Effect of Deep Cervical Flexor training on Respiratory Functions in Chronic Neck Pain patients with Forward Head Posture

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ABSTRACT

Protruded chin posture is one of the commonly seen postural problem associated with patients having chronic neck pain. It is also known by names Forward Head Posture (FHP) or anteriorly translated head posture. The FHP causes an alteration in mechanics of rib cage which leads to a reduction in mobility of thorax and abdomen, decreased movement of the diaphragm, reduced ventilatory effectiveness of diaphragm and reduced efficacy of abdominals and intercostals muscles during respiration. Therefore this study was executed to check the effectiveness of deep cervical flexor exercises on Craniovertebral angle and pulmonary functions. It was a comparative experimental study design. Based on the study's selection criteria, the total numbers of 100 subjects were taken and divided into Experimental and Control groups. In-depth Cervical flexor training with the conventional Physiotherapy was given to subjects of the experimental group. Control group subjects received only Conventional Physiotherapy for six weeks. The baseline measurement was taken on day one of the studies. The digital camera assessed the Forward head posture by measuring Craniovertebral Angle (CVA). Spirometry determined pulmonary functions (FEV₁ & FVC).

All measurements were repeated at the end of the 6th week. The baseline measurement and measurement at the end of 6th week were compared by using the t-test. Considerable improvement in Craniovertebral angle and functional status of the lung, resulted in subjects who were given in-depth cervical flexor training along with the conventional Physiotherapy treatment (p<0.05). Therefore it is suggested that deep cervical flexor exercises improve the head posture and also correct the biomechanics of respiratory muscles. Deep neck flexor training can be considered as an efficient technique in lessening protruded chin posture.

INTRODUCTION

One of the most common problems of musculoskeletal system is continuous pain in neck that is chronic neck pain. Once in life time approx 70%-80% of people fall prey to neck pain and in approx 60% of people either pain persists or there are repeated episodes of pain. Since long neck pain was given less priority compared to pain in back (Jull et al, 2008). However, the increasing incidence of neck pain during this century, which can be justified by changes owing to increase used of gadgets & mod-
ernization has led to increased prevalence of pain in neck. This has led to a continuously growing interest and research regarding the clear understanding of causes, manifestations and management of neck pain. Patients with FHP are associated with muscular imbalance around cervical and thoracic spine (Harman et al., 2005).

Positioning of head is believed to be associated with initiation of Neck Pain, and few therapists focus its value at the time of evaluation (Silva et al., 2009). Anterior positioning of head or chin protrusion is one of frequently seen deformities identified with Neck Pain. This can also be defined as much forward bending of neck in sagittal plane where in head protrudes forwarded (Yip et al., 2008). It is regarded to be associated with increased extension insuperior segment of cervical spine and demolishing of inferior portion of cervical spine with stretched and weak retractor of scapulae (Harman et al., 2005). It has been found that Chronic pain in neck has become one of the common problems of muscular & skeletal system affecting more & more number of people. Chronic neck pain has been found to be associated with decreased hand grip strength (Pawaria et al., 2019b). Patients with neck pain present with complaints related to musculoskeletal system like fatigue of cervical musculature. Hypomobility, impaired position sense, abnormal posture and lung functions and psychological compromise are also seen in patients with neck pain (Kapreli et al., 2008).

Disrupted mobility, faulty mechanics of diaphragm is also observed in these patients. There is increased activity of accessory muscles like sternocleidomastoid, elevated rib cage, reduced thoracoabdominal mobility leading to reduced efficiency of diaphragm. The alteration in kinetics and kinematics of respiratory system leads to reduced strength of respiratory muscles which further effects chest expansion and hence all major respiratory functions (Okuro et al., 2011).

Variety of interventions which includes stretching, strengthening exercises, and biofeedback have been suggested by researchers for patients with chronic neck pain (Yip et al., 2008). Specific exercises include stretching of upper cervical extensors, pectorals and strengthening of deep cervical muscles and shoulder retractors. These exercises help in improving neck posture by correcting muscular imbalance that develops in patients with forward head posture (Kendall et al., 1993).

Studies have reported deep cervical flexor training to be an important component of treatment of patients with prolonged neck pain as the training addresses impaired physiological and neuromuscular function of cervical spine (Dusunceli et al., 2009). Chan Woo Nam et al studied on the efficacy of neck stabilization exercises and breathing training on lung functions in stroke patients. They found that the patient with cervical stabilization exercises in adjunct with breathing retraining showed greater improvement in respiratory functions (Nam et al., 2015). The current study intended to investigate role of deep cervical flexion exercise in combination with routine Physiotherapy sessions on pulmonary functions in patients with anteriorly translated head posture.

