**Pakistan Journal of Rehabilitation**

OPEN ACCESS

**RESEARCH REPORT** **Volume 1 (Issue 1), 2012 | Page No. 29-35**

# The Effect of Cranio-Cervical Exercise Intervention and Strength Endurance Training in Neck Pain

## ABSTRACT

### Background

Prolong computer work without proper ergonomics can lead to neck pain which ultimately causes serious problems like muscle imbalance, headache, poor work performance. The purpose of this study is not only to promote awareness of correct exercise regime and to compare two exercise interventions in improvement of neck pain, also effect of these regimes on nine different components of daily living activities like headache, work performance, concentration.

### Study Design

Experimental, Randomized control trail (RCT)

### Intervention

68 participants took part in the study and were divided randomly into two groups. Group one received cranio- cervical (CC) regime of 06 weeks and second group was given treatment in 2 stages. First stage comprises of minimum repetition exercise which was upgraded to three set with weight in second stage. The chief impact was seen as the reduction of pain intensity in both interventions.

### Results

Subjects with neck pain of both groups proven a change in neck pain pre–Neck Disability Index (NDI) mean of CC, group01 (mean 19.18, std 5.2, $p<0.05$), and post NDI score of CC group 01 (mean=6.18, std=6, $p<0.05$) while in strength endurance (SE) group pre-score (mean=18.6, std=6.3, $p<0.05$) And post NDI score (mean=7, std=6, $p<0.05$). Both groups proved significant reduction in neck pain.

### Conclusion

This study showed that participant who had received cranio-cervical regime and strength endurance training significantly improves their work performance as well as neck pain. However, CC group showed improvement regarding work performance and headache while SE group demonstrated significant improvement in weight lifting than second group.

### Keywords

Cervical Exercises, Cranio-cervical, Strength-endurance, Neck Pain, Endurance Training, Ndi

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[Naz E, Sarfraz M. Effect of Cervicocranial Exercise Intervention and Strength- EnduranceTraining In Neck Pain Pak. j. rehabil. 2012;1(1):18-22]

## INTRODUCTION

Posture is the reflection of one's personality. Upright posture attracts where poor posture seems awkward. People habitually or intentionally adapt poor posture during driving, reading, sleeping and computer work which ultimately propel them towards neck pain. If someone is walking in office with neck protruded forward rather than between the shoulders it would obviously hinder the work performance and causes extra pressure on cervical spine due to Poor posture compromising neck curvature. Putting neck in forward position is common observation during computer work or long seated works; on the other hand, people using laptop have more problems at neck due to poor biomechanics resulting in neck pain. Prevalence of neck pain due to poor sitting posture in computer workers spending more than eight hours per day is eighty three percent (83%)[1]. Neck related headache and chronic pain has strong association with poor posture[2]. In addition to it seat ergonomics also has strong impact on forward neck posture and muscular function of cervical spine. Seats cushion help in preventing the work – related neck disorder[3]. To maintain curvature of cervical spine the muscles play an important role and hence if these muscles work properly there are less chances of getting neck ache. The important muscles contributing in maintaining cervical posture are longus colli which is place anteriorly and semispinalis cervicis and cervical multifidus support cervical spine posteriorly6. Whereas the longus colli muscle has a major postural function in supporting and straightening the cervical lordosis[7]. However, least amount of energy is required to maintain the alignment of ideal neck posture as a result it less stress is place on ligament, muscle, and joints[8], sooner or later poor posture cause pain, muscles ache, headache which eventually lead to complication like osteoarthritis[9]. On the other hand, proper sitting posture and exercises are the way to prevent from neck pain. It has already proved that isolated superficial muscle contraction of neck muscle produce movement and instability in the absence of deep neck flexor[10]. So people who are working most of the time in neck forward bending cannot perform task efficiently without synergetic action of deep neck muscles[11,12]. This study is conducted to evaluate the effect of two different exercise regimes on neck pain because the repeated action of particular muscle has different effect on proper alignment of body parts. Muscle those are in use become stronger than neglected muscle via acquiring wrong position. Low load exercise and strength endurance regime are the choice of treatment to reduce neck pain as compare to conventional range of motion exercise. It is evident that superficial muscle creates more tension in forward neck posture[13]. Moreover, the intention of this study is to increase the awareness of exercise to prevent neck pain but not least to avert the secondary effect of poor neck position. The goal of the study is to determine the effect of two different exercises on neck pain with the purpose to find out which regime is more effective to reduce neck pain and at the same time to promote the awareness of importance of neck exercises in subject to those who have long duration of sitting.

