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Research Article

Cranio-Cervical Exercise Combined with Usual Care: An Effective Physiotherapy Treatment to Minimize Pain and Increase Range of Motion among Patients with Chronic Neck Pain

Mohammad Habibur Rahman[1]*, Md. Obaidul Haque[2], Samena Akter Kakuli[3] and Ehsanur Rahman[1]

[1]Assistant Professor, Department of Physiotherapy, Bangladesh Health Professions Institute (BHPI), The Academic Institute of Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh

[2]Associate Professor, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka, Bangladesh

[3]Senior Clinical Physiotherapist, Department of Physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh

***Corresponding Author**: Mohammad Habibur Rahman, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka, Bangladesh.

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Abstract

Background: Chronic neck pain is a disabling condition with dominating features of neck pain and limited range of motion (ROM) in the cervical spine. However, traditionally usual physiotherapy treatment protocol includes McKenzie exercises in combination with manual therapy, exercise therapy, superficial and deep heating agents as well as traction. In the exercise therapy, strengthening exercise protocol were limited to only superficial neck muscles rather deep cervical muscles strengthening exercise plays an important role to minimize those symptoms.

Methods: To find out the effectiveness of Cranio-cervical exercise combined with usual care, 28 participants with chronic neck pain was equally randomly assigned to Cranio-cervical exercise combined with usual care group (14) and only usual care group (14).

Results: Both groups of participants were similar in baseline characteristics. In terms of pain, between group (Cranio-cervical exercise combined with usual care versus only usual care) analysis showed statistically significantly ($p < 0.005$) pain reduction. In terms of ROM, all the motions found also significant results as well except flexion ($p > 0.05$). Within group result founds significant improvement in pain and ROM with value of $p = 0.000$ and $p < 0.005$ respectively.

Conclusions: The results of the current study showed that Cranio-cervical exercise combined with usual care is an effective treatment for patients with chronic neck pain.

Keywords: *Chronic Neck Pain; Cranio-Cervical Exercise; Usual Care*

Introduction

Chronic neck pain is defined as pain in the neck with or without pain referred into one or both upper limbs that lasts for at least 3 months [1]. In United States of America, the annual prevalence was 41.5% in which individuals with chronic neck pain were middle-aged (mean age 48.9 years) and the majority of subjects were women [2]. In United Kingdom, the annual incidence was 34% [3]. In Australia, the prevalence of neck pain was 27.1% [4]. In Canada one population based cohort study [5] showed that the annual incidence of neck pain was 14.6% and each year, 0.6% of the population developed disabling neck pain. Women are more likely than men to develop neck

pain more likely to suffer from persistent neck problems and less likely to experience resolution. In the terms of the region of Asia, the prevalence of neck pain demonstrated in the peak position in West and the Midwest of the Asia whereas in the South part of Asia showed relatively lower. In India, the prevalence of chronic neck pain among computer operators was found 47%. Majority of the participants were in between the age of 30 - 50 years. In contrast, no relevant study was found on neck pain prevalence among Bangladeshi people till date. One study found that 22.22% office workers experienced neck pain on regular basis and 52.22% of the respondent sometimes [6].

Different studies found positive correlation between influence of neck muscle weakness and chronic neck pain [7,8]. In particular, general neck and upper limb endurance training, dynamic strengthening programs and cervical stabilization exercises appear to be more favorable exercise options than stretching [9,10]. However, these exercises primarily focused on superficial neck muscles which have shown least effective for long time pain reduction and increase range of motion (ROM).

It has already proved that isolated superficial muscle contraction produce movement impairments and instability in the absence of deep neck flexor muscles synergistic action. Therefore, introducing cranio-cervical exercise would deliver more emphasize to minimize neck pain and improve range of motion. The usual care for neck pain patients are recognized as multimodal treatments such as McKenzie exercises in combination with manual therapy, exercise therapy, superficial and deep heating agents as well as traction.