**MATERIALS AND METHODS**

The design of study was comparative experimental. Ethical Research Committee approved the present study, Ref. No. SGTU/ FMHS/D./96

Period of the study was from April 2016 to August 2018.

The entire data collection was done in Medicine OPD of SGT Hospital with prior permission.

G-power software was utilized for calculation of sample to be included in the study. Power of study was kept 95%.

Subjects that were included for the study had neck pain since > 6 month; they were in the age group of 20-40 years and had disability ranging within score of 5-15 according to Neck Disability Index (NDI) and were unable to achieve target of 24 mm of Hg on Sphygmomanometer in deep cervical flexion test (Thangavelu and Moorthy, 2014).

Patients with neck pain of traumatic origin, vertebral column anomalies, any history of spinal surgeries and with Body Mass Index in category of overweight were excluded from the study.

All the patients were allotted to Group A or Group B by simple random allocation method with 50 subjects in each group. Group A (Experimental Group) received Deep Cervical flexion training with the Conventional Physiotherapy treatment. Group B which was the control group was given routine Physiotherapy treatment. All the subjects underwent baseline assessment for pulmonary functions (FEV1 & FVC) & Craniovertebral angle was measured to assess forward head posture. Whole course of action of treatment program was described to all subjects. A signed written informed consent was taken from subjects.

**Procedure**

Conventional Physiotherapy treatment was given to the subjects of control group for 6 weeks which
included isometric training for neck muscles, TENS and hot pack. A 30 minutes duration was selected with beat frequency and the amplitude was kept between 10-30 mA. Cervical isometric were executed for all cervical muscles in sitting position with contraction duration of 10 sec with 15 sec of rest between holds. All exercises were repeated 10-15 times (Dusunceli et al., 2009).

Experimental group (Deep cervical flex or training + Routine Physiotherapy treatment)

Steps,
1. All patients were asked to lie down in supine position
2. Cuff of sphygmomanometer was kept under occiput
3. Subjects were guided to reach a pressure of 20 mm Hg on sphygmomanometer and then gradually increment to 2 mm Hg pressure to finally reach target of 30 mm of Hg in five progressive position of neck flexion.

IBM SPSS 21 Multilingual software was used for comparison of baseline measurement and measurement at the end of 6th week.

RESULTS AND DISCUSSION

For analyzing data SPSS 21 window version was used. Significance levels was kept < 5%. Student t-test was used for measuring changes between the groups. Table 1 shows both groups were homogenous at baseline. Analysis within groups was done by using related t-test. Significant differences were found in both the groups when the outcomes measures were compared (pre intervention and post intervention) within the groups (Tables 2 and 3 &Figures 1 and 2). A significant difference was seen between Group A& Group B on 6th week with experimental group performing better compared to other group Table 4.

In the study researchers intended to investigate efficacy of deep cervical flexor training combined with traditionally given Physiotherapy intervention on the pulmonary functions in subjects suffering from neck pain which is chronic in nature and is associated with anteriorly translated head posture. Forward head posture causes anterior positioning of head that increases normal anterior cervical convexity and exaggerated cervical lordosis. The anterior slanting of the head results into compression of posterior spinal structures including facet capsules and spinal disks. The muscular imbalance that results causes ischemia of cervical and upper back muscles over a period of time which is trying to counterbalance pull of gravity.

The forward head posture is accompanied by shortening of joint capsule in posterior part of the zygoapophyseal joint leading to narrowing of intervertebral foramen and may cause nerve root compression. These all are the potential sources of neck pain in patients with FHP. In addition, medial rotation of scapulae, development of kyphosis in thorax region occurs in FHP which leads to diminished thoracic capacity resulting into lowered in vital capacity of lungs (Pamela et al., 2005). It is believed that anteriorly translated head posture leads to reduced excursion of rib cage specifically lower portion which affects mechanics of breathing. The efficacy of diaphragm and strength of respiratory muscles is also reduced (Szczygien et al., 2015). A study reported that subjects having forward head posture had reduced activity in accessory muscles of respiration as compared to normal subjects (Han et al., 2016). A research reported that exaggerated cervical lordosis to be responsible for reduced vital capacity in patients with FHP (Lee et al., 2011).

