

Efficacy of Post-Isometric Relaxation vs. Sustained Stretching for Improving Cervical Spine Mobility in Upper Cross Syndrome-A Randomized Controlled Trial

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Abstract

Background: Upper crossed syndrome (UCS) is a common musculoskeletal disorder characterized by muscle imbalance in the head and shoulder areas, often aggravated by poor posture. The Muscle Energy Technique (MET), a method involving post-isometric relaxation (PIR) and various sustained stretching techniques, often alleviates UCS symptoms.

Methodology: A randomized controlled trial compared the effectiveness of PIR and sustained stretching in reducing tightness in the upper trapezius and levator scapulae muscles in 30 subjects at Al-Sehat Rehabilitation Centre in Karachi, Pakistan. Assessment parameters included the Numeric Pain Rating Scale (NPRS) for pain intensity and cervical range of motion (ROM) measured using an inclinometer.

Results: PIR and sustained stretching significantly reduced pain and improved cervical ROM. PIR was more effective in reducing pain, while sustained stretching led to more substantial improvements in left rotation and lateral flexion ROM.

Conclusion: PIR and sustained stretch are promising treatment options for managing UCS-related symptoms. PIR was more effective in managing pain, while sustained stretch was more beneficial for improving cervical ROM. These findings should be taken into consideration when developing treatment protocols for UCS.

Keywords

Disability, Pain Management, Range of Motion, Upper Crossed Syndrome.



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Introduction

Upper Crossed Syndrome is a common musculoskeletal disorder characterized by an imbalance of muscles in the head and shoulder areas¹. It is often caused by long-term muscle imbalance, such as sitting at a desk or working on the computer, and can lead to various disabilities at work². The tightness in the syndrome affects muscles such as the upper trapezius, levator scapulae, sternocleidomastoid, and pectoralis, while there is weakness and lengthening in the deep cervical flexors, lower trapezius, and serratus anterior muscles³.

The Muscle Energy Technique is a beneficial therapeutic approach for treating Upper Crossed Syndrome. This technique involves controlled, isometric contractions followed by relaxation and gentle stretching to release hypertonic muscles and improve muscle function⁴. MET effectively treats various musculoskeletal conditions, including acute somatic dysfunctions and severe muscle spasms⁵.

Janda's model emphasizes that these muscles are neurologically facilitated and are categorized as tonic (postural) and phasic (dynamic), responding predictably to stressors irrespective of underlying pathologies⁶. The typical presentation of UCS includes forward head posture, rounded upper back, raised and protracted shoulders, scapular winging, and reduced thoracic spine mobility⁷. There are two main types of MET: 1) Post-Isometric Relaxation (PIR), which involves stretching a muscle and performing an isometric contraction against minimal resistance. The subsequent relaxation releases tension in the muscle, thereby improving flexibility and reducing pain; 2) Reciprocal Inhibition: This technique involves contracting the antagonist muscle group of a muscle with increased tone isometrically, which helps to reduce the tone and improve movement potential in dysfunctional tissues⁸⁻⁹.

Studies assessing the effectiveness of MET in musculoskeletal disorders have yielded mixed results. A study demonstrated improvements in anterior head carriage related to UCS using active release techniques and prescribed exercises¹⁰; another research suggested that myofascial release therapy is more effective than MET in treating myofascial trigger points in the upper trapezius¹¹.

Additionally, Ghaus et al.¹² linked UCS with cervicogenic headaches, suggesting that chiropractic interventions aimed at addressing muscle imbalance and vertebral subluxations could improve therapy outcomes. Another study compared the effectiveness of PIR and INIT in trigger point pain in the upper trapezius and found both techniques to be very effective¹³.

More comprehensive research still needs to be done on the comparative effectiveness of specific MET techniques, particularly PIR and sustained stretching, in reducing muscle tightness and improving pain and range of motion in UCS. This randomized controlled trial investigated the effectiveness of PIR compared with sustained stretching in reducing muscle tightness in the upper trapezius and levator scapulae related to UCS. Pain and cervical spine mobility are two variables of interest for this study. This research is essential for obtaining clear insights into the most effective therapeutic approach for managing UCS-related symptoms.

Methodology

Study Design

This randomized clinical trial compared the effects of sustained stretching versus post-isometric relaxation in patients with tightness in the upper trapezius and levator scapulae.

Study Setting

The study was conducted at Al-Sehat Rehabilitation Centre, Karachi, Pakistan, from October 2023 to March 2024.

Sample Size and Sampling Technique

A total of 30 subjects were selected and divided into groups: Group A (Sustained Stretching) and Group B (Post-Isometric Relaxation), with 15 subjects in each group. Randomization was done through the envelope method by preparing 30 opaque envelopes inside which a card was kept specifying the opted group, that is, either Group A or B. The envelopes were thoroughly mixed, and each participant drew one, so the assignment remained blind until the time of assignment.