In past, Cranio-cervical exercise was compared to isometric neck strengthening exercise and found effective to minimize neck pain and improve ROM. The specific objectives of this research was to find out the effectiveness of Cranio-cervical exercise combined with usual care to minimize neck pain and increase range of motion within and between groups.

Method

Study design

The study was a quantitative exploration of Randomized Clinical Trial (RCT). Cranio-cervical exercise combined with usual physiotherapy techniques applied to the trial group and only usual physiotherapy techniques applied to the control group.

Participants

28 participants with chronic neck pain were recruited from outpatient musculoskeletal unit, Department of Physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka from a period of September 2015 to May 2016. A computer generated random number was used for group allocation. Thus, 14 participants of each group were allocated.

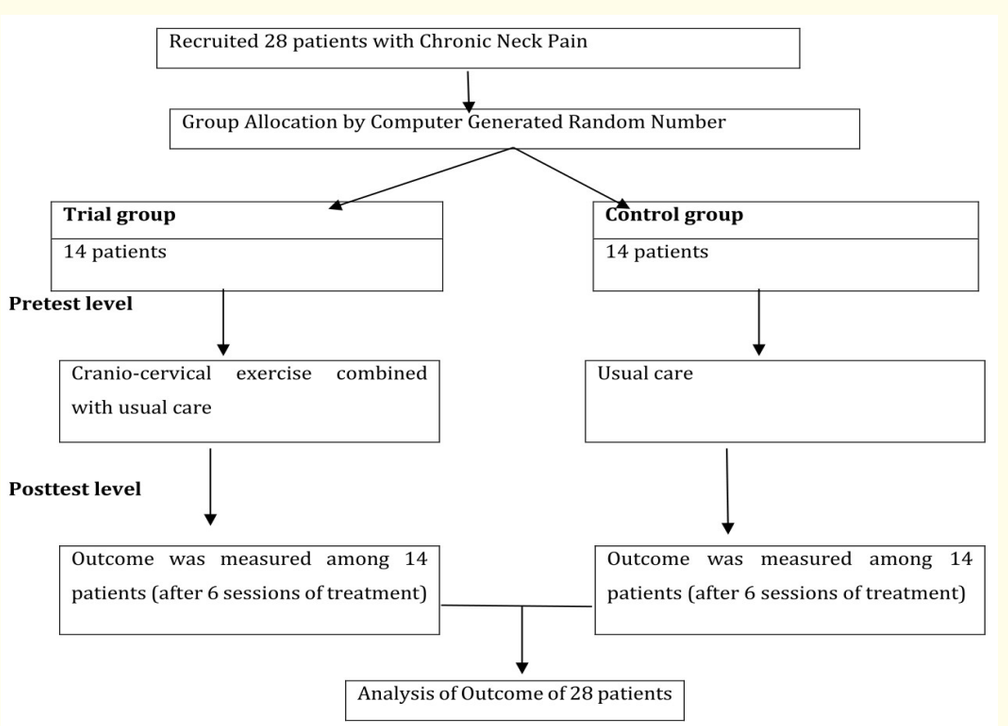

Figure 1: *Flowchart of the Study.*

Measures

10 cm numeric pain rating scale for measurement of pain intensity in resting position and Universal Goniometer to measure range of motion in cervical spine.

Statistical Test

Between groups analysis of pain was calculated by Mann-Whitney U-test and range of motion (ROM) by Unpaired t test. In addition, within group analysis of ROM was carried by Paired t test and within group analysis of pain was analyzed by Wilcoxon signed rank test.

Interventions

All the physiotherapy treatments were performed at center 2 sessions per week for 3 weeks and totaling 6 sessions. Each session consists of 30 minutes. 5 Physiotherapists who have working for more than 10 years in Musculo-skeletal outpatient unit, Department of Physiotherapy, CRP, Savar, Bangladesh delivered treatment to patients.

