ORIGINAL ARTICLE

Effects of eccentric muscle energy technique versus static stretching exercises in the management of cervical dysfunction in upper cross syndrome: a randomized control trial

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Abstract

Objective: To compare the effects of eccentric muscle energy technique versus static stretching exercises combined with cervical segmental mobilisation in the management of upper cross syndrome in patients having neck pain.

Methods: The randomised controlled trial was conducted at the Khan Kinetic Treatment Canada Orthopaedic and Rehabilitation Centre, Rawalpindi, Pakistan, from August 2017 to January 2018, and comprised patients of upper cross syndrome who were randomised into two equal groups using lottery method. Patients in Group-A were treated with eccentric muscle energy technique with cervical segmental mobilisation, while those in Group-B received static stretching exercises with cervical segmental mobilisation. Two sessions per week for 3 weeks were given to each patient who were analysed by measuring tragus-to-wall distance, visual analogue scale and neck disability index. Cervical passive range of motion was measured using inclinometer. Data was recorded at baseline and after 3 weeks of treatment. Data was analysed using SPSS 21.

Results: Of the 40 subjects, 20(50%) each were in the two groups. In Group-A mean age was 42.75±11.13 years. In Group-B, it was 40.50±9.14 years. Eccentric muscle energy technique and static stretching technique both showed significant results ($p<0.05$) for within group analysis, but comparison across groups showed non-significant results ($p>0.05$ each) on all parameters.

Conclusion: Both the techniques used were found to be equally effective in decreasing pain, improving cervical range of motion and reducing neck disability.

Keywords: Forward head posture, MET, Static stretching, VAS, NDI. (JPMA 70: 394; 2020).

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Introduction

Neck pain is the most frequent problem in developed countries. The prevalence of neck pain is approximately 10-15%. Prevalence shows cervical pain typically somewhat more common in middle-aged women compared to men. Neck pain is the most common reason for patients visiting healthcare professionals.[1] Poor posture typically causes upper cross syndrome (UCS), resulting in neck pain. This syndrome can cause dysfunctional tone in posture and muscular disparity of head, neck and shoulder region.[2] Evidence suggests that 6-48% of UCS population complain pain in shoulder girdle and cerivco-thoracic region.[3]

UCS is characterised as common postural dysfunction pattern that causes dysfunctional tone of the musculature around shoulder girdle/cervico-thoracic region.[1] UCS was first identified by Janda according to whom postural muscular imbalances showed neuro-motor aspects of asymmetries in sagittal plane resulting in difficulties to recover from chronic structural pain pattern. The key antagonist of UCS is muscular disparity.[4]

UCS may lead to shortening of upper trapezius, levator scapulae and pectoralis major muscles and at the same time lengthening the deep cervical flexors, including scalenes, middle and lower trapezius, serratus anterior and rhomboids. The main postural muscle imbalances that lead to restricted range of motion (ROM), dorsally are tight upper trapezius and levator scapulae, whereas anteriorly weakness of deep neck flexors and posteriorly middle and lower trapezius weakening and lengthening are responsible.[5] These abnormal postural variations lead

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to stress on muscles and articulating surfaces causing muscular imbalance, pain and restricted ROM. Commonly affected joints include cranio-cervical, cervico-thoracic and gleno-humeral joints along with stress on C4-C5 and T4-T5 segment. The positional change from the original axis causes more stress on muscles to stabilise the continuous activity, thereby degenerating muscles.[6] UCS-related disorders affect greatly the safety and health status worldwide and it is estimated that it may increase in the near future. Early identification and categorisation is usually not possible as diagnostic techniques are based upon individual judgment. With the help of diagnostic process, quantification and identification of UCS at initial stage is possible, thereby guiding proper prevention of UCS. Patients with muscular dysfunctions can be assisted on effective manners if proper rehab plan is designed on routine basis.[7]

Management techniques commonly used to cure thoracic spine dysfunctions mainly limiting cervical ROM, forward head posture, pain and muscular imbalances include joint mobilisation, strain-counter strain (SCS), proprioceptive neuromuscular facilitation (PNF), neuromuscular re-education (NMR) with soft tissue release, active release techniques (ART), active isolated stretching (AIS) and muscle energy techniques (MET).[8] Recently, MET is getting popularity among therapeutic modalities aimed at enhancing elasticity of contractile and non-contractile tissues.[9] According to Cunha et al., stretching exercises and manual therapy techniques both show significant effect in improving ROM in patients with chronic neck pain.[10]

Cervical mobilisation is often used in combination with routine physiotherapy and is found to be effective in the management of neck pain and disability by reducing pain and improving neck ROM in chronic patients with mechanical pain.[11]

However, despite widespread use of MET, there is little evidence to support its effectiveness when compared with stretching exercises for the management of UCS. The current study was planned to uncover the effects of eccentric muscle energy technique versus static stretching exercises in UCS management.