Selection of Samples

The study included individuals of both genders, aged 20-40, who have been experiencing persistent neck and shoulder pain for more than six months. This pain had to be linked to postural issues such as forward head position, increased cervical lordosis, thoracic kyphosis, elevated and protracted shoulder, rotation or abduction, and winging of scapulae.

Exclusion criteria were individuals with systemic and metabolic conditions, cardiovascular and neurological disorders, those with a history of cervical spine and shoulder surgery, severe trauma or injury, instability, spasmodic torticollis, pregnancy, individuals taking analgesic medication in the last two weeks, and those who had received injections in the cervical spine in the past two weeks.

Procedure of Data Collection

- Group A underwent the PIR technique, where they had sessions three times a week for six weeks. During each session, the participants contracted the upper trapezius and levator scapulae muscles against therapist-provided resistance for 10 seconds, followed by a 30-second relaxation and passive stretch phase. This approach uses autogenic inhibition to relax and lengthen the muscles.
- Group B received sustained stretching intervention three times a week for six weeks. In each session, the subjects assumed stretches to maximally stretch the upper trapezius and levator scapulae muscles. They held each stretch for 30 seconds, rested for 10 seconds, and repeated the process three times for each muscle group. The aim was to increase muscle flexibility and range of motion through muscle elongation.

Outcome Measures

The outcomes were measured at baseline and post-six weeks intervention on the following measures:

- **Numeric Pain Rating Scale (NPRS)** was used to measure the intensity of pain. It is a widely used tool where patients were asked to rate their pain from 0—no pain—to 10—worst possible pain. The NRS is a reliable tool with high test-retest reliability for pain intensity measures¹⁴.
- **Range of Motion (ROM)** measurement was executed with the assistance of an inclinometer, which issued a very accurate angular measure of the movement in the articulations. The inclinometer is a reliable instrument in terms of measuring ROM, since it produces consistent and reproducible results.

Data Analysis Procedure

The data analysis used the Statistical Package for the Social Sciences (SPSS), version 21. Paired-sample t-tests were utilized to compare changes within each group. In contrast, independent t-tests were employed to compare differences in pain and ROM between Group A and Group B. The significance level for all tests was set at $p < 0.05$, which was considered statistically significant.

Ethical Considerations

The methodology ensures ethical standards by fully informing participants, obtaining their consent for data use, and maintaining confidentiality while rigorously validating the study's reliability and findings.

Results

The study involved 30 participants, with 21 (70%) females and 9 males, and the average age was 21 years. The majority (43.4%) of the participants were in the 19-20 year age group. The duration of pain was divided into three categories: 60% of patients experienced pain for 6-8 months, 13.3% for 9-11 months, and 26.7% for over 11 months (Table-1).

| Table-1 Demographics of Participants | |
|--------------------------------------|------------|
| Characteristic | n (%) |
| Gender | |
| Male | 9 (30%) |
| Female | 21 (70%) |
| Age | |
| 19-20 years | 13 (43.4%) |

| | |
|-------------------------|-----------|
| 21-22 years | 6 (20%) |
| 23-24 years | 7 (23.3%) |
| 25-29 years | 4 (13.3%) |
| Duration of Pain | |
| 6-8 months | 18 (60%) |
| 9-11 months | 4 (13.3%) |
| > 11 months | 8 (26.7%) |

Group A underwent the PIR treatment and experienced a significant reduction in pain intensity. Additionally, there was an improvement in all movements measured, particularly in terms of cervical range of motion (ROM), including flexion, extension, right rotation, left rotation, right lateral flexion, and left lateral flexion. This suggests that PIR is effective for pain relief and enhancing cervical ROM (Table-2).

| Table-2 Pre and Post changes in Group A (Post Isometric Relaxation - PIR) | | | |
|--|----------------------|-----------------------|--------------------|
| Measurement | Pre-Treatment | Post-Treatment | Improvement |
| Pain (Mean \pm SD) | 5.67 \pm 1.58 | 2.67 \pm 1.29 | 0.002 |
| ROM (Mean \pm SD in degrees) | | | |
| Flexion | 34 \pm 4.58 | 40 \pm 5.00 | 0.035 |
| Extension | 35 \pm 3.99 | 40 \pm 3.99 | 0.027 |
| Right Rotation | 51 \pm 2.80 | 55 \pm 4.23 | 0.017 |
| Left Rotation | 50 \pm 5.98 | 55 \pm 3.52 | 0.019 |
| Right Lateral Flexion | 34 \pm 3.52 | 38 \pm 3.09 | 0.102 |
| Left Lateral Flexion | 32 \pm 3.09 | 40 \pm 3.99 | 0.490 |

