Effect of Deep Cranio-cervical Flexors Training Over Isometric Neck Exercises in Chronic Neck Pain and Disability

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ABSTRACT

Title: Effect of Deep Cranio-Cervical Flexor Training over Isometric Neck Exercise in Chronic Neck Pain and Disability

Objectives : The purpose of this study was to investigate whether a low load DCCF training program is effective in reduction of intensity of pain and perceived neck disability over conventional Isometric neck Exercise (INE) in subjects with chronic neck pain.

Methods: Fifty female between the ages of 17 to 25 years, with chronic non-severe neck pain were randomized into experimental or control group: a low load DCCF training plus conventional INE or only conventional INE respectively for 4 week exercise program. The outcome measures were VAS for intensity of neck pain and NDI for neck disability.

Results: At the end of 4th week follow-up assessment, the experimental group showed no statistical significant difference in reduction of pain intensity and percieved disability compared with the control group

Conclusion: There is no additional effectiveness of low load DCCF training over isometric neck strengthening exercise on chronic pain and disability.

Keywords: *DCCF, Isometric Neck Exercises, Chronic neck pain, Neck Disability.*

Running Title: The DCCF Training in Chronic Neck Pain and Disability.

INTRODUCTION

Neck pain is relatively common complaints, estimations indicate that 67% of individuals will suffer neck pain at some stage of life.[1] Neck pain tends to be a persistent and recurrent disorder in up to 60% of persons.[2] The overall prevalence of neck pain and of chronic neck pain is higher in females.[3]

Poor neck posture has been suggested to be a most common cause of chronic neck pain. Evidence is emerging that suggests that people with neck pain drift into more forward head position when distracted, [4]

The stability of the head and cervical segments is provided by the anterior and posterior muscular sleeves, In particular, the longus colli muscle has a major postural function [5,6,7,8] It is estimated that 80% of mechanical stability of the cervical spine is provided by the surrounding neck musculature, [9,10]. In an upright, neutral posture of the cervical spine, passive resistance to motion is minimal.[11] Deep cervical muscle activity was required in synergy with superficial muscle activity to stabilize the cervical segments.[12]

The activation of these deep craniocervical flexor muscle (DCCF) i.e longus colli, longus capitis are important in maintenance of normal posture. Whenever endurance of these muscles is reduced, cervical lordosis increases and person adapts forward head posture (FHP). FHP or poor cervical posture, increasing the

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antigravity load on the cervical structures instigating abnormal and compensatory activity by them and resulting in neck pain[13].

Reduced DCCF muscle activity has been demonstrated in those with neck pain, and this has been accompanied by increased activity in the superficial flexors[14,15] Recent studies have identified impaired activation of the DCCF muscles, in people with neck pain.[16,17] Studies showed that patients with neck pain and the cervical headache have poor endurance of the DCCF[18,19].

Evidences are available to prove the effect of different neck exercises targeted to improve muscle strength and endurance to reduce neck pain and disability. Among them Falla D et al, 2007 found that following intervention with an exercise program targeted at retraining the DCCF muscles, subjects with chronic neck pain showed reduction in average intensity of pain and perceived disability but there were no statistical difference between two groups post interventionally. They compared low load DCCF training with endurance strength training for cervical flexors as a whole.[20] O'Leary S. et al; 2007 compared the effect of CCF coordination exercise and cervical flexor endurance exercise protocols on immediate pain relief in the cervical spine of people with chronic neck pain. From this study they stated that specific DCCF therapeutic exercise is likely to provide immediate change in mechanical hyperalgesia local to the neck with translation into perceived pain relief on movement in patients with chronic neck pain.[21]

Isometric neck exercise (INE) is commonly prescribed by physiotherapists for chronic neck pain, the

effectiveness of isometric neck exercise on pain and disability has been proved previously,[22]

There is no sufficient data available to check effectiveness of low load DCCF training over isometric neck strengthening exercise on pain and disability.

So there was need to study whether such specific training of the deep cervical flexor muscles is required in rehabilitation or a more general neck isometric exercise was sufficient to reduce neck pain and disability.

MATERIAL AND METHODOLOGY

This study was an Experimental study, conducted at the College of Physiotherapy, Anand. The experimental procedure was ethically revised and approved by the Research and Ethical committee of College of Physiotherapy, Anand.

This study constitutes the double blinded randomized controlled trial devoted to analyze the effectiveness of the low load craniocervical flexor training on sitting posture in people with chronic neck pain.