Usual Care

Manual therapy techniques comprising of Mckenzie, Maitland, Cyriax and Mulligan mobilization depending on patients condition and impairments. Exercise therapy consisting of active ROM exercise, stretching exercise and strengthening of cervical muscles. Electrotherapy consisting of Infrared radiation on cervical spine at 45 cm away from cervical spine and heating by ray at 90° perpendicularly. Finally, home advice and patient education on neck impairments were delivered.

Cranio-cervical Exercise

a. Patient lift head up the chin tucked in from supine lying for neck flexion, lifting head backwards in prone lying for neck extension, lifting head sideways from pillow in side lying position for neck side flexion. These exercises were performed for 8 - 10 repetitions for duration of 3 times a week on alternate days.

b. An un-inflate pressure was placed behind the neck so that it touch the occiput and it inflate to a stable baseline pressure of 20 mm of Hg. The subject was instructed to put the tip of tongue over upper palate and nod the head into flexion (as in saying YES). The subject was instructed to raise the level of pressure in pressure biofeedback (PBFB) device from 20 mm Hg to 22 mm Hg and hold for a minimum of 10 seconds. If the subject is able to hold for 10 seconds, the subject shall be instructed to perform the same procedure and hold at 24 mm Hg for 10 seconds. In similar way increments of 2 mm Hg was added. If the subject meets the target pressure level and holds for 10 seconds, a rest interval of 30 seconds is given before proceeding to next level.

c. Participants performed exercise in sitting position while low resistance ball was placed behind occiput. Then 10 repetitions of chin tuck in with 10 second hold were performed in each repetition.

d. Craniocervical flexion exercises using a circular thera band to facilitate the longus colli muscles. Two sets of 12 repetitions directed forward, obliquely, toward right and left, directed backward were performed. Rest period between each set was 30 seconds and treatment session lasts for 15 minutes.

Results

Demographics

The baseline characteristics of the participants showed that mean age (years) ± SD in the trial group was 41.78 ± 11.19 and in the control group was 43.93 ± 9.75 (Table 1). The table 1 also describe that there was no statistically significant differences between trial and control group in the baseline characteristics. Gender distribution among the participants showed that 12 (42.85%) participants were male and 16 (57.15%) were female (Figure 2).

Variable(s)	Trial group (n = 14)	Control group (n = 14)	Sig.
Age, mean (SD), years	41.78 ± 11.19	43.93 ± 9.75	*
Gender	Male = 06 (42.85%), Female = 08 (57.15%)	Male = 06 (42.85%), Female = 08 (57.15%)	*
Duration of pain (month), SD	10.85 ± 4.89	10.64 ± 4.45	*
Weight (kg), mean (SD)	61.78 ± 6.78	61.57 ± 6.02	*
Height (cm), mean (SD)	156.5 ± 4.14	155.9 ± 5.07	*
BMI (kg/m^2), SD	25 ± 3.61	25 ± 4.17	*

Table 1: *Comparison of baseline characteristic of participants *p>0.05, similar letters denotes significant differences.*

