



## Original Article

## Combined Effectiveness of Static Stretching With and Without Post-Isometric Relaxation (PIR) in Managing Pain, Range of Motion and Functional Status Among Upper Cross Syndrome Patients

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## ABSTRACT

Tightness of cervical muscles especially upper trapezius and levator scapulae leads to the limitation of cervical ranges and develop a painful condition named as Upper cross syndrome. **Objective:** The aim was to determine the effect of Static Stretching along with and without Post Isometric Relaxation (PIR) in managing pain, ranges and disability among the patient with Upper Cross Syndrome. **Methods:** A hospital-based study was carried out following convenience sampling. Study included 22 patients of 18-50 years suffering with Upper Cross Syndrome divided into two groups. Group A (n=11) managed by Post Isometric Relaxation with Group B (n=11) through Static Stretching. Visual Analogue scale (VAS), Neck Disability Index (NDI) and Goniometer were used for assessment of outcomes. The data was analyzed by using SPSS version 25.0 in which within and between group analysis were done by using parametric test with  $p$ -value < 0.05. **Results:** The results showed VAS and NDI were significantly improved by PIR with  $2.27 \pm 1.27$  and SS was  $4.00 \pm 1.94$  and post-NDI value was  $24.90 \pm 2.21$  and  $25.09 \pm 2.84$  respectively. Similarly; the post ranges of PIR showed statistically significant results in improving cervical ranges as compared to Static stretching with  $p$ -value < 0.05 **Conclusions:** The study concluded that combination of Static Stretching and PIR is significantly effective in improving pain, ranges and functional status among Upper cross Syndrome patient along with rapid recovery rate having  $p$ -value < 0.05.

## INTRODUCTION

Upper cross syndrome (UCS) is leading noticeable muscular postural misalignment nowadays. It is the development of abnormal muscular tone at shoulder and upper cervicothoracic segment affecting young population of 20-50 years [1]. It is described with word "X" as in this condition, muscles of one-sided arm become tight or hypertonic while the muscles of other side arm became weak or hypotonic [2]. According to Janda, there was muscular imbalance at the anterior and posterior

cervical muscles lead to lengthening of posterior muscles with shortening of anterior muscles developing UCS [3]. An inadequate sitting posture, inappropriate habits, muscle weakness, sedentary lifestyle, prolonged sitting, obesity, use of the machine in daily life, and very less or no physical activity in leisure time are the major factors affecting biomechanical arrangement of multiple joints [4]. UCS leads to the development of a faulty posture that cause muscular imbalance of neck, shoulders, and chest region

[5] leading to forwarding head posture enhance cervical lordosis and thoracic kyphosis, shrugged with protracted shoulder, scapular winging with non-specific cervical pain [6, 7]. Furthermore; dysfunction is observed at atlanto-occipital, cervicothoracic and shoulder- joint along with different spinal segments including C4-C5 and T4-T5 vertebrae [7]. Multiple treatment protocols including Static stretching, corrective exercises, myofascial trigger point release, Active release technique, strengthening techniques, Kinesio-tapping, Mckenzie's exercise and Muscle energy techniques are used for managing USC [7, 8]. Post-isometric relaxation (PIR) is a MET technique focused on Autogenic Inhibition and Complementary Inhibition that helps in lengthening the short and tight muscles, restricting scope of movement and cause joint limitations [9]. Gillani et al. concluded that eccentric muscle energy technique and static stretching techniques were equally effective in treating UCS [10]. Similarly; Joshi et al. reported METs (PIRP) plays an important role in improving posture by improving the muscular imbalance. This also helps in reducing pain, improving cervical ranges and functional status among the patients [11]. Ali et al., further concluded that muscle energy technique is highly effective in improving the pain and ranges of cervical spine in patients of upper neck pain syndrome [12]. Previous literature described the importance of stretching and muscle energy techniques in managing patients suffering with cervical neck pain and UCS. However, very limited studies conducted with the aim of finding the combine effectiveness of Static stretching and Post Isometric Relaxation in managing UCS for managing pain, cervical ROM and functional status. Additionally; most of therapist either used static stretching or PIR in managing patient as this cause increase the prognosis rate among patient. Therefore, the current study also focuses on determining the combine effectiveness of static stretching and Post Isometric relaxation (PIR) on the prognosis rate of patient suffering with UCS. This also helps in providing awareness about the disease and the role of physiotherapists among the patient in reducing the morbidity rate.

