles around the shoulder girdle.

Objectives: To investigate the effects of using proprioceptive neuromuscular facilitation to correct forward head and rounded shoulders in adolescent children along with ergonomic intervention.

Materials and methodology: An experimental study was conducted at Krishna College of Physiotherapy, Karad. A sample of 40 was selected by convenience sampling conducted over a period of 3 months. The participants were selected on the basis of inclusion and exclusion criteria. The interpretation of the study will be done on the basis of comparing pre and post test assessment

Result: The results of this study showed the pre and post mean±SD of VAS on rest and activity, OTWT, STWT shows <0.0001 which is extremely significant.

Conclusion: This study had a positive effect on adolescent children who had forward head and rounded shoulders and PNF can be used for correcting these along with ergonomic interventions

KEY WORDS: PNF, Forward head, Rounded Shoulders, Ergonomics, Adolescents.

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INTRODUCTION

Children carrying overstuffed backpacks to their school that hang over their shoulders each morning can cause some painful back and neck problems [1].

The regular physical demands of carrying backpacks generate significant forward leaning of the head and trunk [2]. When walking, a loaded backpack can alter posture and gait, hence understanding the consequences of

increased backpack weight on children's developing bodies is crucial. These children are at risk not only short-term but also potential long-term health issues causing deformation of the natural curves in the spine hence there is a decrease in the angle known as Cranio-Cervical angle (CCA) and a shoulder and upper trunk shift [1]. In recent times due to lockdown the students had to attend online school over digital screens. Consequently, students are forced to sit in front of a laptop or on desk for long periods of time in static posture having their neck, shoulders and back fixed without sufficient support. Repetitive static dynamic stress of the spine is a risk factor during classroom lessons, at home and physical inactivity [3,4]. Furthermore, the sitting lumbo-pelvic position can affect deep cervical flexor activation, potentially influencing neck and shoulder deformities such as forward head and rounded shoulder postures [4]. Lately the adolescent children suffer from neck pain, rounded shoulders due to incorrect posture and lack of physical activity forcing the body to adapt to the forward head posture and kyphosis [5].

As a consequence of this, the upper anterior muscles in the neck get shortened and the deep posterior muscles of the spine in the neck area and the lower posterior muscles of the scapulae get stretched and weakened causing early signs of upper cross syndrome [6,7].

Neck musculoskeletal disorder and cervical dysfunction are re-lated to thoracic kyphosis and rounded shoulder posture. Irregular lower trapezius and serratus anterior positions due to abnormal scapular tilt can lead to rounded shoulder posture in children and adults [7]. The growth of spinal structures is rapid during adolescence hence sitting in a flexed static posture is of greater significance [3]. To improve the functional supporting role of the deep postural-stabilizing muscles of the spine adopting a proper and suitable head position is a typical therapy method for neck and shoulder pain syndromes⁴. Postural correction and education have long been used to address pain and injuries caused by postural abnormalities

In addition, different sitting postures lead to

different shoulder kinematics and muscle activities, so appropriate sitting postures should be maintained⁴. Thus, non-ergonomic conditions of classroom and home cause musculoskeletal disorders and ultimately cause skeletal abnormality [5].

Ergonomic among children is important their spinal alignment mainly results from the rapid development of musculoskeletal system during their growing years which will ultimately influence their future posture as an adult. Thus, an early intervention will correct and prevent further deformity.

Proprioceptive Neuromuscular Facilitation or PNF is a simple, effective, non-invasive, more advanced form of flexibility training that involves both the stretching and contraction of the muscle group called post isometric relaxation stretching technique which uses hold-relax/contract relax that can be performed with or without supervision. In clinics, PNF stretching the hold-relax technique techniques are widely utilized to treat pain, increase joint range of motion, and reduce muscle stiffness [6]. The stabilizing reversal technique is intended to improve the muscle strength of the trunk and shoulder girdle postural muscles [6]. PNF has been shown to improve physical balance and function as well as control improper muscle movements [6].

Aim of the Study:

The purpose of the present study is therefore to investigate the effects of PNF training in a corrective exercise program on pain intensity and posture correction in adolescent children who suffer from rounded shoulders and forward head

Objectives

- To determine the effect of PNF in a corrective exercise program on neck pain
- To determine the effect of PNF in a corrective exercise program on rounded shoulders in adolescent children
- To determine the effect of PNF in a corrective exercise program on forward head in adolescent children

Need For Study

- Children usually suffer from neck pain,

shoulders due to incorrect posture and lack of physical activity which will ultimately influence their future postures and mechanics as an adult.