## METHOD

### Study Design

This study based on probability, convenience sampling. Randomized Control Trail (RCT) was used for the study and the duration of the study was two years.

### Inclusion criteria

Computer user with history of three-to-four-month moderate neck pain and also spent more than eight hours were selected for the study. All the patients entering the out-patient department with neck pain were administered with Neck disability index (NDI). Only those patients whose score was less than 15 were selected for intervention with their consent to be a part of the study. NDI scale has previous been selected the studies conducted[14]. Falla D, Bilenkij G, Jull G. had

used this score during task-oriented muscle action of upper limb to find out abnormal muscle stimulation in chronic neck pain patient and dynamic neck function[15].

## INTERVENTION

Initially 80 patients entering the OPD were administered with the NDI score. 12 were unable to fulfill the inclusion criteria due to the high NDI score. The remaining 68 patients were randomly divided into two groups. One group received the conventional strength–endurance training whereas the other group received cranio-cervical exercises to reduce pain. Each patient visited the OPD only once a week and an experienced and trained Senior Physical Therapist entertain each subject at least 30 minutes and supervised every individual and gave weekly instructions to for the home-based program. This program was designed for only ten to twenty minutes of workout. The dosage advised was twice per week; mean while the patient recorded their home-based performance on a patient record card that was already given to them. The patients were advised to record any side effect felt on the medical card. The patients were advised to discontinue the exercises if symptom aggravate like pain or fatigue. However, subjects were investigated for not receiving any other specific treatment for their neck pain; however, any medication that a subject was using previously was not withdrawn. The exercises were performed without any provocation of neck pain.

### Cranio-Cervical Flexor Training Intervention

In this intervention deep neck flexor muscle of upper cervical region were focused; (the longus capitis and longus coli) which flexes the head or tuck in the chin rather than substituted by neck flexors (sternocleidomastoid, hyoid, and anterior scalene muscles). The prescribed intervention used was of low load which trigger the deep neck flexor as compared to complete neck. In addition to it the physical therapist instructed the patient to tuck in the chin in which was actually retraction and sustains the contraction. Exercise protocols followed were:

1. Participants performed exercise in sitting position while low resistance ball was placed behind occiput. Then 10 repetition of chin tuck in with 10 second hold were performed in each repetition.
2. On the other hand, special instructions were given such as “Do not restore from retraction before time and stop exercise in case of fatigue or if the intervention aggravate pain”
3. Perform exercise in front of the mirror to monitor the contribution of superficial neck flexors that only focused on chin tuck in. Physical therapist began the exercise from low resistance to high. The subject was guided by feedback via progressively increasing ball resistant from soft, moderate and hard respectively.

### Endurance-Strength Training Intervention

In this intervention progressive resisted exercise program was used to improve strength–endurance in neck flexor. The intervention was carried out in supine position, while the head was well supported and relax.

Following steps were taught by the physical therapist to train the subject.

1. Do cervical flexion or take off the head from table while maintaining neutral upper cervical posture.
2. Touch the chin slowly across the full range of neck forward bending, and make sure that movement is not jerky
3. Be cautious and stop the exercise regime if the symptoms aggravate symptoms.

The recommended treatment was delivered in two stages. Duration of first stage of treatment was of two weeks and the second was conducted for four weeks16. In stage 1, the subjects performed 12 to 15 repetitions with a weight that they could lift 12 times (12-repetition

maximum [RM]) on the first training session and progressed to 15 repetitions and maintained this level for the remainder of the 2-week period[17,18]. In stage 2, the subjects performed 3 sets of 15 repetitions of the initial 12-RM per day while one-minute rest period was provided between sets. If repetitions were overcome easily, additional weighted sandbags were applied to the patient's forehead with an increase of 0.5- kg to improve the strength. If the subject was unable to perform repetitions of the head lift maneuver, then the load on the neck flexors was reduced by allowing the subject to perform the task with the upper body (trunk and neck) inclined up from the horizontal so that the subject could perform the required repetitions of the movement

## DATA ANALYSIS

Data analysis was done on SPSS version 20. A paired sample t test was conducted to determine if NDI is significantly different before and after the intervention for both the exercise groups. Independent sample t-tests were conducted to compare for group differences. A value of $P<0.05$ was used as an indicator of statistical significance.