## METHODS

A quasi experimental study was conducted from September 2022 to March 2023 in two governmental hospitals of Lahore, Services Hospital and Jinnah Hospital. The study was conducted after getting ethical approval from the Ethical Review board of Johar Institute of Professional Studies, Lahore with Reference Number JIPS/ACD/23-142. A sample of 22 patients were calculated by using G-power version 3.1 having  $d=1.628$ , Power  $(1-\beta \text{ err prob}) = 0.95$ , with  $df = 20$  and  $t=2.085$ . The patients were selected by using convenient sampling technique in which male and female patients of 18-50 years of age were

selected. These patients were suffering with sub-acute mechanical neck pain having duration from 6 weeks to 3 months with limited neck movement were included. Patients having history of Inflammatory, malignant, and neurological conditions, Metabolic Disease, Cervical radiculopathy, torticollis, facial pain, headache, disc prolapse, spondylolisthesis, trauma or fracture history and who were taking analgesics were excluded from the studies. The verbal and written consent form was taken and signed by each patient. After selection, patients were allocated in two groups: Group A ( $n=11$ ) - Moist Heat Pack (MHP) + Post Isometric Relaxation + Static Stretching and Group B ( $n=11$ ) - Moist Heat Pack (MHP) + Static Stretching. In Group A; the patients were managed by using Moist Heat Pack the supine lying position for 10 minutes. After MHP; a sustained Static stretching applied on upper trapezius, pectoralis major and cervical muscles by placing the tightened muscles in stretched and lengthen position for 15-30 seconds. The Static stretching was applied in 3 sets, 3 to 5 times per week [12]. Additionally; Post isometric relaxation technique was applied to the upper trapezius, levator scapulae, and pectoralis major muscles by moving the muscles to barrier point. The patients were advised to perform isometric on traction against resistance for 3 to 5 sec. The patient than relax and move to the new limit. The whole technique was applied for 3-5 times, 3 to 5 times per week [10]. In Group B; the patients were managed by using Moist Heat Pack in supine lying position for 20 minutes. After MHP; After MHP; a sustained Static stretching applied on upper trapezius, pectoralis major and cervical muscles by placing the tightened muscles in stretched and lengthen position for 15-30 seconds. The Static stretching was applied in 3 sets, 3 to 5 times per week [12]. Furthermore; patients were provided with plan for home exercises including active range of motion and cervical isometrics performed with 10 repetitions, 2 sets daily. The data were collected by using Goniometer, Neck Disability Index (NDI) and Visual Analogue scale (VAS) on first day and last day of physiotherapy session. NDI is a disability assessment tool excellent reliability of 95% (CI: 0.46-0.97in). Disability is assessed with cut off values as 13.0 as no disability, 45.5 as mild, 15.6 as moderate and 18.2 as severe interference of loss of function [13]. Furthermore; VAS is pain assessment tool having validity and reliability of (ICC >0.70) [14]. The scale had five pictorial that are described as in numerical values form 0-10 in which 0 described as no pain and 10 shows sever pain. The level further described as <3.4 as mild, 3.5 to 6.4 as moderate and >6.5 as severe interference of functioning and pain [15]. The data were analyzed by using SPSS version 26.0 in which results were described in frequency (%), Mean and S.D. along with p-value <0.05.

## RESULTS

The results of the study were described in the tabulated form. The demographic characteristics of patients were described in Table 1. According to Table 1; the mean age of participants was  $38.73 \pm 10.78$ . The gender distribution showed 9 (40.9%) were male while females were 13 (59.1%). Similarly; the behavior of pain showed 20 (90.9%) was suffering with radiating pain while 2 (9.1%) was suffering with localized pain and among all patients; 15 (68.2%) were married, 5 (22.7%) were single while 2 (9.1%) were widow.