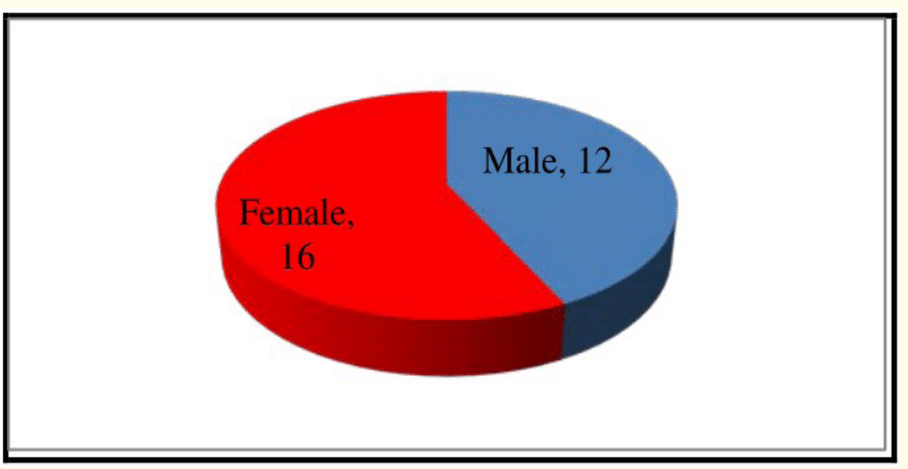

Figure 2: *Gender distribution among participants.*

Figure 3 showed, among the 28 participants, housewife was 8 (28.6%), service 4 (14.3%), student 3 (10.7%), farmer 1 (3.6%), teacher 3 (10.7%), driver 1 (3.6%), business 2 (7.1%), garment worker 2 (7.1%), shopkeeper 1 (3.6%), retired from service 1 (3.6%) and banker 2 (7.1%).

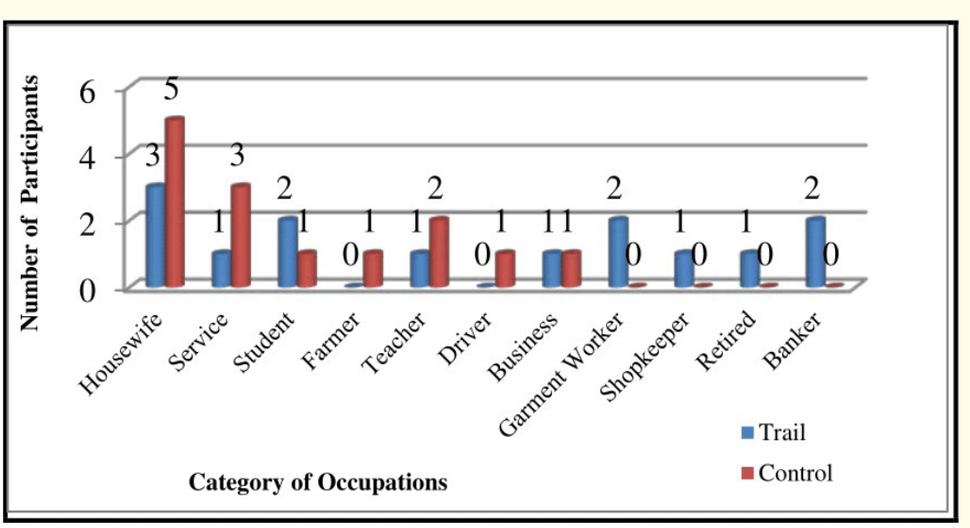

Figure 3: *Occupations of participants.*

Patient rated general pain (cm) between groups (control and trial)

Table 2 showed that the calculated value of U is 36 for pain in resting position and the table value of U for n1= 14 and n2= 14 is 42 for 0.005 in one tailed hypothesis. Therefore, the result is significant for one tailed hypothesis. This means that difference between trial group treatment (Cranio-cervical exercise combined with usual care) and control group treatment (usual care only) was significant i. e. improvement occur in the trial group were not same with control group. They differ significantly as trial group improvement was more than control group.

	Category of Participants	N	Mean of posttest pain (cm)	Mean Rank	Mann-Whitney *U* Score	Sig.
Patient rated general pain (cm)	Control	14	3.07	18.93	36.00	**
	Trial	14	2.20	10.07		
	Total	28				

Table 2: *Rank and test statistics of patient rated general pain (cm) between trial and control group, **p < 0.005, similar letters denotes significant differences.*

Patient rated pain in general within control group and trial group

The table's legend showed that any participants did not have increased pain after application of usual care in both groups. 14 participants had higher pain score before application of usual care compare with after usual care. In addition, no participants had equal amount of pain before and after treatment in control group

By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 3 weeks, twice weekly usual care treatment course showed a statistically significant change in neck pain among individuals with chronic neck pain in trial and control group (Table 3).

