“EFFICACY OF NECK STABILIZATION EXERCISES IN THE IMPROVEMENT OF MUSCLE ENDURANCE & FUNCTION IN SUBJECTS WITH CHRONIC NECK PAIN”

A DISSERTATION SUBMITTED TO THE TAMILNADU Dr. M.G.R MEDICALUNIVERSITY, CHENNAI, AS PARTIAL FULFILLMENT OF THE MASTER OF PHYSIOTHERAPY DEGREE

APRIL 2012.

CERTIFICATE

Certified that this is the bonafide work of **Mr. SARANRAJ. P** of K.G. College of Physiotherapy, Coimbatore, Submitted in partial fulfillment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr.M.G.R. Medical University under the **Registration No: 27102205** for the April 2012 Examination.

Date: Principal

Place : Coimbatore

Date :

"EFFICACY OF NECK STABILIZATION EXERCISES IN THE IMPROVEMENT OF MUSCLE ENDURANCE & FUNCTION IN SUBJECTS WITH CHRONIC NECK PAIN"

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_____ _____

Internal Examiner **External Examiner**

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I INTRODUCTION

Neck disorders remain a common problem in modern, industrialized countries. Neck pain is common ailment occurring in all age groups affecting 50-70% people prevalence of neck pain are diagnosed and is common for women 45% than men 38%. Neck pain is the most common among computer professionals. Neck disorders are common and costly problem in the community, affecting 70% of people at some point in their life. Literature shows there is strong relationship between the cervical posture and neck pain.

Neck pain accounts 25% of disability, In work related injuries neck pain is major musculoskeletal health problem in modern society occurring in many different occupational groups mainly software professionals. Forward head posture is one of the type of poor head posture seen in patients with neck disorders. Forward head posture is one of the common abnormal postures seen in 90% of computer professionals. As head moves forward centre of gravity shifts, to compensate this shift upper body drift backward and hip tilt forward. Likewise excessive use of computer, the head forward position for long period of time leads to pain and disability.

The origin and exact pathological mechanism of chronic neck pain remain obscure either because of trauma or severe degenerative conditions leading to micro trauma on connective tissue or pathological stress leading to muscle tension. Muscles play a major role in supporting of Cervical segment,

Muscular sleeve formed by longus colli muscle anteriorly, semispinalis cervicis and cervical multifidus muscle posteriorly.

Deep cervical muscle activity was required in synergy with superficial muscle activity to stabilize the cervical segments, especially in functional mid-range of the cervical spine.

Recent studies had identified that there is impaired activation of the deep cervical flexor muscles, the longus colli and longus capitis, in people with neck pain. (Falla DL et al., 2004). Given the role of the deep cervical flexor muscles in postural support and the knowledge of impaired activation of these muscles in people with neck pain, it is likely that patient population would display deficits in the postural endurance of these muscles. Indeed, evidence is emerging that suggest people with neck pain drift into a more forward head position when distracted.

Conventional neck exercises are generally prescribed for the management of neck pain but researches shows that these exercises are not much beneficial in controlling pain or disability. Craniocervical training was a newly developed program using low load endurance exercise in physical therapy. It is mainly dealt with specific deficits in muscle control of the craniocervical exercises. It is the effective physical therapy management techniques in the treatment of chronic neck pain patients. Craniocervical flexion exercises are targeting the deep flexor muscle of the upper cervical region. Craniocervical flexion exercises are given to reduce the pain and disability of the neck and maintain

the upright neutral posture when distracted by the computer professionals. The deep neck muscle training increases the activation of deep cervical flexor muscle during movement and improves activity to maintain upright posture of cervical spine.

At present there is no consensus as to the best method of training Craniocervical flexor muscle performance. Jull et al., 2004, endorse a specific Craniocervical flexion exercises.

1.1 NEED FOR STUDY:

Evidences for many of the standard treatment approaches to neck pain is lacking, (Aker PD et al., 1996), Conservative management of neck disorders includes both passive and active therapies. Neither of which is shown to be effective. However these treatments are widely prescribed by physicians. (Gross AR et al., 1996).