Sample size of the study was 50. 25 subjects being in each group after randomization with age between 15 to 30 years.

The study population covers the female students of College of Physiotherapy, Anand and were recruited according to the inclusion and exclusion criteria mentioned below.

Inclusion criteria

1. Subjects with a history of chronic (between 3 months to 5 years), non severe (d"7cm on VAS) neck pain.
2. Only female students of college of physiotherapy, Anand.
3. The subjects who scored d"15 (out of possible 50) on Neck Disability Index (NDI).

Exclusion criteria

1. Subjects having significant history related to cervical spine i.e. trauma, surgery, any congenital deformity or neurological signs.
2. Subjects who participated in a neck exercise program in the past 12 months.

After meeting suitable criteria, the written informed consent was obtained from each subject after explaining the details of various non-invasive tests and training to be conducted on them. Demographics and baseline outcome measures had been measured before allocating them into two groups.

Outcome measures

1. Pain Intensity was measured by using Visual Analog Scale (VAS) and subjects were asked to tick their perceived pain intensity at that moment
2. Perceived Disability was measured by Neck Disability Index (NDI). Which is a numerical (0-50) scoring functional test used to assess disability in chronic neck pain. All subjects were asked to score their perceived disability by this index.

Following baseline measurements, the subjects with chronic neck pain were randomized into experimental and control groups: a training regimen of the deep craniocervical flexor muscle training plus neck isometric exercise regimen and only neck isometric exercise regimen respectively. The allocation sequence was

generated by using 2×2 random table; the progression of subjects through the exercise trial is illustrated below. (Figure-1)

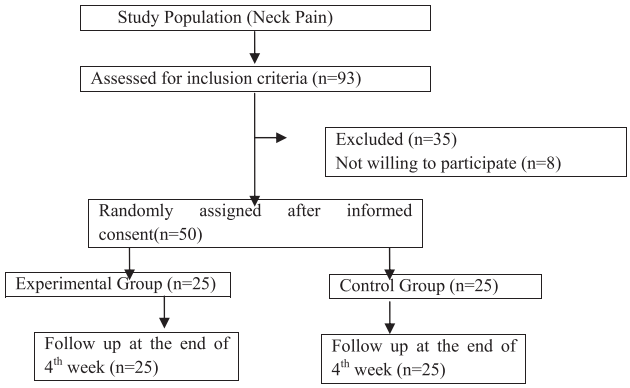


Figure-1 Flow chart describing the progress of subjects through the trial.

Figure-2: Training procedure of DCCF muscle

Exercise Regimens:

The exercise regimen was conducted over a 4-week period and subjects in each group received personal instruction and supervision by an experienced physical therapist twice per week for the duration of the trial. None of the exercise sessions were longer than 30 minutes. Subjects were asked not to receive any other specific intervention for their neck pain. All subjects were requested to practice their respective regimen twice per day for the duration of the task. The exercises were performed without any provocation of neck pain.

Deep Cranio-cervical flexor training intervention. (Figure-2)

Training of the deep craniocervical flexor muscles followed the protocol described, by Jull G et al [23]. Training was commenced at the level which the subject could achieve with a correct movement of craniocervical flexion. They then trained to be able to sustain progressively increasing ranges of craniocervical flexion. At each level patient asked to perform 3 sessions of 10 repitions with 10 seconds hold with the 1min rest between the sessions.

Neck – isometric exercise regimen:

In upright sitting position subject was asked to perform a single series of 15 repetitions with 10 seconds hold of isometric exercises for cervical flexors, extensors and left and right side flexors (Figure-3 A,B,C and D). Resistance provided at right angle from the plan of the movement by the therapist's one hand placed on forehead for flexion, back of the head for extension and on the sides of the head, just above the ear for side flexions. Patient was asked to place their own hand instead of therapist for home exercise. Resistance applied was judged and progressed every weekly according to patient capacity.

