

Effect of Scapular Stabilisation Exercises on Chronic Neck Pain among Precision Workers – A Randomised Control Trial

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ABSTRACT: Chronic neck pain is a commonly occurring musculoskeletal strain that occurs among precision workers (skilled workers working in the field of silver and gold jewellery manufacturing). This is mainly due to their work nature that demands forward bending of head and neck for extended time. The major postural change is identified as Forward Head Posture that causes muscular imbalance both in cervical spine and shoulder. Physiotherapy treatment aims at reducing the muscular imbalance and correcting the posture. This study was conducted among 34 male participants from Shevapet, (an area well known for jewellery business), Salem and evaluates the effect of commonly used thermotherapy and scapular stabilization exercises for a period of 2 weeks in reducing the chronic neck pain and restoring normal posture among the precision workers. The outcome measures of the study are pain, pressure threshold and posture assessed through Northwick Park Pain questionnaire, Neck Disability Index and Cranio Vertebral angle. The study revealed a significant reduction in Neck Pain and CV angle in the group that received scapular stabilization exercises. The authors suggest that correction of FHP is critical and primary for any treatment that aims to reduce chronic neck pain among precision workers. There were challenges in reaching the subjects if they were absent at the work place. The authors had to call on their number to and check with them. But the subjects were willing to take the intervention on the following day of their leave.

Keywords: Chronic Neck Pain, Forward Head Posture, Neck Exercise, Scapular exercises, Neck Disability.

INTRODUCTION

Neck pain is one of the most common health issue faced by almost all individuals at least once in their life time. Especially with digitalization and technology, neck pain and associated shoulder pain are commonly occurring in young generation too. Any pain that is persistent or repeats itself within three months of duration is classified as Chronic Pain. Chronic pain is defined as pain lasting beyond normal tissue healing time, generally taken to be 12 weeks.

Chronic neck pain is characterized by continuous pain present for more than 6 months and was commoner in women with an incidence of 22%, and in men with an incidence of 16% (Guez *et al.*, 2002). Hogg-Johnson *et al.* (2008) reported an annual prevalence of 435 out of 1000 estimating to 66.7% in general population. And it is attributed to certain factors like sex, older age, jobs that demand continuous bending of neck, low work support, ex-smoker status, and a history of lower back disorders (McLean *et al.*, 2010). Mahmud *et al.* (2014) disclosed poor working conditions and prolonged bending of neck causes postural mal alignment both in neck and shoulder. In general chronic neck pain causes

disability, anxiety, depression, sleep disturbances, poor quality of life, and healthcare costs (Andersen *et al.*, 2011). Hence a chronic neck pain is epitomised not only with pain and physical disability but also with psychological low feel and angst.

Precision workers are skilled workers working in the field of silver and gold jewellery manufacturing. The term was coined for this study as their work nature demands carefulness, exactitude and accuracy. Their job involves cutting of metals, setting of precious stones, electroplating, enameling and engraving.

These work demand a good hand skill, proper vision, prolonged bending of neck, sitting with folded legs on ground for hours together without back support. The wastage of raw material and the cost of remaking are of high cost. Hence the precision workers neglect their health and adopt poor posture and are forced to work for extended hours which impact their health. Such patients with non-specific and chronic neck pain have altered dynamic scapular stabilization and scapular orientation (Castelein *et al.*, 2015).

There is a close relationship, identified by Castelein *et al.*, 2015, between the neck and scapula with an

increasing awareness on the role of scapular stabilization exercise as a cure to neck pain. Scapula is a flat bone that connects both the clavicle and the humerus and plays a vital role in all shoulder movements. It is situated in the posterior rib cage in the upper thoracic region between T 2 to T 7 or T 9 spine (Cagnie *et al.*, 2014). It rotates 30 to 45 degree inwards in frontal plane and 10 to 20 degrees vertically upwards and 50 to 60 degrees from resting position and was identified by Helgadottir *et al.* (2011). Gauns & Gurudut (2018), pin pointed that the muscles like the trapezius, serratus anterior, rhomboid major and minor, and levator scapulae, together called axioscapular muscles, are attached to the scapular bone and can attribute to movement of the neck and shoulder complex. According to Johnston *et al.* (2008), patients with chronic neck pain demonstrate decreased clavicular retraction and upward rotation. In addition they exhibit axioscapular muscular pathology that lead to muscle tightness and shortening at two ends in a diagonal pattern as stated by Hogg Johnson *et al.* (2010). This phenomenon is referred as Scapular dyskinesia. Kibler *et al.* (2003) defined Scapular Dyskinesia as an alteration in the normal position or motion of the scapula during coupled scapulo humeral movement. It not only produces altered motion in shoulder and cervical spine but also in thoracic spine. It is reported that the forward shift of head and protraction of scapula has been a major postural distress in computer professionals as observed in a study conducted by Johnston *et al.*, 2008. Kim *et al.* (2020) pinpointed that there was high incidence of reference to pain and disability in female workers.