- This is commonly seen in children of adolescent age due to lifting heavy school bags straining the neck and shoulders muscles and in recent times studying in front of screens for online school due to lockdown for long hours
- There is paucity of literature as no study is conducted in adolescents where PNF is used for correcting posture.

MATERIALS AND METHODOLOGY

An experimental study was conducted at Krishna College of Physiotherapy, Karad. A sample of 40 was selected by convenient sampling conducted over a period of 3 months. The participants were selected on the basis of inclusion and exclusion criteria. Inclusion criteria consisted of the both male and female students who had neck pain and are diagnosed with forward head and rounded shoulders by a physiotherapist and aged group between 12 to 15 years and voluntarily participating

Exclusion criteria consisted of the students who had no neck pain or forward head and rounded shoulders, students who have this problem but do not fit in adolescent age group, if there is any history of injury, surgery or fracture and students who are not voluntarily participating. The participants were explained the purpose of the study and their signatures were taken on the information sheet, consent form and on the assent form. Pre test assessment was taken with the use of Visual Analogue Scale (VAS), Occiput to Wall test (OTWT) and Shoulder to Wall test (STWT). The data collection sheet consisted of demographic data such as name, age, gender, chief complaint along with pre test parameters. After the pre test participants were instructed about the exercise program. The exercise plan included 60-80 minutes training, 3 sessions per week for 8 weeks with ergonomic intervention [9].

After completion of 8 weeks, post test assessment was taken. Post test assessment was with the use of same parameters as pre test. The

interpretation of the study will be done on the basis of comparing pre and post test assessment of all the outcome measures.

The corrective exercise program consisted of:

Stretching- Using a resistance band the child would perform PNF pattern of upper extremity (D1 and D2) stretching the upper trapezius, pectoralis major, pectoralis minor and levator scapulae.

Strengthening exercises- Shoulder exercise and scapular muscle stabilizing exercises were done by isometric contraction using the hold relax technique of PNF for 10 seconds with 5 repetitions [6] gradually increasing it week-wise.

- a) Scapular squeeze or retraction
- b) Wall push ups
- c) Elbow in 90-90 abduction and sliding up n down in standing against a wall
- d) I ,V ,T and W arm exercise in prone
- e) Chin tucks with towel roll behind neck in supine
- f) Core muscle strengthening like plank, spinal extension exercises

The following ergonomics were asked to follow during the 8 weeks protocol:

Avoiding bending forward on the laptop and leaning on the front portion of the desk and slouching backward or to the sides was avoided for maintaining S-shaped structure of the spine and the neutral position of the neck [8].

- a) Sitting and walking erect was encouraged [8]
- b) Staying in a fixed position for a long time should be avoided and taking frequent breaks was encouraged [8]The feet should be supported on the floor [8]
- c) Sleeping position also plays an important role hence the students are asked to sleep on their back and avoid sleeping in side-lying for decreasing excessive load on one side the shoulders while sleeping [7]
- d) While sleeping a pillow should be placed horizontally under the shoulders for relieving pressure, stabilizing the upper back and relaxing the shoulder girdle muscles.

RESULTS

Statistical analysis of the recorded data was

done by using the software Instat. Unpaired t test was used to compare results of pre and post test for VAS, OTWT and STWT. On the basis of data analysis, it can be seen that there is a significant effect of PNF in correcting the forward head and rounded shoulder.

Interpretation of Fig 2: Patients were assessed pre intervention and post intervention through VAS on rest. Patients treated with the given exercise program has shown decrease in pain VAS on rest mean score 2.35 to 1.075. Statistically it shows that there was extremely significant difference ($p < 0.0001$) between pre intervention assessment and post intervention assessment.

Interpretation of Fig.3: Patients treated with the given exercise program has shown decrease in pain VAS on activity mean score 6.57 to 3.90. Statistically it shows that there was extremely significant difference ($p < 0.0001$) between pre intervention assessment and post intervention assessment.

Interpretation of Table no. 2: Patients treated with the given exercise program has shown decrease in deformity of forward head with mean score 7.1 to 5.24. Statistically it shows that there was extremely significant difference ($p < 0.0001$) between pre intervention assessment and post intervention assessment.