Many literatures show that active neck muscle training provides benefits in pain reduction as well as in improvement of function in neck pain subjects. Moreover, retraining the deep cervical flexor muscles, which has been shown to decreases the symptoms of neck pain and increase the activation of the deep cervical flexor muscles during performance of the clinical test of craniocervical flexion, may improve the muscle endurance and function of the cervical spine. (Jull T et al., 2002, 2005).

Recent studies had identified that impaired activation of the deep cervical flexor muscles in people with neck pain. Maintenance of upright posture of neck needs strong muscles, exercises shown to be beneficial in it. Conventional neck exercises are helpful for reducing pain, but the literatures suggest that Craniocervical flexion exercises are found to be more effective in reducing disability. So this study aims to find out the efficacy of both exercises.

1.2 PURPOSE OF THE STUDY:

The purpose of study is to find the efficacy of neck stabilization exercises in the improvement of muscle endurance and function in subjects with chronic neck pain**.**

1.3 OBJECTIVE OF THE STUDY:

- To find out the effect of Conventional neck exercises in the improvement of muscle endurance and function in subjects with chronic neck pain.
- To find out the effect of Craniocervical flexion exercises in the improvement of muscle endurance and function in subjects with chronic neck pain.
- To compare the effect of conventional neck exercises and Craniocervical flexion exercises in the improvement of muscle endurance and function in subjects with chronic neck pain**.**

1.4 HYPOTHESIS:

NULL HYPOTHESIS:

There is no significant difference between Conventional neck exercises and Craniocervical flexion exercises in improving muscle endurance and function in subjects with chronic neck pain**.**

ALTERNATE HYPOTHESIS:

There is a significant difference between Conventional neck exercises and Craniocervical flexion exercises in improving muscle endurance and function in subjects with chronic neck pain**.**

II REVIEW OF LITERATURE

Poland C.A et al., (1984)

They conducted a study in chronic neck pain patients with neck disability index as a tool to measure the disability in activities of daily living. On the basis of study findings they concluded that neck disability index is a valid tool in assessing neck pain and disability.

Jull G et al., (1999)

They conducted a study to determine the ability to perform craniocervical flexion test in neck pain patients. They used air filled pressure biofeedback unit to assess the endurance of deep cervical flexors muscles. Results showed that there was a reduction in holding time of deep cervical flexor muscle in neck pain patients and there is a linear co - relation between neck pain and deep cervical flexor muscle.

Croft et al., (2001)

They conducted a study to evaluate the incidence of neck pain in patients attended the physical therapy. On the basis of study findings they concluded that neck pain was a common complaint of patients presenting to physical therapy, with an annual incidence estimated as high as 17.9% of the population, with estimates of lifetime incidence ranging from 22% to 70% (and estimates of more than one-third of all patients with neck pain continuing to experience discomfort upon 6 month follow-up).

Ackelman. B.H et al., (2002)

They conducted a study to assess the reliability of modern version of the neck disability index in chronic neck pain patients. The results concluded that neck disability index had a high inter-rater reliability in subjects with neck pain.

Jari Ylinen et al., (2003)

They conducted a study to evaluate the effects of isometric neck strength training and lighter endurance training in reducing pain and disability in women with non specific neck pain. 180 subjects were allotted into 3 groups and trained for a period of 12 months duration. The neck pain disability index, pain intensity and range of motion were measured. On the basis of study findings they concluded that both the exercise training are effective methods for improving the range of motion, reducing pain and disability .There was no significant difference between the 3 groups.

Gwendolen Jull et al., (2003)

They conducted a study to evaluate the deep cervical flexor muscle activity in subjects with neck pain activity by electromyographic technique. 10 subjects with neck pain and 10 subjects without neck pain were included in the study. The study finding showed that a linear relationship was evident between the amplitude of deep cervical flexors muscle activity and the incremental stages of the craniocervical flexion test. The results of the study shows there was a dysfunction of deep cervical muscles in subjects with chronic neck pain.