## RESULTS

### Comparison between Two Exercise Interventions.

68 participants took part in this study who were divided into two equal groups of 34 male each, while they become the part of the study by picking the subjects who have NDI score less than fifteen (15) and has spent at least eight hours in front of computer.

### NDI SCORE

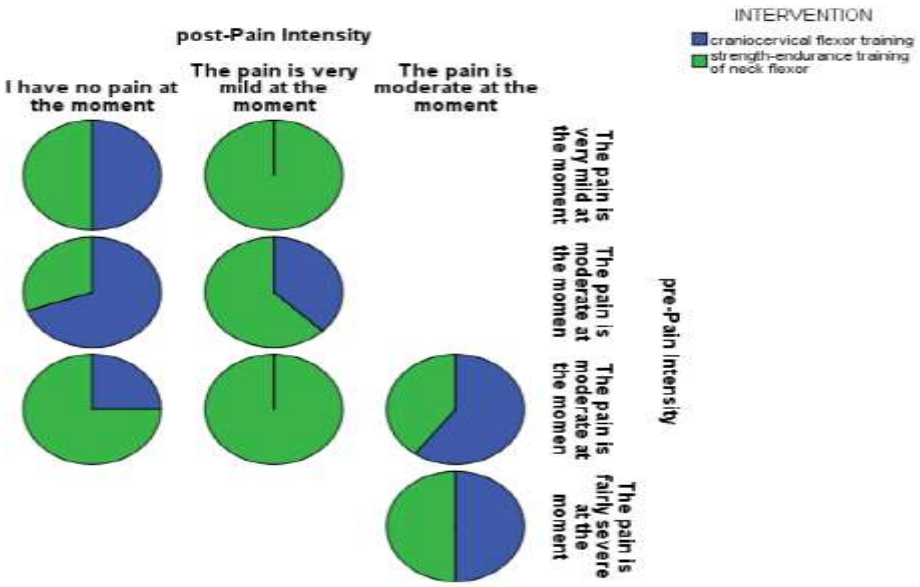
| Groups | Group 01 | Group 01 | Group 02 | Group 02 |
|---|---|---|---|---|
| NDI Score | NDI Pre intervention | NDI Post intervention | NDI Pre intervention | NDI Post intervention |
| Mean ± SD | 19.1 ±5 | 6.1± 6 | 19± 6 | 7± 6 |

### PAIN INTENSITY

| Group | Pre-Pain Intensity | Post Pain Intensity | p-Value |
|---|---|---|---|
| Intervention 01 (craniocervical flexor training) | 1.94±0.736 | 0.32± 0.7 | <0.05 |
| Intervention 02 strength endurance training of neck flexor | 2.09± 0.9 | 0.44±0.7 | <0.05 |

All the individuals completed the treatment till 6th week without any dropout. Yet, no one complain of any adverse effect. It was observed in pre intervention score indicated that most of the subject had moderate pain and NDI score was 16 to 22in ten different parameters. In this research significant difference are present in pre score and post score of both the group. The pre and post intervention score of groups 01 ($19.1 \pm 5$, $p<0.05$, $6.1 \pm 6$, $p<0.05$) and pre and post score of groups 02($19\pm 6$ $p<0.05$, $7\pm 6p<0.05$). In addition, both groups, Craniocervical intervention and strength – endurance intervention have significant impact on pain intensity that was ($0.32\pm 0.7$, $p<0.05$) and ($0.44\pm0.7$, $p<0.05$). It was observed on personal care that the majority of patient stated ‘can do own care without awakening pain’ ($0.29\pm0.6$, $p<0.05$) on the post NDI score in Craniocervical intervention group whereas the pre-score in strength – endurance exercise in neck flexors intervention was ($1.7\pm0.8$, $p<0.05$) and the post score