Patients treated with the given exercise program has shown decrease in deformity of rounded shoulders with mean score 4.08 to 2.0. Statistically it shows that there was extremely significant difference ($p < 0.0001$) between pre intervention assessment and post intervention assessment.

Table 1: Demographic data based on Age and Gender.

Variable	Number	Percentage
Age		
12	7	17.50%
13	13	32.50%
14	9	22.50%
15	11	27.50%
Gender		
Male	14	35%
Female	26	65%

AGE DISTRIBUTION

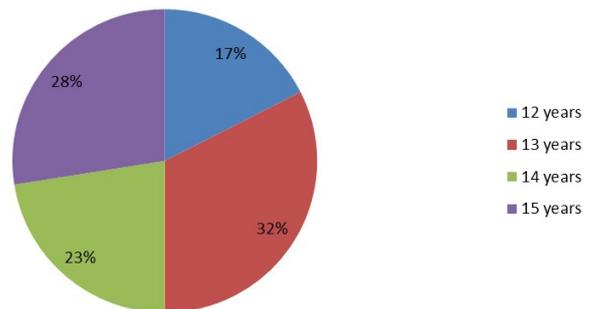


Fig. 1: Representation of number of students in each age group.

Table 2: Mean standard deviation and p values of pre and post assessment of pain in VAS on rest and activity.

Outcome measures	Pre intervention	Post intervention	p-value
	Mean±SD	Mean±SD	
VAS on rest (0-10)	2.35±1.210	1.075±0.8590	<0.0001
VAS on activity (0-10)	6.575±1.152	3.9±0.8102	<0.0001

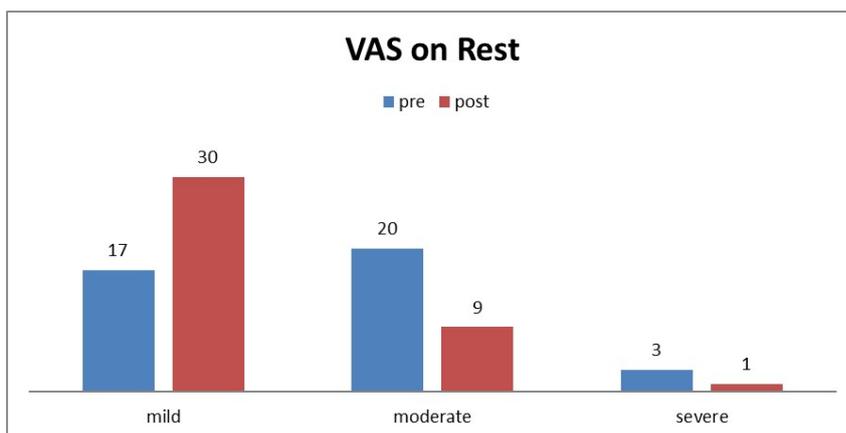


Fig. 2: Representation of VAS on rest Pre and Post test.

Table 3: Mean standard deviation and p values of pre and post assessment of OTWT and STWT

Outcome measure	Pre test	Post test		Interpretation
	Mean ± SD	Mean ± SD	p - value	
OTWT	7.1±1.430	5.24±1.474	< 0.0001	Extremely significant
STWT	4.082±1.112	2.0025±1.118	< 0.0001	Extremely significant

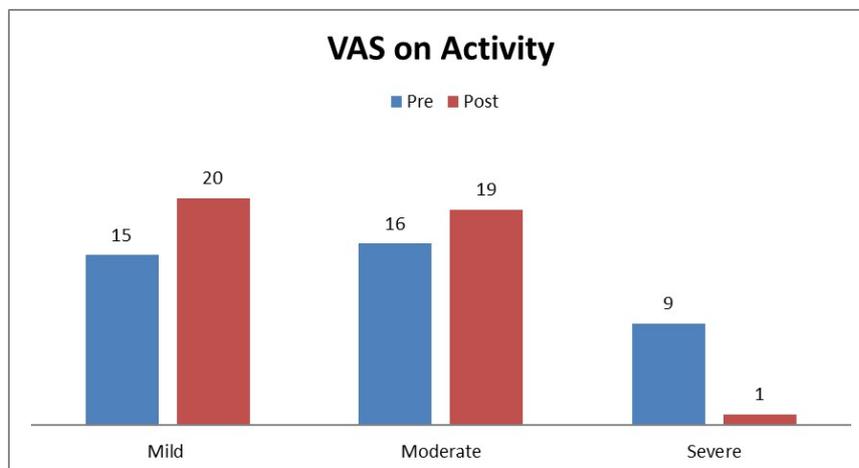


Fig. 3: Representation of VAS on activity Pre and Post test.