**Table 1:** Demographic values of patients

Variables		Results
Age		$38.73 \pm 10.78$ .
Gender	Male	9 (40.9%)
	Female	13 (59.1%)
Behavior of Pain	Radiating pain	20 (90.9%)
	Localized pain	2 (9.1%)
Marital Status	Married	15 (68.2%)
	Single	5 (22.7%)
	Widow	2 (9.1%)

The within group analysis between groups were described in Table 2. According to Table 2; the VAS value of PIR with pre-treatment was  $7.00 \pm 1.67$  while the post-treatment was  $2.27 \pm 1.27$ . Similarly; VAS value of Static Stretching with pre-treatment was  $6.18 \pm 1.88$  while the post-treatment was  $4.00 \pm 1.94$  with  $p$ -value = 0.00. In Table 2; the NDI value was described. According to results; NDI scoring of Static Stretching with pre-treatment was  $32.36 \pm 3.32$  while the post-treatment was  $25.09 \pm 2.84$  with the  $p$ -value = 0.00. While; NDI scoring of PIR with pre-treatment was  $34.45 \pm 3.07$  and the post-treatment was  $24.90 \pm 2.21$  with the  $p$ -value = 0.00. Furthermore; the cervical ranges within analysis were described in Table 2. Both groups showed significant improvement in the cervical ranges from pretreatment values to post-treatment values with  $p$ -value = 0.00. The results showed Static Stretching with and without PIR played significant result in improving cervical ranges among Upper Cross Syndrome patients.

**Table 2:** Paired T-test analysis of Groups

Variables	Group A (PIR)		p-value	Group B (SS)		p-value
	pre	post		pre	post	
VAS	$7.00 \pm 1.67$	$2.27 \pm 1.27$	0.00	$6.18 \pm 1.88$	$4.00 \pm 1.94$	0.00*
NDI	$34.45 \pm 3.07$	$24.90 \pm 2.21$	0.00	$32.36 \pm 3.32$	$25.09 \pm 2.84$	0.00*
Flexion	$26.72 \pm 2.64$	$33.90 \pm 3.26$	0.00	$26.45 \pm 1.21$	$29.54 \pm 1.57$	0.00*
Extension	$28.18 \pm 1.94$	$35.72 \pm 1.84$	0.00	$26.81 \pm 2.04$	$29.63 \pm 1.85$	0.00*
Lateral Flexion (RT)	$28.45 \pm 1.75$	$35.72 \pm 2.79$	0.00	$27.72 \pm 1.79$	$31.00 \pm 2.04$	0.00*
Lateral Flexion (L)	$27.54 \pm 1.86$	$34.27 \pm 2.28$	0.00	$32.00 \pm 1.61$	$34.63 \pm 1.50$	0.00*
Rotation (RT)	$34.00 \pm 1.18$	$40.45 \pm 1.03$	0.00	$35.81 \pm 1.32$	$39.00 \pm 1.34$	0.00*
Rotation (LF)	$25.63 \pm 1.28$	$32.72 \pm 2.28$	0.00	$26.81 \pm 1.66$	$29.90 \pm 1.64$	0.00*

The between the group analysis was described by using Independent T-Test in Table 3. The results showed in post-VAS; PIR value was  $2.27 \pm 1.27$  and SS was  $4.00 \pm 1.94$ . The post-NDI value of PIR was  $24.90 \pm 2.21$  and SS was  $25.09 \pm 2.84$ . The post flexion value of PIR was  $33.90 \pm 3.26$  and SS was  $29.54 \pm 1.57$ , The post extension value of PIR was  $35.72 \pm 1.84$  and SS was  $29.63 \pm 1.85$ , the Right sided post Lateral flexion value of PIR was  $35.72 \pm 2.79$  and SS was  $31.00 \pm 2.04$ , the Left sided post Lateral flexion value of PIR was  $34.27 \pm 2.28$  and SS was  $34.63 \pm 1.50$ , the Right sided post Rotation value of PIR was  $40.45 \pm 1.03$  and SS was  $39.00 \pm 1.34$  and the Left sided post Rotation value of PIR was  $32.72 \pm 2.28$  and SS was  $29.90 \pm 1.64$  with  $p$ -value < 0.05. This showed Static Stretching with PIR played significant result in improving cervical ranges among Upper Cross Syndrome patients as compared to other groups.