Trevore Russell et al., (2003)

They conducted a study to compare the effects of craniocervical flexion training and endurance strength training of cervical flexor muscle in subjects with neck pain during distracting type of computer tasks. 58 subjects were allotted into 2 groups by random sampling method. They measured the cervical and thoracic posture by digital photographic method during tasks. They concluded that craniocervical flexor training group had a significant improvement in maintaining neutral cervical posture during distracting type of computer task.

Deborah L Falla (2003)

He conducted a study to qualify the sagittal angular displacement of the head (craniocervical flexion) for five incremental stages of the craniocervical flexion test. 20 subjects participated in the study and their stages of craniocervical flexion were recorded by digital photographic method. On the basis of study findings the author found that a linear relationship existed between the incremental pressure targets of the craniocervical flexion test and increasing amount of craniocervical flexion range of motion to achieve the five successive stages of the craniocervical flexion test reflecting an increasing contractile demand on the deep cervical flexor muscles.

Shaun P. O'leary et al., (2003)

They conducted a study to evaluate effects of the craniocervical flexion test in assessment of deep cervical flexor muscle endurance. The pressurized biofeedback unit was used to analyze the neck muscle endurance. On the basis of the results they concluded that the pressure biofeedback unit is a reliable tool used for assessing the deep cervical muscle endurance.

Campbell CD (2003)

He conducted a study for analyzing cervical and thoracic posture during craniocervical flexion test in neck pain subjects. A digital photographic analyzer was used to analyze the posture during test. On the basis of the study findings he concluded that the digital photographic analyzer was a reliable tool for quantifying changes in cervical angle.

Fall D et al., (2004)

They conducted a study to compare the activity of deep cervical flexor muscles in craniocervical flexion test between subjects with chronic neck pain and in subjects without neck pain. A total of 20 subjects participated in the study .10 subjects had neck pain and 10 subjects did not have neck pain.The muscle activity was recorded with an electromyographic method. On the basis of study results they concluded that the amplitude of the deep cervical flexors during EMG activity was recorded and is less for the group with neck pain than in the group without neck pain, and this difference was significant for higher increments of the task.

Jari Ylinen (2004)

He conducted a study to evaluate the neck flexion, extension and rotation strength in women with neck pain compared with healthy controls and to evaluate the repeatability of peak isometric neck strength measurements in patients with neck pain and he found that the group with neck pain had a lower neck strength in all the directions tested than the control group.

Thomas T.W et al., (2004)

They conducted a study to evaluate the reliability of neck disability index in assessing the reduction of pain and disability in subjects with neck pain. On the basis of the study findings the author concludes that the neck disability index had a combined effect of assessing pain reduction and disability in activities of daily living.

Chiutt Lawey et al., (2005)

They conducted a study to compare the performance of the deep cervical flexor muscle on the craniocervical flexion test in individuals with and without neck pain. A total of 40 subjects participated in the study. Among them 20 were neck pain subjects and 20 were normal subjects, i.e. subjects without neck pain. Craniocervical flexion test was performed in supine lying and was recorded by pressure biofeedback unit. On the basis of study findings they found that the subjects with chronic neck pain had a significantly poorer performance on the craniocervical flexion test when compared with those in the asymptomatic group.

Kevin D Haris et al., (2005)

They conducted a study to determine the inter and intra - rater reliability in subjects with or without neck pain and also to determine whether there was a difference in neck flexor endurance between the two groups. On the basis of the results they found that, the inter-rater reliability was good to excellent for the group without neck pain and intra-rater reliability was moderate to good for the same group. For the group with neck pain the inter-rater reliability was moderate.

Law E Y et al., (2005)

They conducted a study to compare the performance of the deep cervical flexor muscle by craniocervial flexion test in subjects with or without neck pain. The craniocervical flexion test was performed by pressure biofeedback unit which was considered a reliable device for assessing the craniocervical flexor muscle in neck pain subjects.

Chiu et al., (2005)

They conducted a study to determine the effect of TENS and exercises training in chronic neck pain patients. On the basis of the results they concluded that the 6 weeks training program showed an improvement in neck muscle strength and reduction of pain in neck pain subjects.