Group B received sustained stretching treatment, which also resulted in a significant decrease in pain levels. Similarly, this group saw improvements in all cervical movements' post-treatment, enhancing cervical flexion, extension, rotations, and lateral flexions. These findings indicate that Sustained Stretching efficiently relieves neck pain and improves cervical ROM.

| Table-3 Pre and Post Changes in Group B (Sustained Stretching) | | | |
|--|---------------|----------------|-------------|
| Measurement | Pre-Treatment | Post-Treatment | Improvement |
| Pain (Mean ± SD) | 4.93±1.35 | 2.33 ± 1.35 | 0.001 |
| ROM (Mean ± SD in degrees) | | | |
| Flexion | 35±4.42 | 38±5.23 | 0.035 |
| Extension | 34±4.17 | 37±4.17 | 0.027 |
| Right Rotation | 51±4.17 | 53±4.14 | 0.017 |
| Left Rotation | 49±6.04 | 55±2.97 | 0.019 |
| Right Lateral Flexion | 34±4.71 | 37±4.50 | 0.102 |
| Left Lateral Flexion | 36±5.63 | 40±3.99 | 0.490 |

Comparing the two modalities of treatment, both significantly improved pain and ROM. However, results for the sustained stretching were better about ROM improvements, mainly at left rotation and left lateral flexion. The results underline the effectiveness of PIR and sustained stretching in the clinical management of upper trapezius and levator scapulae tightness and provide some critical insights for clinical physiotherapy practice.

Discussion

Our study aimed to compare the effectiveness of PIR and sustained stretching in reducing tightness in two muscles—the Upper Trapezius and Levator Scapulae—often associated with neck pain and cervicogenic headaches. As detailed in the results section, both techniques significantly reduced pain and improved range of motion (ROM). However, the PIR group showed a more significant reduction in pain, while the sustained stretching group experienced remarkable improvements.

Studies have been conducted about treatment methods for the tightness of the Upper Trapezius and Levator Scapulae¹⁶⁻¹⁷. A study highlighted the effectiveness of the Active Release Technique for the UCS¹⁸, while another compared Myofascial Release to the Muscle Energy Technique (MET) for myofascial trigger points in the Upper Trapezius, showing a preference for the former¹⁹. These studies underscore the variety of approaches available for similar conditions, each advocating for their efficacy.

In this study, PIR significantly outperformed sustained stretching in pain reduction. This aligns with findings from a study where PIR, combined with integrated neuromuscular ischemic technique, ultrasound, and massage, showed significant pain reduction and improved ROM²⁰. Similarly, another study found PIR more effective than static stretching in reducing subacute mechanical neck pain²¹. These comparisons further highlight PIR as a powerful intervention for

pain management in musculoskeletal conditions. Interestingly, in our study, sustained stretching achieved more significant improvements in ROM than PIR. This contrasts with specific prior findings but suggests that while PIR excels in pain alleviation, sustained stretching could offer better outcomes in enhancing flexibility and motion. A study found Myofascial Release superior to cold packs and exercise in treating Upper Trapezius spasms, prioritizing Myofascial Release due to its significant results²². These findings, alongside ours, suggest that manual techniques like PIR offer notable advantages in pain relief, whereas sustained stretching may be more beneficial for improving mobility.

The study's strengths are rooted in its rigorous comparative design, which allowed a direct evaluation of two distinct manual therapy techniques using comprehensive measurements for pain intensity and cervical ROM outcomes. Our data collection and analysis methodologies were robust. However, the limitations include a modest sample size and the study being conducted in a single-centre setup, which might impact the generalizability of the results. Also, a longer-term follow-up might provide more insight into the sustained effects of PIR and sustained stretching. Future research should further elucidate these mechanisms and develop clinical practice guidelines to promote these modalities.

Conclusion

PIR and sustained stretching effectively managed Upper Trapezius and Levator Scapulae muscle tightness. PIR was more successful in reducing pain, whereas sustained stretching led to better outcomes in ROM improvement. Consequently, clinicians should consider both techniques' unique benefits when designing treatment plans, prioritizing PIR for pain management and sustained stretching for ROM enhancement.

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Conflict of Interest

None.

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None.

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AUTHORS' CONTRIBUTION

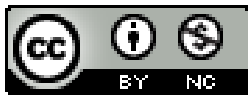
The following authors have made substantial contributions to the manuscript as under:

Conception or Design: Kumar V, Tanveer E

Acquisition, Analysis or Interpretation of Data: Kumar V, Ahmed H, Kumar S

Manuscript Writing & Approval: Kumar V, Tanveer E

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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