

Effects of Sub-Occipital Muscles Inhibition Technique and Cranio-Cervical Flexion Exercise for Mechanical Neck Pain

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ABSTRACT

Aim: To compare the effects of Suboccipital muscle Release (SMI) techniques and Cranio-Cervical Flexion Exercise (CCFE) for Range of motion, pain, neck disability and forward head posture (FHP) in mechanical neck pain patients.

Methodology: This Randomize Clinical Trial was conducted in Railway General Hospital Rawalpindi, within a duration of 6 months. Total 28 patients who fulfilled inclusion criteria such as were randomly allocated equally into two treatment groups through lottery method. Group A received suboccipital muscle inhibition technique while Group B received craniocervical flexion exercises. Both groups were evaluated at baseline and after four weeks through numeric pain rating scale (NPRS), Neck Disability Index (NDI), Goniometer, and craniovertebral angle. IBM SPSS 24 was used for statistical analysis. Parametric test i.e., independent t test was applied on normal distributed data for between group analysis and Paired t test was applied for within group analysis for NDI. Non-parametric test i.e., Mann-Whitney U test was applied for between group analysis and Wilcoxon test were applied for within group analysis for FHP, NPRS and ROM.

Results: Groups A and Group B showed significant improvement ($p < 0.05$) in within group analysis in Numeric Pain Rating Scale, forward head posture, neck disability index and cervical range of motion.

Practical implication: Mechanical neck pain accounts approximately 50% to neck pain and may induce functional disability in many patients. The current study findings can be used to formulate effective, accessible and economical treatment strategies for Mechanical neck pain, so it may be interesting to the readers of your journal.

Conclusion: Sub occipital muscle inhibition technique and cranio cervical flexion exercises are equally effective techniques to increase cervical range of motion, decrease neck disability, decrease pain intensity, and improve cranio-vertebral angle in patients with mechanical neck pain.

Keywords: Cranio-cervical flexion exercises, Cranio-vertebral angle, Neck Disability Index, Range of Motion,

INTRODUCTION

Mechanical Neck pain (MNP) can be defined as a pain in the neck or shoulders with mechanical features that can be triggered by cervical spine positions, motion, or palpation of the cervical spine¹. Mechanical origin neck pain accounts for approximately 45% to 50% of neck pain² and 67% of the whole population experiences this pain at some point in their life, also causing functional disability in many populations². The primary etiology of neck pain is not fully understood. Often, prolonged workstation use and biomechanical causes such as position and endurance of neck motion can be cause of cervical pain³. Psychosocial stress may also result in cervical pain⁴.

Physical therapy is often the first treatment option for people with an insidious onset of mechanical neck pain. Various therapies, including mobilization techniques, massage techniques, suboccipital muscle suppression techniques, cranial cervical flexion exercises, and electrical methods are used for the treatment of mechanical neck pain⁵⁻⁸. A study conducted by Eun-Dong Jeong et al in 2018 compared the cranio-cervical flexion exercise (CCFE) and suboccipital muscle inhibition (SMI) manual therapy technique. They concluded that both techniques had better and immediate effects regarding ROM and cranio-vertebral angle in patients of neck pain⁹. Bo-Been Kim et al conducted a study on forward head posture regarding Effects of SMI versus CCFE on cervical muscular activity and cervical posture and found that SMI and CCFE significantly increased Cranio-vertebral angle (CVA) and cervical flexion and extension ROM with forward head posture¹⁰.

Another research by Camitsis et al identified that craniocervical flexion exercise (CCFE) increase ranges of cervical

spine and Craniovertebral angle (CVA)⁶. Deborah Falla et al conducted study in 2007 reported that the craniocervical flexor training group shows a significant decrease in the variation of cervical angle and an enhanced capacity to uphold a neutral posture of cervical spine during continued sitting position¹¹. M Nezamuddin et al also concluded that Pressure biofeedback guided for cervical flexor training is shown to be somewhat better than conventional therapy on FHP in visual Display Terminal (VDT) workers so it can be included in the recovery of participant pain from forward head posture¹². Alberto M et al conducted a study in 2012, they conclude that SMI technique can instantly improve the head position with the patients sitting and standing. It also it can also instantly reduce the mechano-sensitivity of the nerve¹³. Martin-Gomez C et al conducted a study in 2019; they concluded that motor control therapy (CCFE) for participant's decreases pain and disability. Motor control therapy (CCFE) seems to be highly effective to decrease pain and disability than other therapies¹⁴. Kim BB et al conducted a study in 2016 reported that, Suboccipital muscle Release (SMI) Cranio-Cervical Flexion Exercise (CCFE) was a highly effective therapy to increase forward head posture and induce downstream result from the cervical area to the thorax and shoulders in patient with forward head posture¹⁵.

Therefore, the aim of this study was to compare the effectiveness of Suboccipital muscle Release (SMI) techniques and Cranio-Cervical Flexion Exercise (CCFE) for Range of motion, pain, neck disability index and forward head posture (FHP) in mechanical neck pain patients.