Studies have found posture correction exercise along with deep neck muscles strengthening have
Table 1: Measurements on day 1 of study

| Parameters       | Group A          | Group B          | P    |
|------------------|------------------|------------------|------|
| Age (years)      | 33.52 ± 1.9      | 33.34 ± 1.84     | 0.76NS|
| Height (cm)      | 162.30 ± 8.4     | 160.06 ± 9.47    | 0.39NS|
| Weight (kg)      | 62.48 ± 16.86    | 60.28 ± 15.56    | 0.21NS|
| CV Angle         | 32.16 ± 1.69     | 32.02 ± 1.63     | 0.93NS|
| FVC(L)           | 2.53 ± 0.50      | 2.55 ± 0.50      | 0.85NS|
| FEV1(L)          | 1.79 ± 0.57      | 1.78 ± 0.54      | 0.59NS|

Data are presented as mean ± SD. Results of analysis of independent t-test, comparison of Group 1 versus Group 2 at baseline. Significance level was set at p<0.05.

Table 2: Changes in dependent variables with in Group A

| Outcome measures | 0 Week | 6 Week | P    |
|------------------|--------|--------|------|
| CV Angle         | 32.16 ± 1.69 | 43.74 ± 1.20 | 0.000**|
| FVC(L)           | 2.53 ± 0.504 | 3.25 ± 0.508 | 0.000**|
| FEV1(L)          | 1.79 ± 0.578 | 2.41 ± 0.607 | 0.000**|

Data are presented as mean ± SD. Results of analysis of paired t-test, comparison of Group 1 versus Group 2 at baseline. Significant was set at p<0.05.

Table 3: Change in dependent variables within Group B

| Variables       | Baseline | 6th Week | P    |
|-----------------|----------|----------|------|
| CV Angle        | 32.02 ± 1.63 | 36.34 ± 1.79 | 0.000**|
| FVC(L)          | 2.55 ± 0.508 | 2.60 ± 0.506 | 0.000**|
| FEV1(L)         | 1.78 ± 0.548 | 1.84 ± 0.551 | 0.004**|

Data are presented as mean ± SD. Results of analysis of paired t-test, comparison of Group 1 versus Group 2 at baseline. Significant was set at p<0.05.

Table 4: Comparison of dependent variables at 6th Week

| Outcome measures | Control Group | Experimental Group | P    |
|------------------|---------------|-------------------|------|
| CV Angle         | 43.74 ± 1.20  | 36.34 ± 1.79      | 0.000**|
| FVC(L)           | 3.25 ± 0.508  | 2.60 ± 0.506      | 0.000**|
| FEV1(L)          | 2.41 ± 0.607  | 1.84 ± 0.551      | 0.001**|

Data are presented as mean ± SD. Results of analysis of paired t-test, comparison of Group 1 versus Group 2 at baseline. Significant was set at p<0.05.

A study reported inclusion of cervical stabilization exercises into conventional treatment to be effective in reducing chronic neck pain (Dusunceli et al., 2009). Similar results were reported by Akodu AK et al. Patients were benefitted in terms of psychological symptoms like depression & anxiety associated with their neck pain. Suppression of pain pathways in brain due to enhanced stimulation of motor pathways and improved functional status of patients have also been reported by researchers (Akodu et al., 2018).

It is reported that deep cervical flexor exercises are helpful not only in reducing neck pain but also improving strength of respiratory muscles, craniovertebral angle in patients with chronic neck pain and respiratory status of patients (Kalra et al., 2017). Neck stabilization training given with feedback was also found to improve the respiratory status in patients suffering from chronic neck pain due to enhanced stimulation of motor pathways.
pain (Pawaria et al., 2019a).

It was found that subjects who received the deep cervical flexor training with the conventional physiotherapy program benefitted more. Results of this study suggested that reduction of forward head posture with cervical stabilization exercises improve pulmonary functions by correcting the altered biomechanics of cervical and thoracic spine which inturns improve the thoracoabdominal mobility and efficacy of diaphragm.

CONCLUSIONS

Inclusion of deep neck flexor training in treatment regimen of patients with chronic pain helps in reduction of forward head posture by reducing craniovertebral angle (CVA) and thereby improves the respiratory function in terms of FVC and FEV1 by improving the mechanics of respiration. Therefore, it is concluded that deep cervical training should be included in the rehabilitation program of chronic neck pain patients with forward head posture.

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Conflict of interest

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REFERENCES

Akodu, A. K., Odunsi, F. A., Giwa, S. O. 2018. Effects of Neck stabilization exercise on pain, disability, craniovertebral angle and psychological status in patients with non-specific chronic neck pain. Journal of Riphah College of Rehabilitation Sciences, 6(1):10–15.