Hodges PW et al., (2006)

They conducted a study to assess the effects of craniocervical flexion exercise and cervical flexion exercise training in neck pain subjects during rest, activity and immediately after training. In this training 47 females were allotted into 2 groups and the intensity of pain was measured. On the basis of the results they concluded that there was immediate local pain relief occurred after the craniocervical flexion training. But the duration of the effect was unknown.

Lee E Olson et al., (2006)

They studied the endurance deficiencies of the deep cervical flexors and suggested that they are associated with pain, increased lordosis, and headache and also found that the subjects without neck pain showed good cervical flexor endurance than in subjects with neck pain. The results showed that the neck pain caused muscle weakness which in turn resulted in reduction of muscle endurance.

Gwendolen Jull et al., (2006)

They conducted a study to evaluate the isometric craniocervical flexor muscle performance in the neck pain group and in the control group. A total of 93 patients participated in the study. 46 subjects were included in the neck pain group and 47 subjects in the control group. The isometric craniocravical flexor muscle strength and endurance was measured. On the basis of the results it was concluded that the neck pain subjects had impairment in isometric

craniocervical flexor muscle performance in low, moderate and maximal contractile intensity.

Julia Treleaven et al., (2006)

They conducted a study to compare the effects of conventional proprioceptive training and craniocervical flexion training on cervical joint position error (JPE) in people with persistent neck pain. 64 subjects were divided into two groups by random sampling method. They measured the cervical joint position error, pain intensity and disability. Subjects were trained for about a period of 6 weeks duration. On the basis of the results they concluded that the proprioceptive acuity following intervention with both the exercise protocols occurred through an improved quality of cervical afferent input or by addressing inputs through the direct training of relocation sense.

Math.J.Nykanen et al., (2006)

They conducted a study to evaluate the effects of progressive strength training and stretching exercises in chronic neck pain patients. On the basis of the results they concluded that the neck muscle strength improved following the progressive strength training.

Leon M Straker et al., (**2007)**

They conducted a study to evaluate the incidence of neck pain in men and women. On the basis of the results they concluded that 5.3% of the adolescents are reported to be suffering from neck pain in prolonged sitting posture and females were more affected by posture than males.

Cook et al., (2007)

They conducted a study to evaluate the incidence of neck pain in office workers. On the basis of the study findings they concluded that the complaints of work related neck pain are becoming increasingly prevalent especially among the intensive computer workers. In twelve months of period of study, 45.5% of 512 office workers reported pain in the neck region.

O'leary S et al., (2007)

They conducted a study to evaluate the effects of a craniocervical flexion exercise program to that of a conventional craniocervical flexion exercise program in training isometric cervical flexor muscle performance. 50 subjects were randomized into 2 groups and the training was given for a period of 6 weeks. The muscle performance was recorded pre and post training by isometric dynamometer. On the basis of the results they concluded that both the exercise interventions significantly improved the isometric craniocervical flexor muscle performance. There were no significant differences observed in improvement of muscle performance between the 2 exercise interventions.

Vicenzino B et al., (2009)

They conducted the study to evaluate the effects of low load craniocervical flexion exercise and the neck flexor strengthening exercise in the activation of deep cervical flexor muscles during neck movement. 64 subjects were divided into 2 groups and muscle activity was measured by Electro myo graphy. On the basis of the study findings they concluded that the craniocervical

flexion exercises has increased amplitude in deep cervical flexor and decreased amplitude in the strenocleidomastoid muscle and the anterior scalene muscle during various stages of craniocervical flexion test. There was a significant change in the spatial and temporal characters of deep cervical flexor muscle following low load craniocervical flexion exercise training.

Cathrin Griffiths et al., (2009)

They conducted a study to determine the effects of specific neck stabilization exercise with general neck exercise and advice is better than general neck exercise alone. 74 subjects were allotted into two groups and were trained for a period of 6 months duration. The neck pain disability scale and pain intensity was measured in pre and post training sessions. On the basis of the study findings they concluded that there was no significant difference between the groups. But the specific neck exercise group had less pain relieving medication than the other groups.