Group	Pain at resting position (cm) (Pretest) - Pain at resting position (cm) (Posttest)	N	Mean rank	Sum of Ranks	Test statistics (Wilcoxon signed-rank test)	
					Based on negative ranks Z	Sig.
Control	Negative ranks	0	.00	.00		
	Positive ranks	14	7.50	105	-3.39	**
	Ties	0				
	Total	14				
Trial	Negative ranks	0	.00	.00		
	Positive ranks	14	7.50	105	-3.32	***
	Ties	0				
	Total	14				

Table 3: *Patient rated general pain within control group and trial group **p < 0.001, ***p = 0.000, similar letters denotes significant differences.*

However, between and within groups analysis found significant changes of ROM in Cervical Spine after application of treatment (Table 4 and Table 5).

Between group: Range of motion of cervical spine

Variable	Unpaired 't' value	df	Sig.
Flexion	1.255	26	+
Extension	3.69	26	***
Right Side Flexion	3.87	26	**
Left Side Flexion	3.39	26	**
Right Side Rotation	2.73	26	**
Left Side Rotation	1.92	26	*

Table 4: *ROM changes between trial and control group +p > 0.05, *p < 0.05, **p < 0.005, ***p < 0.0005, similar letter denotes significant differences.*

Within trial and control group: Range of motion of cervical spine

Variable	Within Control Group			Within Trial Group		
	Paired 't' value	df	Sig.	Paired 't' value	df	Sig.
Flexion	12.628	13	***	8.251	13	***
Extension	4.177	13	***	9.786	13	***
Right Side Flexion	7.577	13	***	10.962	13	***
Left Side Flexion	6.734	13	***	10.962	13	***
Right Side Rotation	8.586	13	***	11.259	13	***
Left Side Rotation	9.787	13	***	10.339	13	***

Table 5: *ROM changes within control and trial group ***p < 0.0005, similar letter denotes significant differences.*

Discussion

The present study found almost similar characteristics on baseline in age, gender, duration of neck pain, mean weight, mean height and body mass index (BMI) pretest score between both groups of participants. One study stated that similarities in baseline characteristics between both groups confirmed successful randomization. In addition, it was also proved that both the groups recorded in dependent variables were equal at pretest and there was hardly any influence on post test scores. The results of the study revealed that 43% participants were male and 57% participants were female [11].

In this study, participants in the trial and control group received 2 sessions per week and totaling 6 sessions of treatment during the treatment period of study by one experimental study [12]. The authors evaluated efficacy of manual therapy and exercise therapy among

patients with chronic nonspecific neck pain. Akhter and his colleagues included subjects who had nonspecific neck pain for more than three months and excluded them who had spinal instability, whish plash injury or radiculopathy of the cervical spine. Thus, these criteria matched with the current study and the numbers of treatment sessions were appropriate to prove or disprove the hypothesis.

Different studies found [13, 14] conventional physiotherapy as an effective treatment for patients with chronic neck pain. In contrast, few numbers of studies [13, 15] established Cranio-cervical exercise was an effective treatment to reduce pain and improve ROM among patients with chronic neck pain. The current study demonstrated that Cranio-cervical exercise combined with usual care showed significant effects on neck pain and ROM. The exercise program was carried out for 6 sessions in both groups. However, Cranio-cervical exercise combined with usual care shown effective than usual care and statistical test was conducted between the groups to identify which intervention was more effective than others. Data was also analyzed within trial and control group and found both trial and control had reduced pain and improved ROM but in most of the variables trial group outcomes were highly significant.