Dusunceli, Y., Ozturk, C., Atamaz, F., Hepguler, S., Durmaz, B. 2009. Efficacy of neck stabilization exercises for neck pain: A randomized controlled study. Journal of Rehabilitation Medicine, 41(8):626–631.

Han, J., Park, S., Kim, Y., Choi, Y., Lyu, H. 2016. Effects of forward head posture on forced vital capacity and respiratory muscle activity. Journal of Physical Therapy Science, 28:128–131.

Harman, K., Hubley-Kozey, C. L., Butler, H. 2005. Effectiveness of an Exercise Program to Improve Forward Head Posture in Normal Adults: A Randomized, Controlled 10-Week Trial. Journal of Manual & Manipulative Therapy, 13(3):163–176.

Jull, G., Sterling, M., Falla, D., Treleaven, J., Leary, O., S 2008. Whiplash, headache and neck pain: research-evidenced directions for physical therapies. Churchill Livingstone, China.

Kalra, S., Pal, S., Pawaria, S. 2017. Correlational study of chronic neck pain and hand grip strength in physiotherapy practitioners. Physiotherapy and Physical Education, 2(4):30–32.

Kapreli, E., Vourazanis, E., Strimpakos, N. 2008. Neck pain causes respiratory dysfunction.

Kendall, F., McCreary, K., Provance, E., P 1993. Muscles: Testing and Function. Williams & Wilkins, Baltimore, MD.

Kim, S. Y., Kim, N. S., Kim, L. J. 2015. Effects of cervical sustained natural apophyseal glide on forward head posture and respiratory function. J Phys Ther Sci, 27:1851–1854.

Lee, K., Jung, S., Lee, Y., Kang, K. W. 2017. Effects of exercise on cervical angle and respiratory function in smartphone users. Osong Public Health Res Perspect, 8(4):271–274.

Lee, Y., Gong, W., Kim, B. 2011. Correlation between cervical lordosis, vital capacity, T-spine ROM and equilibrium. Journal of Physical Therapy Science, 23:103–105.

Nam, C. W., Lee, J. H., Park, Y. H. 2015. Effect of Cervical Stabilization Exercises on the Respiratory Function of Stroke Patients. Advanced Science and Technology Letters (Healthcare and Nursing), 88:196–199.

Noh, H. J., Shim, J. H., Jeon, Y. J. 2013. Effects of Neck stabilization exercise on neck and shoulder muscle activation in adults with forward head posture. International Journal of Digital Content Technology and its Applications, 7(12):492–498.

Okuro, R. T., Morcillo, A. M., Riberio, M. A. 2011. Mouth breathing and forward head posture: effects on respiratory biomechanics and exercise capacity in children. J Bras Pneumol, 37(4):471–480.

Pamela, L., K, Norkin, C. C. 2005. Joint Structure and Function: A comprehensive Analysis. Philadelphia, PA.

Pawaria, S., Sudan, D. S., Kalra, S., Yadav, J. 2019a. Effectiveness of cervical stabilization exercises with feedback on respiratory status in chronic neck pain patients with forward head posture. International Journal of Physiotherapy, 6(3):70–74.
Pawaria, S., Sudhan, D. S., Kalra, S. 2019b. Effectiveness of Cervical Stabilisation Exercises on Respiratory Strength in Chronic Neck Pain Patients with Forward Head Posture- A Pilot Study. *Journal of clinical and diagnostic research*, 13(4):6–09.

Silva, A. G., Punt, T. D., Sharples, P., Vilas-Boas, J. P., Johnson, M. I. 2009. Head Posture and Neck Pain of Chronic Nontraumatic Origin: A Comparison Between Patients and Pain-Free Persons.

Szczygiel, E., Weglarz, K., Piotrowski, K. 2015. Biomechanical influence on head posture and the respiratory movements of the chest. *Acta of Biomechanics and Biomechanics*, 17(2):143–148.

Thangavelu, K., Moorthy, A. 2014. Effect of cranio-cervical flexor training and cervical flexor training on sitting neck posture in patients with chronic neck pain; comparative study. *Indian Journal of Physical Therapy*, 2(1):66–70.

Yip, C. H. T., Chiu, T. T. W., Poon, A. T. K. 2008. The relationship between head posture and severity and disability of patients with neck pain. *Manual Therapy*, 13(2):148–154.