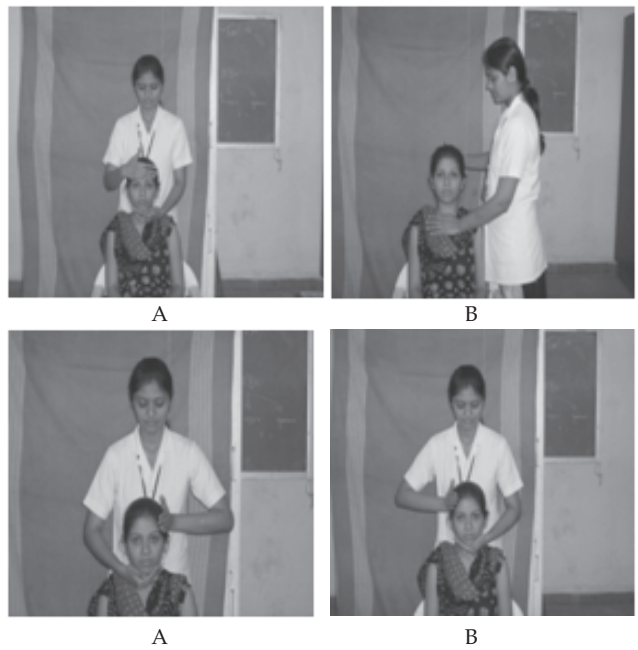


Figure-3: Isometric Neck Exercise A) for cervical flexor, B) for cervical extensor, C) for cervical left side flexor and D) for cervical right side flexor muscles training

Both the outcome measures including VAS and NDI were assessed in the week immediately after the 4 week intervention period for both the groups.

STATISTICAL METHOD

All participants in the experimental group and control group received the full 8 treatments and

performed their respective exercise at home twice daily, measured by home exercise record diary. No patients reported any adverse events. Of the 50 participants with neck pain who participated in the study, none were lost to follow up assessment at the end of the study.

Unpaired t tests were used to find out homogeneity of two groups for all demographic and baseline outcome measures and to compare the outcome measurement data between two groups after 4-week intervention.

Paired t tests were conducted to determine whether reduction in pain intensity (VAS) and perceived disability (NDI) were significantly different before and after the intervention.

Each calculated t-value is compared with t-table value to test one tailed hypothesis at 0.005 level of significance. Data analysis software SPSS 13.0 version has been used for the data analysis of the present study.

RESULT

Subject's demographic data and baseline outcome measures are presented in table-1. Which showed that both the experimental and control groups were homogenous for all possible confounding factors at baseline.

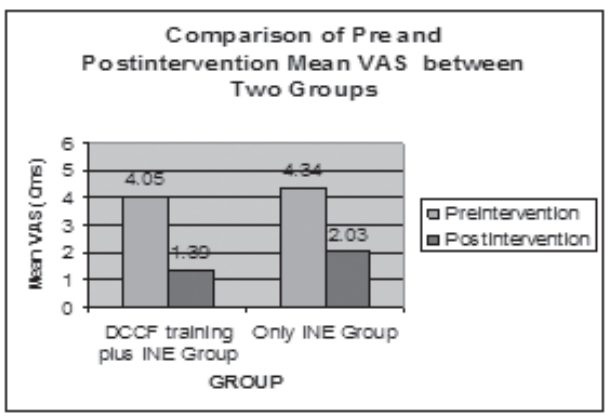
Table-1. Demographic Data and Baseline Outcome Measures for both the groups

Parameters	Deep craniocervical training intervention (n=25)			Neck isometric exercise intervention (n=25)			Un-paired 't'-cal Value
	Mean±SD	Median	Range	Mean±SD	Median	Range	
Age (y)	20.12±2.1	20	17-25	20.2±1.76	20	18-26	0.147
BMI (Kg/m^2)	20.01±3.14	19.19	15.6-29.4	20.43±1.54	19.73	15.4-31.12	0.368
Duration of the symptom(month)	29.76±12.78	24	6-60	30.72±18	24	3-60	0.217
VAS (0-10)	4.05±1.34	4.2	1.8-6.6	4.34±1.54	4	0.7-4.3	0.697
NDI (1-50)	7.8±3.48	7	3-15	8.8±3.37	9	3-15	1.033

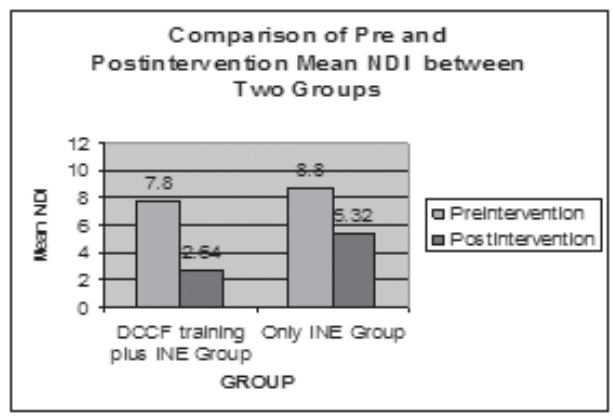
Both the experimental and control groups showed reduction in pain intensity postintervention when compared with preintervention measurement. Post intervention mean±SD of pain intensity was 1.39±0.9 and 2.03±1 respectively compared with preintervention mean±SD 4.05±1.3 and 4.34±1.5 respectively. (Graph-1A) 't'cal value

for experimental group was 11.572 and for control group was 12.849 at n-1 degree of freedom. (Table-2)