remained (0.4±0.7, p<0.05). 8% of the patients replied on the progress about pain free reading in Craniocervical intervention group as compare to strength–endurance exercise in neck flexors intervention. Regarding concentration it was found that the both groups have minor differences in full concentration during work, with minor difficulty and fair degree of accomplish task when they want. It was noted in descriptive data analysis that (0.25±0.6, p<0.05) subject had no disturbance in sleeping whereas in strength-endurance flexor training group showed almost similar result that was 72% (0.24±0.5, p<0.05) but few participants still felt one to two hours difficulty. When compared weight lifting in both intervention; strength endurance intervention was found more effective that was 7% (0.10±0.6, p<0.05) as compared to craniocervical training (0.9±0.7, p<0.05). On the other hand, half of the subjects reported extra stain on weight lifting in compared intervention. It was apparent about headache that 52% (0.65±0.7, p<0.05) of patients had not experienced in group 1 and 47% (0.74±0.8, P<0.05) in group 2. All members of the study showed minor difference in recreational activities, it was evident that work performance improve greatly in craniocervical group that was 65% (0.65±0.7, p<0.05) while it was 47% (.82±0.8, p<0.05) in the other training group. During driving none of the participant reveals marked improvement. Both intervention groups showed similar improvement out of ten components like both parallel effect in reduction of neck pain, while cranio-cervical is quite effective in treating headache. In addition, individuals of group B can lift weight easily.




## DISCUSSION

The current study demonstrates that craniocervical intervention and strength- endurance training of neck flexor intervention has significant effects on neck pain in computer user male, in addition both exercise programs reveal statically significant improvement in NDI score. The craniocervical group showed a decrease in pain after taking six-week intervention, which is of most important clinical relevance whereas SE group demonstrate minor difference in contrast with strength endurance group. On the other hand, the participants improved their performance in activities of daily living. This improvement could be attributed to the factor such as increase awareness of exercise importance. However, only the group that received the craniocervical flexor training steps forward than strength-endurance training group. Falla D conducted the study related to the same topic and his study showed equal difference in pain intensity[19]. Kay TM work on the effect of exercise on neck pain and disability and shows the evidence of moderate benefit on chronic neck pain SMD -0.42 (95%CI: -0.83 to - 0.01). While, our research also shows significant results 4.8(3.4 ±6.3, p<0.05) on paired sample T-Test[20]. Twenty-four

months duration study showed 69% improvement in neck pain while rapid response was present in our study. Armani J[21] find mean significant difference in pain in endurance training group as compared to proprioceptive group which is similar in our endurance training group whether strength endurance group statically significant reduction in pain (2.09±0.86) to (0.4± 0.6,95%CI). In this study 3 sessions per week were advised to participant. Most of the previous study used 16-week intervention like Hagberg, Viljanen, Waling K used 3- 5 session per week with 8–15-week treatment regime[22-24]. Another factor which may influence the outcome in inclusion and exclusion criteria of this study in which non severe, chronic pain participant worked on computer offices were selected for intervention, while in most of the previous studies nonspecific neck pain. For example, one study was conducted on myalgia of trapezius. Falla D et al. have conducted similar study among female participant on neck pain and revealed that strength–endurance exercise was effective not only on neck pain but also on NDI score[25]. Kay TM found unclear result regarding strengthening exercise in neck pain and headache in mechanical disorder while in our study craniocervical group had good results to treat headache26. Haines T et al. research paper showed that there was no significant difference inpatient education or education with exercise and also defined that it was not effective to control pain in acute, intermediate and chronic work-related neck pain[27]. The strength of our study is the effectiveness of exercise regimes on neck pain which should be a good addition in computer user guide rather than conventional range of motion exercise to prevent neck pain. The weakness of the study is the lack of availability of electromyography equipment to assess the strength of the muscle.

## CONCLUSION

Our research concluded that the patients with chronic non-severe neck pain demonstrated marked improvements in all components of ADL's in both groups/regime with patent effect on neck pain. This most likely reflects that both treatments have impact on neck posture and muscle strength during sustain position of neck. The craniocervical group participants felt more improvement in accomplishing their daily targets with reduction in headache, confirming craniocervical exercises efficacy in maintaining the upper neck posture, while on the other hand, strength endurance group showed marked improvement in weight lifting.

## REFERENCES

[1] Smith L, Low Q, Cross L, Grimmer- sumer SK. Prevalence of neck pain and headache; impact of computer user and other associative factors. Cephalgia 2009;29(2):250-7

[2] Oatis CA. Kinesiology: The Mechanics and Pathomechanics of Human Movement; Philadelphia, Lippincott. Williams and Wilkins 2004 .

[3] Blatter BM, Bongers PM. Duration of computer use and mouse use in relation to musculoskeletal disorders of neck or upper limb. International J of Industrial Ergonomics 2002;30:294– 308.

[4] Boyd-Clark LC, Galea MP, Brigs CA. Muscle Spindle distribution, Morphology, & Density in longuscolli and multifidus muscles of the cervical spine. Spine 2002;(27):694–702.