METHODOLOGY

The single blinded, randomized controlled trial (RCT) was conducted using Non-probability purposive technique and randomization was done through sealed envelope method. The study was conducted at IIMCT/Pakistan Railway Hospital. After BASR approval, study was conducted on mechanical neck pain

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patients from March 2020 to August 2020 but due to uncertain condition of Covid-19, it was extended to the month of November 2020. Sample size was calculated with the help of EpiTool¹⁶. Participants were divided into two groups, 14 in each group. The Inclusion Criteria was Both gender, having five (5) points on neck disability index (NDI), 2-6 points on numerical pain rating scale (NPRS), Chronic pain of more than 3 months, flexion less than 80°, extension less than 70°, lateral flexion less than 20° and rotation less than 90°. The exclusion criteria were patients had suffer from RTA including trauma/ fractures, pain for less than 3 months, back and neck herniated intervertebral disk history, arterial or vascular pathophysiology in the cervical spine and neurological deficits. The forward head posture was accessed by crano-vertebral angle method.

Patients were screened for cervical range of motion, forward head posture and crano-cervical flexion test. Tools used were goniometer for ROM ,NPRS for pain, Digital camera for CVA and NDI for disability index. CROMs were measured with goniometer, forward head posture was accessed by crano-vertebral angle (CVA) method. Normal crano-vertebral angle is 49.9 degrees¹³. The subjects with a CVA below 48 had forward head posture¹². CVA was calculated with digital camera by taking side view photographs of participants. Cranio-Cervical Flexion Exercise was applied by Pressure bio-feedback unit. Group A was treated with Suboccipital Muscle Inhibition Technique and Group B was treated with crano-cervical flexion technique. There was total 8 sessions of treatment. Treatment sessions were 2 time a week for 4 weeks^{14,15}.

Suboccipital Muscle Inhibition Technique was applied and pressure was to maintained for 2 min until the tissue was relaxed. Repeat this procedure in 10-12 times in each session¹³. Hot Pack was applied for 8 mins at the start of treatment. Cervical Isometric was also given including 3 sets of 10 repetitions.

Cranio-Cervical Flexion Exercise: Pressure bio-feedback unit, was positioned in the sub-occipital region of the neck of the participants with the aim of a head movement (nodding) to target of 2mmHg from baseline of 20-30 mmHg. Each step was maintained for 10 seconds and repeated three times. The subject was trying to perform the next pressure increase exercise with 10 sec rest amongst stages⁶. Hot Pack was applied for 8 mins at the start of treatment. Cervical Isometric was also given including 3 sets of 10 repetitions.

Statistical Analysis: SPSS-21 was used and data was displayed by tables and charts. When normality test was applied using Shapiro-wilk test, it shows some of the data were normally distributed and some data were not normally distributed. Parametric test i.e., independent t test was applied on normal distributed data for between group analysis and Paired t test was applied for within group analysis for NDI. Non-parametric test i.e., Mann- Whitney U test was applied for between group analysis and Wilcoxon test were applied for within group analysis for FHP, NPRS and ROM.

RESULTS

Overall mean age of all participants was 39.3±6.1 in group A and 37.4±6.0 in group B. In group A, there were 84.6% females and 15.3% males, in group B, there were 76.9% females and 23% males. For NDI between groups comparison of end value was assessed by Independent T-test. NDI showed non-significant (p value>0.05) at post intervention 4th week. While Paired t test was used for within group analysis of NDI. Group A showed improvement having (p value<0.05) and similar finding was also observed in Group B having (p value=.00) on post intervention (Table 1).

Between-group analysis was done by Mann Whitney U test for NPRS, FHP and ROMs. FHP, NPRS and ROM (Flexion, Extension, Rotation, Lateral flexion) showed non-significant (p value>0.05) at post intervention (Table 2).

While within group analysis was done by Wilcoxon test for FHP, NPRS and ROM in patients with mechanical neck pain. Group A showed significant (p value=.00) and similar finding was also observed in Group B having (p value=.00) on post intervention for all variables (Table 3).

Table 1: NDI in mechanical neck pain patients

Variable	Group	Frequency	Mean± SD(pre)	P. Value	Mean ± SD(post)	P. value
Between Group Analysis						
NDI	A	13	68.7±19.7	0.93	40.0±14.8	0.98
	B	13	67.0±16.2		37.6±14.4	
With-In Group Analysis						
NDI	A	13	68.7±19.7	0.70	40.0±14.8	0.00
	B	13	67.0±16.2	0.87	37.6±14.4	0.00