DISCUSSION

The result of this study demonstrated that the corrective exercise protocol has been effective in adolescent children who suffer from forward head and rounded shoulder. This is the first study in our knowledge where PNF techniques were used to correct the faulty postures in children therefore there is limited scope of comparison. Postural change occurs throughout ontogenesis, with key stages around school age and puberty [17]. Neck pain is the most common symptom as there was high level of neck flexion as well as static and awkward postures during sitting causing leaning forward movement [2]. A study looked at the weight of schoolbags and the prevalence of musculoskeletal problems among 140 students conducted in New Zealand. The neck, shoulders, upper back, and lower back were the most affected. Although musculoskeletal problems are complex in nature, large schoolbags are thought to be a contributing component and may represent an undetected everyday physical stress [10]. Heavy backpacks, according to Children’s Health, can cause upper and lower back pain as well as neck strain. Back pain and poor posture caused by the backpack can exacerbate the situation. The University of Surrey in the United Kingdom conducted a cross-sectional research

of self-reported back and neck pain and its physical and psychological risk factors among English schoolchildren [1]. The goal of the study was to see if there were any links between ergonomics and back, neck pain in schoolchildren [1]. Also the number of adolescents who use computers/laptops is expected to rise in the near years to come, the chance of acquiring musculoskeletal illnesses at a relatively young age will rise as well [3].

As a result, simply studying and correcting one cause will not prevent children from developing severe musculoskeletal complaints. As a result, if we want to see a major and long-term improvement in symptoms, we need to take a multidimensional strategy.

Because poor muscle tone and limited functions might diminish the effectiveness of treatment and lead to recurring problems, they should be managed with appropriate therapeutic interventional strategies. Many research on PNF have been conducted to date, with positive results on the control of inappropriate muscle activity as well as the enhancement of physical balance and functions [6]. Physical dysfunction caused by damage or disease is commonly treated with PNF [6]. Stretching therapy combined with PNF techniques, as well as stabilizing exercises that

stimulate the proprioceptive myoreceptors of the muscles and tendons, are thought to have improved the efficiency of the nerves muscle control, normalized muscle tone, and increased blood and tissue fluid circulation [6]. Only when the surrounding structures, such as muscles, bones, and ligaments, are properly placed and organically collaborate and act, can the functional actions of the neck and shoulders be accomplished without injury [6]. However, in patients, pain and physiological or psychological factors impede the surrounding structures from completing their usual duties [6].

Limitation and Recommendation for Further Studies: The limitations faced in this study was sample size taken was comparatively small and the duration was also limited. Recommendation are that the future research can use electromyography to determine simultaneous muscle activation due to musculoskeletal imbalances and comparing corrective workouts training the muscle, as well as postural alterations³. Finally, instead of using static measure for forward head and rounded shoulders, a more dynamic outcome measure should be taken [3].

CONCLUSION

This study showed that using corrective exercises can execute posture correction in the adolescent children who suffer from forward head and rounded shoulders. Using PNF techniques along with ergonomic advice has a positive effect on children and extensive results were seen. An early identification and intervention is necessary to prevent any subsequent deformities of spine and muscular weakness in the future. Stretching exercise has been proven to reduce forward head, rounded shoulder posture, and lumbar lordosis. Accordingly, the optimum posture is important to reduce the pain and deformity [18-20].

ABBREVIATIONS

PNF - Proprioceptive Neuromuscular Facilitation
VAS- Visual Analogue Scale
OTWT- Occiput to wall test
STW- Shoulder to wall test
CCA - Cranio-Cervical angle

AUTHORS CONTRIBUTION

Saumya Kumta – Data collection, research design, research process, discussion, editing, manuscript drafting.

Amrutkuvar Rayjade – Research process, review of literature, discussion, research analysis.

Siddhi Lakkad – Data collection, statistical analysis

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ETHICS APPROVAL AND PATIENT CONSENT: The study was approved by the "Institutional Ethics Committee" of Krishna Institute of Medical Sciences, "Deemed to be" University, Karad, Maharashtra. The author had explained the study and the intervention to be given to the participants and had taken participants consent prior to the study from every participant.

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Conflicts of interest: None

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