Patient rated general pain was measured in the pre-test level and after completing of 6 sessions of treatment. However, patient rated general pain intensity between group was highly significant ($p<0.005$) (Table 2). In addition, exercise significantly decreased pain in trail group ($p=0.000$) and control group ($p<0.001$) (Table 3). This means that Cranio-cervical exercise combined with usual care significantly differ from usual care whereas both exercises also were significantly decreased pain simultaneously. Meanwhile Gupta., *et al*. (2013) evaluated the efficacy of pain, deep cervical muscle strength training program and found significant outcome ($p = 0.001$) in between group and within group (trail group, $p = 0.000$; control group $p = 0.000$). In contrast, the present study outcomes on patient rated general pain intensity was similar as Gupta and his colleagues study but there was difference in outcome of pain intensity between trial and control group results. The main reason for this difference was that Gupta and his colleagues selected participants with age range of 20 - 40 years and in this study the participant's age range was 27-65 years. Thereby, age might be a factor for the inequality of outcome. In addition, one study found in their study that age and intensity of neck pain was significantly associated thereby patients with increased age were more prone to have severe symptoms of neck pain [16].

In cervical range of motion (ROM) variable, both exercises significantly improved ($p = 0.000$) ROM within group analysis. In addition, significant improvement ($p < 0.005$) was observed in all directions of range of motion except flexion ($p > 0.05$) in between group analysis (Table 4). In addition, there was also significant ($p < 0.0005$) results found in the left side rotation (Table 5). One study conducted a randomized control trial and compared among active release technique (ART), joint mobilization (JM) and control group (did not receive any treatment) among patient with chronic neck pain. The study found significant outcomes on dependent variables such as visual analog scale (VAS), pressure pain threshold (PPT) and cervical ROM. However, the authors concluded with significant improvement in VAS, PPT and cervical ROM within and between group analyses. In ROM component, there was significant ($p < 0.05$) difference in cervical flexion between ART and JM group and others ROM were not significant ($p > 0.05$). In contrast, the ART and the control group significantly differed in terms of ROM in all directions. Both the study found significant results in cervical ROM section except there was difference in flexion ROM. In this thesis, half of the participants (50%) performed their activities of daily livings in neck forward bending position and 68% of the participant's pain increased by neck forward bending. Therefore, the cranio-cervical angle becomes abnormal. This ultimately predisposed neck pain [17]. One study found positive correlation between active cervical ROM and cranio-cervical angle in flexion. Therefore, an increased in cranio-cervical angle resulting in increased cervical flexion thereby increased the intensity of neck pain [18]. Meanwhile another study evaluated ROM among patients with chronic neck pain and found significant improvement ($p<0.05$) in both side lateral flexion [19].

Despite of the effectiveness of Cranio-cervical exercise combined with usual care on dependent variables in this study, there were some limitations. The main limitation was unable to develop a sampling frame to which the study lacks external validity. As samples were

collected only from CRP- Savar, it could not represent the wider chronic neck pain population and the study lacks in generalizability of results to wider population. In addition, the study was conducted with 28 patients of chronic neck pain, which was a very small size of samples in compare with the real world prevalence. Data were collected only two times during study and it created study limitation as it lacks follow up daily or weekly basis changes in dependent variables.

Conclusion

In clinical practice, physiotherapists preferred to apply manual therapy, exercise therapy, electrotherapy and formal education program. But in the long run, there has been a chance of recurrence of neck symptoms if the muscles acting on cervical spine are not conditioned properly.Chronic neck pain not only affects the bodily system but also the entire personnel daily activities. Thus, International Classification of Functioning, Disability and Health (ICF) core sets could be applied with this finding in future time. A double blinded randomized clinical trial is recommended in future with large sample size. Since Cranio-cervical exercise has been practicing by physiotherapist in limiting manner outside of this study setting, the outcomes of the study would help practitioners outside the study setting to formulate a management guideline to treat patients with chronic neck pain.

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Bibliography

1. Hoy D., *et al*. "The global burden of neck pain: estimates from the Global Burden of Disease 2010 study". *Annals of Rheumatic Diseases* 73.7 (2014): 1309-1315.