Table 2 : Between Group Analysis for FHP,NPRS,ROM

Variables	Time Period	Group	Mean Rank	Median (I,Q)	P. Value
FHP	Pre	A	13.04	44(4)	0.05
		B	13.96		
	Post	A	13.55	50(2)	0.813
		B	13.85		
NPRS	Pre	A	14.4	7(3)	0.53
		B	12.5		
	Post	A	14.6	1(1)	0.36
		B	12.3		
Flexion	Pre	A	13.2	70(15)	0.85
		B	13.7		
	Post	A	12.3	77.5(5)	0.41
		B	14.6		
Extension	Pre	A	11.5	60(10)	0.16
		B	15.5		
	Post	A	13.9	70(5)	0.71
		B	13.0		
Rotation	Pre	A	13.2	70(11.3)	0.85
		B	13.7		
	Post	A	12.0	80(15)	0.32
		B	14.9		
Lateral Flexion	Pre	A	11.6	16(10)	0.20
		B	15.3		
	Post	A	11.19	20(5)	0.06
		B	15.8		

Table3 : With-In Group Analysis for FHP, NPRS,ROM – Group A and B

Group	Variable	Time Period	Median (I,Q)	Mean Rank	P. Value
A	FHP	Pre-Post	44(4.0)-50(1.5)	7.00	0.00
	NPRS	Pre-Post	07(2.5)-2(1)	7.00	0.00
	Flexion	Pre-Post	70(15)-75(5)	7.00	0.00
	Extension	Pre-Post	60(7.5)-70(2.5)	6.50	0.00
	Rotation	Pre-Post	70(15.5)-80(12.5)	6.50	0.00
	Lateral Flexion	Pre-Post	15(10)-20(0)	5.50	0.00
B	FHP	Pre-Post	44(4.0)-50(27.5)	7.00	0.00
	NPRS	Pre-Post	07(2.5)-1(1)	7.00	0.00
	Flexion	Pre-Post	70(15)-80(5)	6.50	0.00
	Extension	Pre-Post	60(10)-70(5)	5.50	0.00
	Rotation (R/L)	Pre-Post	70(7.5)-80(7.5)	7.00	0.00
	Lateral Flexion	Pre-Post	20(7.5)-20(5)	5.50	0.00

DISCUSSION

The results suggested that participants in both groups showed significant improvement in mechanical neck pain by improving cervical range of motion, pain scores, neck disability and forward head posture. Current study shows significant improvement in crano-vertebral angle ,cervical ROM (extension, flexion) after using both technique (SMI and CCFE) which is supported by a randomized control trail conducted (2016) by Bo Been Kim et al¹⁰. Current study shows significant effect of CCFE in reducing neck disability index points in group B, which is supported by Enrique Lluch et al that reported significant reduction on NDI points after craniocervical flexion exercises(p=0.01)⁸. The FHP (crano-vertebral angle) was significantly improved in muscle inhibition group. Similar results were reported in Rizo AM et al that showed improved FHP applying suboccipital muscle inhibition technique(p=0.001)¹⁷.

Current study shows (P<0.05) of cervical extension within group A which is supported by Jeong ED et al regarding effect of SMI and CCFE. They showed improvement in cervical ranges and crano-vertebral angle in neck pain patients⁹. Current study shows

p-value of craniovertebral angle within group B (cranio cervical flexion exercises) p value ($p=0.00$) which is supported by Suvannato et al that (2019) reported significant p value of craniovertebral angle within group B ($P=0.001$)¹⁸. Current study shows Within group B (CCFE), p value of non-pain rating scale was $p=0.00$ which is supported by Bobos p et al, that showed significant difference at non-pain rating scale is ($p=0.001$)¹⁹.

Current study showed better effects in cervical ranges and craniovertebral angle by craniocervical flexion exercises which is supported by a study conducted in 2015 by Camitsis A et al regarding effect of craniocervical flexion exercises on neck pain patients. They reported the significant effects of craniocervical flexion exercises on cervical angle and ranges²⁰. Fernandez de laspenas C found that sub occipital muscle inhibition technique and cranio-cervical flexion exercises are most effective for reducing hyper tonicity in neck extensors and flexors¹³.

Ranges of cervical spine after the sub occipital muscle inhibition and the craniocervical flexion exercises was greater than those before using these two techniques. Similar level of improvement observed in ranges of cervical spine after using SCI and CCFE in the current study. Pilat recommended that suboccipital technique has been used to reduce tension in deep superior neck muscle. After applying suboccipital muscle inhibition technique, it gives bilateral effect (release) on sub occipital area so will get vagus nerve release by stretching the fascia of post cervical²¹. Current study also showed improvement by inducing relaxation and breaking adhesion in the muscles of and induce better motor control capability in patients with neck pain.

CONCLUSION

The result suggests that both the sub occipital muscle inhibition technique and craniocervical flexion exercises improve cervical range of motion, cranio-vertebral angle and similarly effective in improvement of neck disability and reduction of pain in patients with mechanical neck pain patients.

Limitations & recommendations: This study has certain limitations including goniometer was used to measure cervical range of motion rather than inclinometer, Sample size was small and Time was limited and faced a lot of uncertain hindrances due to COVID-19 pandemic. Therefore, further study should be conducted for longer period to access long term effects in mechanical neck pain. Study should be conducted using inclinometer to measure cervical ROM.

Conflict of Interest: Authors declare no conflict of interest.

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