Patients and Methods

The randomised controlled trial (RCT) was conducted at the Khan Kinetic Treatment Canada Orthopaedic and Rehabilitation Centre (KKT&CORC) from August 2017 to January 2018. After obtaining permission from the institutional review board, the sample size was calculated using Open-Epi version 3[12] with 95% confidence interval (CI), 80% power and variance for group (A) was 16.5 and 15.8 for group (B).[13] Mean score of visual analogue scale (VAS) was used for sample calculation.[5] The sample was raised using non-probability convenience sampling. Randomisation was done using the lottery method, and the participants were divided into experimental Group-A and control Group-B.

Those included were diagnosed UCS patients aged 20-70 years of either gender. Patients having any diagnosed muscle pathology or disease of soft tissues fracture of cervical spine, or diagnosed pathology, like malignancy, infection, inflammatory disorder and osteoporosis, were excluded. After informed consent was signed by all the participants, physiotherapy sessions of 30 minutes were given twice a week for 3 weeks to each participant.

In the experimental Group-A, conventional transcutaneous electrical nerve stimulation (TENS) high-frequency (50-100 Hz), low-intensity (paraesthesia, not painful), small pulse width (50-200μs) was applied for 10-20 minutes.(14) Soft tissue tension and pain was managed using either TENS or moist heating pad and infrared (IR) light for 10 minutes.[15]

Eccentric muscle energy technique was applied to subjects' cervical spine. The cervical spine was brought to the barrier of motion in each plane i.e. flexion/extension, lateral bending and rotation. Then subjects were asked to push their heads into the direction opposite that of the barrier. The therapist provided isometric resistance for 3-5 seconds, after which the subjects relaxed their muscles completely and the therapist applied stretch. Three to five repetitions were performed.[16]

Cervical segmental mobilisation was performed slowly, with varied rhythm and speed. Three sets of grade I-II mobilisation (posterioanterior) with 8-10 repetition for 2-3 minutes in resting position was given.[17]

In the control Group-B, as in the experimental Group-A, the subjects were also treated with TENS, IR and cevical segmental mobilisation along with static stretching of the upper trapezius, levator scapulae muscle and pectoralis major muscle. Slow stretch was applied with the duration of 6-60 seconds.[18]

During upper trapezius stretching, the participants were in seated position by holding the chair with one arm, and

Table-1: Demographic data of the participants.

Variables	Experimental Group-A n (%)	Control Group-B n (%)	Both Groups n (%)
Marital status			
Married	15 (75)	16 (80)	31 (77)
Unmarried	3 (15)	4 (20)	7 (17)
Others	2 (10)	0	2 (5)
Occupation			
Businessman	3 (15)	2 (10)	5 (12)
Executive	5 (25)	5 (25)	10 (25)
Government Job	2 (10)	2 (10)	4 (10)
Housewife	7 (35)	11 (55)	18 (45)
Retired	1 (5)	0	1 (2.5)
Others	2 (10)	0	2 (5)
Duty Hours			
< 6 hours	2 (10)	0	2 (5)
< 12 hours	8 (40)	8 (40)	16 (40)
< 18 hours	0	1 (5)	1 (2)
No job	10 (50)	11 (55)	21 (52)
Onset of pain			
Sudden	5 (25)	7 (35)	12 (30)
Gradual	15 (75)	13 (65)	28 (70)
Duration of pain			
3 month before	4 (20)	8 (40)	12 (30)
6 month before	5 (25)	4 (20)	9 (22)
9 month before	2 (10	3 (15)	5 (12)
12 month before	3 (15)	3 (15)	6 (15)
More than a year	6 (30)	2 (10)	8 (20)
Previous Treatment			
No treatment	3 (15)	3 (15)	6 (15)
Self-medication	5 (25)	4 (20)	9 (22)
General Practitioner	1 (5)	3 (15)	4 (10)
Orthopaedic 6 (30)	6 (30)	12 (30)	
Physiotherapy	5 (25)	4 (20)	9 (22)

Table-2: Between groups and within group analysis for variables not normally distributed.