**Table 3:** Independent T-test analysis of Groups:

Variables	Post-Treatment value		p-value
	Group A	Group B	
VAS	$2.27 \pm 1.27$	$4.00 \pm 1.94$	0.02*
NDI	$24.90 \pm 2.21$	$25.09 \pm 2.84$	0.00*
Flexion	$33.90 \pm 3.26$	$29.54 \pm 1.57$	0.03*
Extension	$35.72 \pm 1.84$	$29.63 \pm 1.85$	0.01*
Lateral Flexion (R)	$35.72 \pm 2.79$	$31.00 \pm 2.04$	0.00*

Lateral Flexion (L)	$34.27 \pm 2.28$	$34.63 \pm 1.50$	0.02*
Rotation (R)	$40.45 \pm 1.03$	$39.00 \pm 1.34$	0.02*
Rotation (L)	$32.72 \pm 2.28$	$29.90 \pm 1.64$	0.00*

## DISCUSSION

The purpose of the study was to determine the effectiveness of Static Stretching with and without Post Isometric Relaxation in managing pain, improving range of motion and functional status in Upper Cross Syndrome

patients. The results showed that measured pre- and post-treatment values showed significant improvement in pain, range of motion, functional abilities of the neck and functional status in both groups. However; on the comparison, there was a statistically significant difference in group managed by Static Stretching with Post Isometric Relaxation better results than static Stretching without Post Isometric Relaxation with a  $p$ -value  $<0.05$ . The recent study showed VAS value of Static Stretching with pre-treatment was  $6.18 \pm 1.88$  while PIR pre-treatment was  $7.0 \pm 1.8$ . However, the post-treatment of Static Stretching was  $4.00 \pm 1.94$  while the post-treatment was  $2.27 \pm 1.27$  with a  $p$ -value  $=0.25$ . This showed that Static Stretching with PIR was statistically significant in reducing pain in UCS. Gillani *et al.*, 2020 concluded that Static Stretching and PIR were equally effective in treating UCS for improving ROM, reducing pain, and improving functional ability [10]. This study in contrast to current study results as group managed by static stretching with post-isometric relaxation produce significant improvement in the pain and reduce the risk of disability among the patient suffering from UCS. Similarly; Mahajan *et al.*, 2012 concluded that static stretching and METs both are effective in improving the pain, active ranges and disability of neck while METs is more effective when used in combination with the conventional treatment protocol with  $p$ -value  $<0.05$  [16]. This again support current study results as study group managed by Static stretching along with PIR showed rapid recovery in pain and ranges of spine This depend on the inhibition of Golgi tendon organ activity along with simultaneously activation of mechanoreceptors of muscle and joints. This activation cause excitation of somatic efferent and periaqueductal gray matter. All these activations cause the reduction in the intensity of pain [16]. Additionally, Park *et al.*, 2019 reported that PIR is highly effective in improving the prognosis rate and cervical ranges especially left and right cervical rotation and flexion relaxation ratio with  $p$ -value  $<0.05$  [17]. This again supported current study results as patients managed with PIR along with static stretching showed rapid recovery especially in rotational movement of cervical spine with  $40.45 \pm 1.03$  and  $32.72 \pm 2.28$ ,  $p$ -value  $<0.05$ . The improvement in the ranges by PIR cause the activation pattern of the muscle that showed significant improvement in the rotational ranges of cervical spine as compared to static stretching [17]. Shende *et al.*, 2022 also reported that METs (PIR) is highly effective in managing ranges as it improves the muscular strength that helps in preventing and managing compensatory movements at different associated joints [18]. Chaudhary *et al.*, 2020 concluded that MET (PIR) and Static stretching both are effective in improving ranges by increasing the flexibility of

tight muscles. Still; METs (PIR) is statistically more significant in improving the flexibility of muscles that ultimately enhance the limited ranges of affected joint [19]. This again supported current study results as Group A managed by PIR showed greater improvement in all cervical ranges of UCS patients. Shellock *et al.*, 1985 supported that PIR focus on the activation of Golgi tendon organ through isometric contraction and it cause the stretching of Golgi tendon and inhibition of reflex leading to relaxation and lengthening of tightened muscle [20]. PIR with Static Stretching is highly significant in improving pain, cervical ranges and disability among Upper Cross Syndrome patients as compared to Static Stretching by focusing on inhibition of Golgi tendon organ and mechanoreceptors in UCS.

## CONCLUSIONS

From this study, it was concluded as static stretching with post isometric relaxation was very effective in reducing pain and level of disability along with improving ranges of neck in patient suffering from upper cross syndrome. This combination is highly effective in increasing the prognosis rate among UCS patients.

## Authors Contribution

Conceptualization: PM, ZB

Writing, review and editing: RM, KH, AS, AK

Methodology: PM, ZB

Formal analysis: RM, IY

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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