Exercise is the prerequisite for treating neck pain (Leaver *et al.*, 2010). Jull *et al.* (2002) observed that the role of deep cervical muscles play a key role in reducing the neck pain, especially the cranio cervical flexor exercise and cranio cervical extensor exercise strength enhances the neuromuscular activity (O Leary *et al.*, 2012) and maintains correct posture of the cervical spine. Among the deep cervical flexors the role of longus colli and longus capitis are inevitable in reducing pain and disability. According to Mc Lean *et al.*, 2010, the deep cervical extensors semispinalis and multifidus are important cervical stabilisers. Their role in reducing neck pain cannot be neglected though activation of semispinalis is still under exploration (O Leary *et al.*, 2012). Schory *et al.*, (2016) put forward that the serratus anterior, rhomboid major and minor, levator scapulae, and trapezius muscles are the main muscles that stabilize the scapula. They strengthen the shoulder girdle muscles to restore normal scapular motion and correct dyskinesia. However, the prescription of exercise that includes frequency, intensity, interval and repetitions influence the effects of these exercises.

The aim of this study was to compare the effects of Craniocervical deep Flexor and Extensor exercises over scapular stabilisation exercises on chronic neck pain among Precision workers whose nature of work involves prolonged bending of neck.

METHODOLOGY

The study is a randomised control trial with one control group and 1 experimental group. The subjects were volunteers from Shevapet, Salem district, Tamil Nadu, India who willingly participated in the study. A preliminary survey was done using a questionnaire format and 53 participants filled it. They were scrutinised and 34 participants who fulfilled the inclusion criteria were included in the study. The inclusion criteria included a history of neck pain for past 3 months, job nature that involved prolonged bending of neck and participants between the age group of 25 & 50 and male alone were included in the study. 19 participants were excluded from the study. Exclusion criteria included any kind of cervical or thoracic fracture in recent 2 years, diagnosed for cervical radiculopathy or cervical myelopathy, unstable medical condition, history of surgery in cervical/thoracic spine, any kind of osteoporosis/osteopenia of cervical spine, spinal infection and history of whiplash injuries, cervicogenic headache were excluded from the study.

The purpose of the study was explained and consent taken. The 34 participants were randomly assigned into two groups - Control Group and Experimental group through simple random sampling method with 17 subjects in each group. The participants of both the groups underwent a pre-test assessment of pain, neck disability and craniocervical angle. The tools used were Northwick Park Pain questionnaire, Neck Disability Index and Digital Camera. The level of pain was assessed through NPNPQ which contains a set of 10 questions related to neck pain intensity, duration, sleep disturbance, ADL. Each question carries a 0 to 4 marks, 0 indicating no pain and 4 indicating maximum pain. Neck Disability index assess the disability caused by neck pain and consists of a set of 10 question with an option of 0 to 5, where 0 indicated no disability and 5 maximum disability. The disability ranges from pain intensity, personal care, lifting, bathing etc. CV angle was measured with a photograph with participant in standing position. The camera was fixed on a tripod at a distance of 150 cm. The CV angle is the angle formed by an imaginary line that passes horizontal through the spinous process of C 7 vertebrae and the line drawn through the tragus of the ear. The measurement needs expertise in palpating and marking of C 7 spinous process.

The subjects in control group received deep cervical flexor exercises and cranio cervical extensor exercises. These exercises employ the deep cervical flexor rather than the superficial flexor muscles as in isometric exercises. It was performed in supine lying with neck in slight flexion position. The researcher places the hand over the subject's occiput on the suboccipital region to palpate the contraction of deep flexor muscles. Instruction was given to attempt flexion maintaining the chin-tuck in position. This was followed by cranio cervical extensor exercises which was performed in prone lying. The subject attempted extension of cervical spine while maintaining the chin tuck-in position. Both

the exercises were performed to hold a resistance for 10 seconds, ten times per set with three sets a day. Adequate rest of 30 seconds were given. The entire exercise regime was given thrice a week for 2 weeks.