Duncelli et al., (2009)

They conducted a study to evaluate the effects of physical agents, isometric strengthening exercise training and stability exercise training in neck pain subjects. 60 subjects were divided into 3 groups and trained for a period of 12 months duration .The neck disability index, pain intensity and beck depression scale were taken in the 1,3,6 and 12 months interval of the training sessions . On the basis of the results they concluded that there was a significant improvement following the stability exercise training in neck pain subjects.

III METHODOLOGY

3.1 STUDY DESIGN

Randomized control trail with one experimental group and one control group.

3.2 STUDY SETTING

K.G. Information system (P) Limited (KGISL) and Outpatient department- K.G College of physiotherapy, K.G Hospital, Coimbatore.

3.3 STUDY POPULATION

Subjects with neck pain in KGISL were selected for the study after due consideration of inclusion and exclusion criteria. Who are working in medical transcription division of KGISL.

3.4 STUDY DURATION

The study was conducted for a duration of 8 weeks.

3.5 SELECTION OF SAMPLES

Total of 40 subjects were included for the study using simple random sampling method.

3.6 CRITERIA FOR SELECTION

INCLUSION CRITERIA:

- ✓ Age – 25 -35 yrs
- ✓ Sex – Both sex
- ✓ Mechanical Neck pain with duration more than 6 months
- ✓ Subjects had not underwent any treatment for the past 4 months
- ✓ Desk job workers with work duration of more than 8 hours a day
- ✓ Neck Disability Index Score greater than 15
- ✓ Willing to participate

EXCLUSION CRITERIA:

- ✓ Fractures around Neck
- ✓ Neck pain following Trauma
- ✓ Radiating pain
- ✓ Subjects with cardiovascular complaints
- ✓ Neck Disability Index Score less than 15
- ✓ Unwilling to participate

3.7 VARIABLES

- Independent variables
    - Conventional neck exercises
    - Craniocervical flexion exercises
- Dependent variables
    - Muscle endurance
    - Disability

3.8 OPERATION TOOLS

- Pressure biofeedback unit
- Neck Disability Index

3.9 PARAMETERS FOR MEASUREMENT

- Muscle endurance
- Disability

3.10 PROCEDURE

Subjects who are visiting the Outpatient department- K.G College of physiotherapy, K.G.Hospital and subjects who were coming to the Physiotherapy Outpatient Department with chronic neck pain were assessed. Patients who are meeting the inclusion and exclusion criteria were selected for this study. A clear explanation of the study was given to the selected patients and those who agreed to participate were given up with an informed consent. After obtaining consent form, all subjects then completed a thorough physical examination by senior therapist.

Following the examination a self-report questionnaire was given to the patient to collect data about participant's details, work details, Pressure bio feedback unit and Neck Disability Index (NDI).

40 subjects with chronic neck pain were selected and all the subjects were divided into 2 groups, the subjects randomly assigned into two equal groups, 20 subjects in each group.

Regardless of treatment group, all patients were scheduled for the first treatment session within 3 days of the baseline examination.

All subjects attended two days of educational sessions by a senior physiotherapist in the first 2 weeks.

GROUP A

20 subjects in this group underwent Conventional neck exercises for duration of 30 minutes followed with moist heat was applied for 10 minutes. This reduces the muscle soreness following the exercises. Conventional neck exercises were described in Appendix.

GROUP B

20 subjects in this group underwent Craniocervical flexion exercises for duration of 30 minutes followed by moist heat was applied for 10 minutes. This reduces the muscle soreness following the exercises. Craniocervical flexion neck exercises were described in Appendix.

All these exercises are demonstrated to the patients individually and brochures were given. Exercises explained in Appendix.

Following treatment, the patient was advised to continue the home program and thanked for their co-operation. The data was noted separately and was taken for analysis.

CONVENTIONAL NECK EXERCISES

ISOMETRIC NECK FLEXION

ISOMETRIC NECK EXTENSION

CRANIOCERVICAL FLEXION EXERCISES

AGAINST WALL

SITTING POSITION

3.11 STATISTICAL TOOL

Paired ‘t’ test

The following statistical tool was used to compare pre test and post test values within the groups.