Variables	Group	Median ± IQ	*p* - value
Mann Whitney U - Test across Groups A & B (Post Intervention)			
Cervical Flexion	Experimental	42.00 ± 24.75	0.602
	Control	40.00 ± 18.75	
Right Side Rotation	Experimental	60.00 ± 10.00	0.554
	Control	55.00 ± 12.50	
VAS	Experimental	4.00 ± 1.75	0.092
	Control	5.00 ± 2.00	
Wilcoxon test pre and post comparison in Group-A (Eccentric MET)			
Variables	Pre Mean ± SD	Post Mean ± SD	P - Value
Cervical Flexion	33.50 ± 23.75	42.00 ± 24.75	0.001
Right Side Rotation	50.00 ±13.75	60.00 ± 10.00	0.001
VAS	7.50 ± 1.00	4.0 ± 1.75	0.001
Wilcoxon test pre and post comparison in Group-B (Static stretching)			
Cervical Flexion	35.00 ± 20.00	40.00 ± 18.75	0.001
Right Side Rotation	50.00 ± 8.75	55.00 ± 12.50	0.001
VAS	7.00 ± 2.00	5.00 ± 2.00	0.001

VAS: Visual analogue scale

Table-3: Parametric Test for across group Analysis.

Independent Sample T-test between Groups				
Variables	**Group**	**Pre Mean ± SD**	**Post Mean ± SD**	***p*- value**
Forward Head Posture	Experimental	16.65 ± 2.37	13.90 ± 2.53	0.08
	Control	16.55 ± 2.11	15.20 ± 2.01	
Cervical Extension	Experimental	35.25 ± 4.72	43.25 ± 5.14	0.817
	Control	39.50 ± 7.59	43.75 ± 8.10	
Right Side Bending	Experimental	32.50 ± 8.03	40.35 ± 7.80	0.751
	Control	34.25 ± 7.48	39.60 ± 7.02	
Left Side Bending	Experimental	32.50 ± 8.66	39.80 ± 8.00	0.346
	Control	34.25 ± 4.38	37.85 ± 4.45	
Left Rotation	Experimental	53.00 ± 14.90	58.75 ± 13.85	0.543
	Control	53.75 ± 9.98	56.45 ± 9.40	
Neck Disability Index	Experimental	17.75 ± 5.41	13.90 ± 3.39	0.343
	Control	17.15 ± 4.79	15.10 ± 4.45	

Table-4: Parametric test for with-in group analysis.

Variables	Pre Mean±SD	Post Mean±SD	*p*-value
With-in group anaylysis (Paired T-test) Group-A (Eccentric MET)			
Forward head posture	16.65±2.37	13.90±2.53	0.001
Cervical Extension	35.25±4.72	43.25±5.14	0.001
Right side bending	32.50±8.03	40.35±7.80	0.001
Left side bending	32.50±8.67	39.80±8.00	0.001
Left rotation	53.00±14.9	58.75±13.85	0.001
Neck disability index	17.75±5.42	13.90±3.39	0.001
With-in group analysis (Paired T-test) Group-B (Static stretching)			
Forward head posture	16.55±2.11	15.20±2.01	0.001
Cervical extension	39.50±7.60	43.75±8.10	0.001
Right side bending	34.25±7.48	39.60±7.02	0.001
Left side bending	34.25±4.38	37.85±4.45	0.001
Left rotation	53.75±9.99	56.45±9.40	0.001
Neck disability index	17.15±4.80	15.10±4.45	0.001

laterally tilted the head to the opposite side with the other hand pushing the head to increase lateral stretch. The change in ROM and flexibility stretched the muscle for 15-30 seconds with 2-4 repetitions.[19]

For pectoralis muscle stretch, participants were asked to stand in front of the doorframe with elbow bent at 90^{O} and was asked to lean forward without taking a step forward. The stretch is felt across the anterior chest, which is held for 15-30 seconds with 2-3 repetitions.[20]

For levator scapulae stretch, the subjects were asked to take the seated position while holding the chair with one hand in order to maintain shoulder depression, then to flex and rotate neck to the opposite side by placing the other hand at the back of their head and to slowly pull it down toward the armpit. For 15-30 seconds, they were asked to hold the stretch with 2-3 repetitions on each side.[19]

Certain precautions and postural education was handed down to each participant. These included avoiding prolonged sitting while using laptop or watching TV, 20-30 minutes' rest during office hours, avoiding poking of chin, using of back-support during office work and driving, and using a single pillow while sleeping.