The subjects in experimental group received scapular stabilisation exercises which included scapular protraction in supine lying, elbow push-ups in prone lying, kneel on four limbs and lateral arm raise, and prone I, Y, T exercises. These exercises were performed ten times with three sets a day with a holding time of 10 seconds. A rest of 30 seconds was allowed in between the session if needed. The exercises were given thrice a week for 2 weeks. At the end of 2 weeks both the groups underwent the evaluation of all the three outcome measures in a similar manner to that of the pre-test and was scored as Post-test in data sheet.

Statistical Analysis

The data was analysed through SPSS software version. The within group analysis of parametric was done

through ANOVA and a post hoc was done using Dunns test. The within group analysis of non-parametric test was done through Kruskal Wallis test and post hoc using Dunns test. The between group analysis of parametric test was done through independent t test and non-parametric was done through Mann Whitney test.

RESULTS

The results of the study show that the between group analysis of post-test of NPNPQ, NDI and CV angle with a U value of 62.5 ($z = 2.807$), 45 ($z = 3.409$) and t value of -3.928 ($p = 0.0002$) significant at $p < 0.05$. The within group analysis of NPNPQ of control and experimental group are -3.990 and -3.702 with $p = 0.0457$, p not significant at $p < 0.05$. The independent t-test reveals a mean of 46.705 (1.4476) and 49.235 (0.8314) with MD 2.530 significant at $p < 0.05$ which shows it is highly significant.

Table 1: Within Group Analysis – Control Group.

Variable	Group	Mean	SD	MD	H value	p value
NPNPQ	Pre	28.647	2.598	1.637	3.9909*	0.00475
	Post	27.01	2.497			
NDI	Pre	40.176	2.502	1.647	2.7906	0.09482
	Post	38.529	2.523			

Table 2: Within Group Analysis – Experimental Group.

Variable	Group	Mean	SD	MD	H value	p value
NPNPQ	Pre	28.764	1.863	1.763	8.137	1
	Post	27.001	2.354			
NDI	Pre	39.411	2.680	4.529*	15.826*	0.0007*
	Post	34.882	2.272			

Table 3: Within-group Analysis CV angle.

Variables	Group	f value	p value
CV angle	Control Pre & Post	5.03301	0.03192
	Experimental Pre & Post	39.02902*	0.0001*

Table 4: Between-group Analysis – Control Vs Experimental.

Variable	Group	U value	Z value	p value
NPNPQ	Control Pre	137	0.2411	0.810
	Experimental Pre			
	Control Post	62.5*	2.807*	0.004*
	Experimental Post			
NDI	Control Pre	119.5	0.843	0.400
	Experimental Pre			
	Control Post	45*	3.409*	0.0006*
	Experimental Post			

Table 5: Between-group Analysis – Control Vs Experimental.

Variables	Group	t-value	p value
CV angle	Control & Experimental Pre	0	0.5
	Control & Experimental Post	-3.92837*	0.000214*

*indicates p value significant at $p < 0.05$

DISCUSSION

The aim of the study was to find the effect of cranio-cervical exercises over the scapular stabilisation exercises in reducing neck pain among precision workers. Lluch *et al.*, (2014) overviewed that the weak muscle of the neck results in disrupted and abnormal movement pattern. Hence other muscles replace the weak muscles that result in poor quality of movement (Lluch *et al.*, 2014). O'Leary *et al.* (2007), suggested that recovering normal activation of serratus anterior is essential to retain normal posture and rehabilitation of neck and shoulder. Proper recruitment of serratus anterior and trapezius restores the normal orientation of the scapula and corrects the internal rotation of the scapula (Jull *et al.*, 2002). It was found that the current study was in accordance with the above studies and recruited the correction of serratus anterior which is the primary stabiliser of the neck. The experimental group who received the scapular stabilisation exercises showed significant improvement in all the outcome measures. The current study suggested that scapular stabilisation exercises reduced pain among precision workers whose work nature demand forward bending posture for long duration.

CONCLUSION

The results of the study make us conclude that the scapular stabilisation exercises reduce chronic neck pain among precision workers than the conventional cervical exercises whose job nature demands prolonged bending of neck.

FUTURE SCOPE

The intervention used in this study can be applied to various other conditions that demand forward bending of neck like, typist or computer professionals.