2. Driessen MT., *et al*. "Cost effectiveness of conservative treatments for neck pain: a systematic review on economic evaluations". *European Spine Journal* 21.8 (2012): 1441-1450.

3. Joslin LE., *et al*. "Quality of Life and Neck Pain in Nurses". *International Journal of Occupational Medicine and Environmental Health* 27.2 (2014): 236-242.

4. Hayes MJ., *et al*. "Musculoskeletal disorders and symptom severity among Australian dental hygienists". *BMC Research Notes* 6 (2013): 250.

5. Cote P., *et al*. "The annual incidence and course of neck pain in the general population: a population-based cohort study". *Pain* 112.3 (2004): 267-273.

6. Masum MSB., *et al*. "Prevalence of Neck Pain and Associated Factors among Office Workers". *The American Journal of Innovative Research and Applied Sciences* 1.5 (2015): 167-168.

7. O'Leary S., *et al*. "The relationship between superficial muscle activity during the cranio-cervical flexion test and clinical features in patients with chronic neck pain". *Manual Therapy* 16.5 (2011): 452-455.

8. Sowmya MV. "Isometric Neck Exercises versus Dynamic Neck Exercises in Chronic Neck Pain". *IOSR Journal of Nursing and Health Science (IOSR-JNHS)* 3.2 (2014): 32-43.

9. Dusunceli Y., *et al*. "Efficacy of Neck Stabilization Exercises for Neck Pain: A Randomized Controlled Study". *Journal of Rehabilitation Medicine* 41.8 (2009): 626-631.

10. El-Sodany AM., *et al*. "Sustained natural apophyseal glides mobilization versus manipulation in the treatment of cervical spine disorders: a randomized controlled trial". *International Journal of Advanced Research* 2.6 (2014): 274-280.

11. de Boer M., *et al*. "Testing for baseline differences in randomized controlled trials: an unhealthy research behavior that is hard to eradicate". *International Journal of Behavioral Nutrition and Physical Activity* 12 (2015): 4.

12. Akhter S., *et al*. "Role of manual therapy with exercise regime versus exercise regime alone in the management of non-specific chronic neck pain". *Pakistan Journal of Pharmaceutical Science* 27.6 (2014): 2125-2128.

13. Gupta BD., *et al*. "Effect of Deep Cervical Flexor Training vs Conventional Isometric Training on Forward Head Posture, Pain, Neck Disability Index in Dentists Suffering from Chronic Neck Pain". *Journal of Clinical and Diagnostic Research* 7.10 (2013): 2261-2264.

14. Sambyal S and Kumar S. "Comparison between Nerve Mobilization and Conventional Physiotherapy in Patients with Cervical Radiculopathy". *International Journal of Innovative Research and Development* 2.8 (2013): 442-445.

15. Naz E and Sarfraz M. "Effect of Cervicocranial Exercise Intervention and Strength-Endurance Training in Neck Pain". *Pakistan Journal of Rehabilitation* 1.1 (2012): 1-8.

16. Mustafa MY and Sultan R. "Work Related Neck Pain and Its Associated Factors among Registered Female Nurses Who Are Computer Users in University Kebangsaan Malaysia Medical Centre". *IOSR Journal of Nursing and Health Science* 1.2 (2013): 41-56.

17. Kim JH., *et al*. "Effects of the active release technique on pain and range of motion of patients with chronic neck pain". *Journal of Physical Therapy Science* 27.8 (2015): 2461-2464.

18. Won-Gyu Y and Duk-Hyun AN. "The Relationship between the Active Cervical Range of Motion and Changes in Head and Neck Posture after Continuous VDT Work". *Industrial Health* 47.2 (2009): 183-187.

19. Jeyanthi S and Arumugam N. "Effectiveness of Cranio-cervical Training over Myofascial Pain Syndrome: A Case Study". *International Journal of Physiotherapy and Research* 3.3 (2015): 1032-1036.

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