Data was collected on the first session before treatment and after the last physiotherapy session using neck disability index (NDI) questionnaire, visual analogue scale (VAS), forward head posture (FHP) analysis, ROM of cervical spine (via inclinometer). Results were analysed using SPSS 21.

Results

Of the 52 participants initially assessed, 8(15.4%) were excluded. Subsequently, 4(7.7%) participants were unable to complete the treatment. The final sample stood at 40(77%), with 20(50%) in each of the two groups. In Group-A, there were 7(35%) males and 13(65%) females, while in Group-B, there were 4(20%) males and 16(80%) were females. Overall mean age of the sample was 42.75±11.13 years. In Group-A, mean age were 42.75±11.13 years and it was 40.05±9.14 years in Group-B Most commonly affected population were middle-aged females, making 55% housewives, 25% executive, 12% businessman, 10% government employees, 2% retired and 5% others (Table 1). Majority of the participants had gradual onset of pain 70% whereas 30% had sudden onset of pain. In Group-A 25% experienced sudden pain and 75% experienced gradual onset, while in Group-B, 35% had sudden and 65% had gradual onset of pain.

The comparison of post-treatment measurements across groups showed non-significant difference between the groups in terms of cervical flexion, right-side rotation and VAS ($p>0.05$ each). However, within group analysis showed significant changes in pre- and post-treatment measurements (Table 2).

The comparison of post-treatment measurements across groups for homogenous variables showed non-significant difference ($p>0.05$) (Table 3). Within group analysis of both groups showed significant difference in pre- and post-treatment measurements ($p=0.001$) for all the variables (Table 4).

Discussion

The present study was undertaken to evaluate the effect of MET and static stretching in combination with mobilisation and soft tissue relaxation using TENS and hot pack / IR to improve scores for pain, NDI and cervical ranges in patients having UCS. Evidence greatly lacks having minimal findings for UCS so outcome measures are compared with impairments caused by UCS.

In this study, eccentric MET in comparison with static stretching was found to be equally effective for decreasing pain and improving cervical ROM as reported by a study as well.[21] MET reduces perception of pain by improving tolerance to stretch. Combination of stretching and isometric contraction stimulates muscle and joint mechano-receptors and propio-receptors[22] would reduce the sensation of pain, making stretch stress-free and tolerable. A study also reported effectiveness of MET in terms of mobility for cervical, thoracic and lumbar spine.[19]

Effectiveness of stretching in improving neck pain and ROM may be due to the inhibitory effects of golgi tendon organs, that reduces the motor neuronal discharges, thus inducing relaxation of the muscle tendon unit by resetting its resting length and pacinian corpuscle modification.[23] Effects of stretching on neck pain and ROM are supported by a study which concluded that stretching can significantly improve pain and ROM.[24] Current study reports that stretching in combination therapy is effective in the management of pain and ROM.

A study on the effects of MET in cervical ROM on healthy population comprised a four-week treatment programme to determine the effectiveness of MET on asymptomatic individuals. It had 18 volunteers having limited cervical ROMs who were randomly allocated to control or experimental groups. Results demonstrated a significantly greater improvement in ROM with MET. Results supported that MET was an effective technique for improving cervical ROM. This study supports current results that MET helps to improve cervical ROM.[6]

Eccentric MET and static stretching were also found equally effective for reducing pain and neck disability score. A study to check the efficacy of MET and strain or counter-strain on low backache with 30 subjects found that MET and strain counter-strain were effective in decreasing pain and functional disability.[25]

The results concluded that both techniques were effective treatment options. However, both the techniques were not used alone. MET and stretching were accompanied by TENS, IR and mobilisation. Further studies should be conducted on isolated treatment approaches to clearly

identify the effect of each interventional technique. It is a limitation of the current study that despite making efforts, the RCT could not get a trial number due to the unavailability of a trial registration office in Pakistan.

Conclusion

Both treatment techniques in combination with TENS, IR/hot pack and mobilisation were effective in alleviating symptoms of UCS. No combination was superior than the other.

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