Both the experimental and control groups showed reduction in percieved disability postintervention when compared with preintervention measurement. Post intervention mean±SD of percieved disability was 2.64±1.7 and 5.32±2.5 respectively compared with preintervention mean±SD 7.8±3.5 and 8.8±3.7 respectively. (Graph-1B) 't'cal value for experimental group was 9.545 and for control group was 7.527 at n-1 degree of freedom. (Table-2)



A

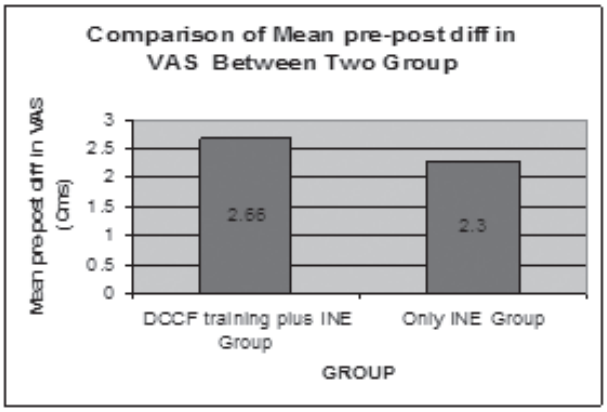


B

Graph-1 Comparison of pre and postintervention mean A) pain intensity and B) Perceived disability between two groups

Both the groups showed reduction in pain intensity postintervention. Mean±SD of pre-post difference in pain intensity for experimental group was 2.66±1.2 and for control group was 2.3±0.9 (graph-2A) and 't'cal value was 1.248 at n_1+n_2-2 degree of freedom.

Both the groups showed reduction in percieved disability postintervention. Mean±SD of pre-post difference in percieved disability for experimental group was 5.16±2.7 and for control group was 3.48±2.3 (graph-2B) and 't'cal value was 2.362 at n_1+n_2-2 degree of freedom.



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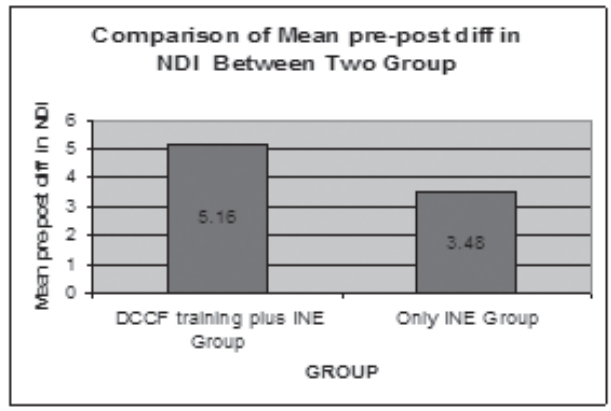

B

Graph-2 Comparison of mean pre-post diff in A) pain intensity and B) Perceived disability and between two groups

After 4-week intervention program both the groups showed statistical significant reduction in pain intensity and perceived disability compared with preintervention measurement.

The experimental group showed no statistical significant difference in reduction of pain intensity and percieved disability compared with the control group after intervention

DISCUSSION

There was significant reduction in average intensity of pain (VAS) and perceived disability (NDI) was identified for both training groups however there was no significant difference found between two groups.

Reduction in pain intensity and perceived disability can be a reflection of improvement in all over cervical muscle strength in control group and an additional improvement of DCCF endurance in experimental group following the 4-week intervention.

The common cause of chronic neck pain and disability in young females is muscular fatigue either because of prolonged flexed or forward head posture at study, recreation or work. The improvement of muscle performance by exercises given in this study results in reducing the early fatigability of the muscles which support and move cervical spine and hence the pain and disability.

Result of present study was not compared with any other study because of varieties in treatment protocol and population studied in previous studies.

CONCLUSION

There is no additional effectiveness of low load DCCF training over isometric neck strengthening exercise on chronic pain and disability.

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