Conflict of Interest. None

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REFERENCES

- Andersen, L. L., Saervoll, C. A., Mortensen, O. S., Poulsen, O. M., Hannerz, H., & Zebis, M. K. (2011). Effectiveness of small daily amounts of progressive resistance training for frequent neck/shoulder pain: randomised controlled trial. *Pain*, 152(2), 440-446.
- Cagnie, B., Struyf, F., Cools, A., Castelein, B., Danneels, L., & O'leary, S. (2014). The relevance of scapular dysfunction in neck pain: a brief commentary. *Journal of orthopaedic & sports physical therapy*, 44(6), 435-439.
- Castelein, B., Cools, A., Bostyn, E., Delemarre, J., Lemahieu, T., & Cagnie, B. (2015). Analysis of scapular muscle EMG activity in patients with idiopathic neck pain: a systematic review. *Journal of Electromyography and Kinesiology*, 25(2), 371-386.
- Gauns, S. V., & Gurudut, P. V. (2018). A randomized controlled trial to study the effect of gross myofascial release on mechanical neck pain referred to upper limb. *International journal of health sciences*, 12(5), 51.
- Helgadottir, H., Kristjansson, E., Mottram, S., Karduna, A., & Jonsson, H. (2011). Altered alignment of the shoulder girdle and cervical spine in patients with insidious onset neck pain and whiplash-associated disorder. *Journal of applied biomechanics*, 27(3), 181-191.
- Hogg-Johnson, S., van der Velde, G., Carroll, L. J., Holm, L. W., Cassidy, J. D., Guzman, J., ... & Peloso, P. (2008). The burden and determinants of neck pain in the general population: results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *European Spine Journal*, 17, 39-51.
- Johnston, V., Jull, G., Souvlis, T., & Jimmieson, N. L. (2008). Neck movement and muscle activity characteristics in female office workers with neck pain. *Spine*, 33(5), 555-563.
- Jull, G., Trott, P., Potter, H., Zito, G., Niere, K., Shirley, D., ... & Richardson, C. (2002). A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache.
- Kibler, B. W., & McMullen, J. (2003). Scapular dyskinesis and its relation to shoulder pain. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, 11(2), 142-151.
- Kim, E. K., & Lee, D. K. (2018). Effect of scapular brace on the pulmonary function and foot pressure of elderly women with forward head posture. *The Journal of Korean Physical Therapy*, 30(4), 141-145.
- Kim, J. H., Jeong, Y. W., & Kim, S. J. (2020). Effect of posture correction band on pulmonary function in individuals with neck pain and forward head posture. *Physical Therapy Korea*, 27(4), 278-285.
- Leaver, A. M., Refshauge, K. M., Maher, C. G., & McAuley, J. H. (2010). Conservative interventions provide short-term relief for non-specific neck pain: a systematic review. *Journal of physiotherapy*, 56(2), 73-85.
- Lluch, E., Schomacher, J., Gizzi, L., Petzke, F., Seegar, D., & Falla, D. (2014). Immediate effects of active cranio-cervical flexion exercise versus passive mobilisation of the upper cervical spine on pain and performance on the cranio-cervical flexion test. *Manual therapy*, 19(1), 25-31.
- Mahmud, N., Bahari, S. F., & Zainudin, N. F. (2014). Psychosocial and ergonomics risk factors related to neck, shoulder and back complaints among Malaysia office workers. *International Journal of Social Science and Humanity*, 4(4), 260-263.
- McLean, S. M., May, S., Klaber-Moffett, J., Sharp, D. M., & Gardiner, E. (2010). Risk factors for the onset of non-specific neck pain: a systematic review. *Journal of Epidemiology & Community Health*, 64(7), 565-572.
- O'Leary, S., Jull, G., Kim, M., & Vicenzino, B. (2007). Specificity in retraining craniocervical flexor muscle performance. *Journal of orthopaedic & sports physical therapy*, 37(1), 3-9.
- O'Leary, S., Jull, G., Kim, M., Uthakhip, S., & Vicenzino, B. (2012). Training mode-dependent changes in motor performance in neck pain. *Archives of physical medicine and rehabilitation*, 93(7), 1225-1233.
- Paine R, Voight ML. The role of the scapula. *International journal of sports physical therapy*. 2013 October;8(5):617.
- Schory, A., Bidinger, E., Wolf, J., & Murray, L. (2016). A systematic review of the exercises that produce optimal muscle ratios of the scapular stabilizers in normal shoulders. *International journal of sports physical therapy*, 11(3), 321.

Zakharova-Luneva, E., Jull, G., Johnston, V., & O'Leary, S. (2012). Altered trapezius muscle behavior in individuals with neck pain and clinical signs of

scapular dysfunction. *Journal of manipulative and physiological therapeutics*, 35(5), 346-353.

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