[5] Oatis CA. Kinesiology: The Mechanics and Pathomechanics of Human Movement. Philadelphia; Lippincott Williams & Wilkins 2012.

[6] Conley MS, Meyer RA, BloomBerg J. Noninvasive analysis of human neck musclefunction. Spine 1995(20):2504– 2513.

[7] Mayoux-Benhamou MA, Rewel M, Valle C et al. Longuscolli has a postural function on cervical curvature. Surg Radiol Anat 1994;16(4):367–371.

[8] Danis, C. G.; Krebs, D. E.; Gill-Body, K. M. Sahrmann S. Relationship between Stability and standing Posture. APTA 2012(39);549–519.

[9] 31st Annual International Conference of the IEEE EMBS Minneapolis, Minnesota, USA, September 2009;2-6,

[10] Winters JM, Peles JD. Neck muscle activity and 3D head kinematics during quasi static and dynamic tracking movements; Biomechanics & Movement Organization. New York, NY: Springer-Verlag; 2012:462–480
[11] Hanten WP, Olson SL, Russel JL, et al. Total head excursion and resting head posture, normal and patient comparisons. Arch Phys Med Rehabilitation 2000(81):63–67.
[12] Haughie L, Fiebert I, Roach K .Relationship of forward head posture and cervical backward bending to neck pain;J Manipulative Physiol Ther1995(3):91–98.
[13] Szeto G, Straker L, O'Sullivan P. Comparison of symptomatic and asymptomatic office workers performing keyboard work, shoulder & neck kinematics. J Manual Therapy 2005(10):280–294.
[14] Vernon H, Mior S. The Neck Disability Index: A study of reliability and validity. J Manipulative Physiol Ther 1991(14):408–415.
[15] Falla D, Billenkij G, Jull G .Patients with chronic neck pain demonstrates altered patterns of muscle activation during performance of a functional upper limb task. Spine 2004(29):1435–1442.
[16] Watson DH, Trott PH. Spine Cervical headache; an investigation of natural head posture and upper cervical flexor muscle performance. Cephalalgia 1993(13):271–284.
[17] McArdle WD, Katch FI, Katch VL. Exercise Physiology: Energy, Nutrition, and Human Performance. Baltimore, Md: Williams & Wilkins; 4th Ed, 1996.
[18] Falla D, Jull G, Trevor R, Vicenzino B and Hodges P. Effect of Neck Exercise on Sitting Posture in Patients With Chronic Neck Pain. Phys Ther 2007;87(4):408-17.
[19] Falla D, Jul G, Russell T, Vicenzino B, Hodges PC. Strength endurance training program in muscle fatigue .J Neurosci2006;117(4); 828-37.
[20] Kay TM, Gross A, Goidsmith C, Santaguida PL, Hoving J, Bronfort G. Group exercise for mechanical neck disorder. Cocharnce Database Sys Rev 2005;20(3).
[21] Arami J, Reza Oltani A, Kalkhali Z , Avieh M, Rahnama L. Endurance training group as compared to proprioceptive group. J Res Med Sci 2012;14,1(64):77-84.
[22] Hagberg M, Harms-Ringdahl K, Nisel R, Hjelm EW. Rehabilitation of neck- shoulder pain in women industrial workers: a randomized trial comparing isometric shoulder endurance training with isometric shoulder strength training. Arch Phys Med Rehabil 2000;81:1051–8
[23] Viljanen M, Malmivara A, Uiti J, Rine M, Palmroos P, Laippal P. Effectiveness of dynamic muscle training, relaxation training, or ordinary activity for chronic neck pain. BMJ 2003; 326- 475
[24] Sundelin G, Ahlgren C, Jarvholm B. Perceived pain before and after three exercise programs, a controlled clinical trial of women with work-related trapezius myalgia. Pain 2000;85:200– 7.
[25] Kay TM, gross A, goldsmith C,santaguida Pl, hoving J, bronfort G. Exercises for mechanical neck disorders. Cocharnce Database Sys Rev. 2012;8.
[26] Haines T, Grossa A, Burnies J, Goldsmith C, Perry l. Patient education for neck pain with or without radiculopathy. Systemic rev. 2009;21(1).
[27] Mongini F, Evangelista A, Milani C, Ferrero l, Ciccone G, Ugolini A, Piedimonte AD, Carlino E, Banzatti E, Galasssi C. An educational and physical program to reduce headache, neck/shoulder pain in a working community: a cluster-randomized controlled trial. PLOS ONE7(1);e29673.