Formula: Paired t-test

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$t = \frac{\overline{d}\sqrt{n}}{s}$$

Where,

d = difference between the pre test versus post test

$\overline{d}$ = mean difference

n = total number of subjects

S = standard deviation

Unpaired ‘t’ test:

The unpaired‘t’ test was used to compare the pre test and post test values between the two groups.

Formula: Unpaired t-test

$$S = \sqrt{\frac{\sum\left(X_1 - \overline{X_2}\right)^2 + \sum\left(X_2 - \overline{X_2}\right)^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\overline{X_1} - \overline{X_2}}{S}\sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

$\overline{x_1}$ = Mean of Group A

$\overline{x_2}$ = Mean of Group B

$\sum$ = sum of the value

n_1 = number of subjects in Group A

n_1 = number of subjects in Group B

S = standard deviation

Level of significance: 5%

IV DATA ANALYSIS AND INTERPRETATION

TABLE-I

DEMOGRAPHIC DATA

S.NO	AGE GROUP CLASSIFICATION	No of subjects
1	25—27	11
2	28—30	8
3	31—33	9
4	34—35	12
	Total	40

GRAPH-I

AGE GROUP CLASSIFICATION

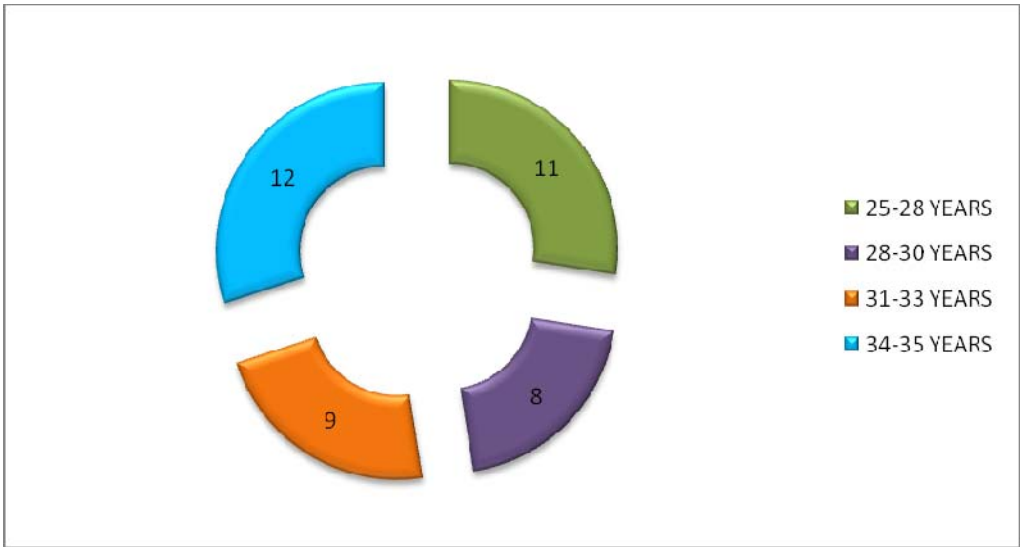


TABLE-II

PAIRED ‘t’ TEST

PRE TEST AND POST TEST VALUES OF GROUP A

GROUP A – CONVENTIONAL NECK EXERCISES

NECK DISABILITY INDEX

The comparative mean values, mean differences, standard deviation and Paired ‘t’ test values of Group A who were treated with Conventional Neck Exercises.

S.NO	GROUP A	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED ‘t’ VALUE
1.	PRETEST	32.05	8.4	3.647	10.2
2.	POSTTEST	23.65			

The table II shows analysis of NDI on paired ‘t’ test. The test value for Group A was 10.2 at 0.05 % level of significance, which was greater than the tabulated‘t’ value 2.093. The result shows that there was marked difference between pre test and post test values.

GRAPH-II

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP A (CONVENTIONAL NECK EXERCISES)

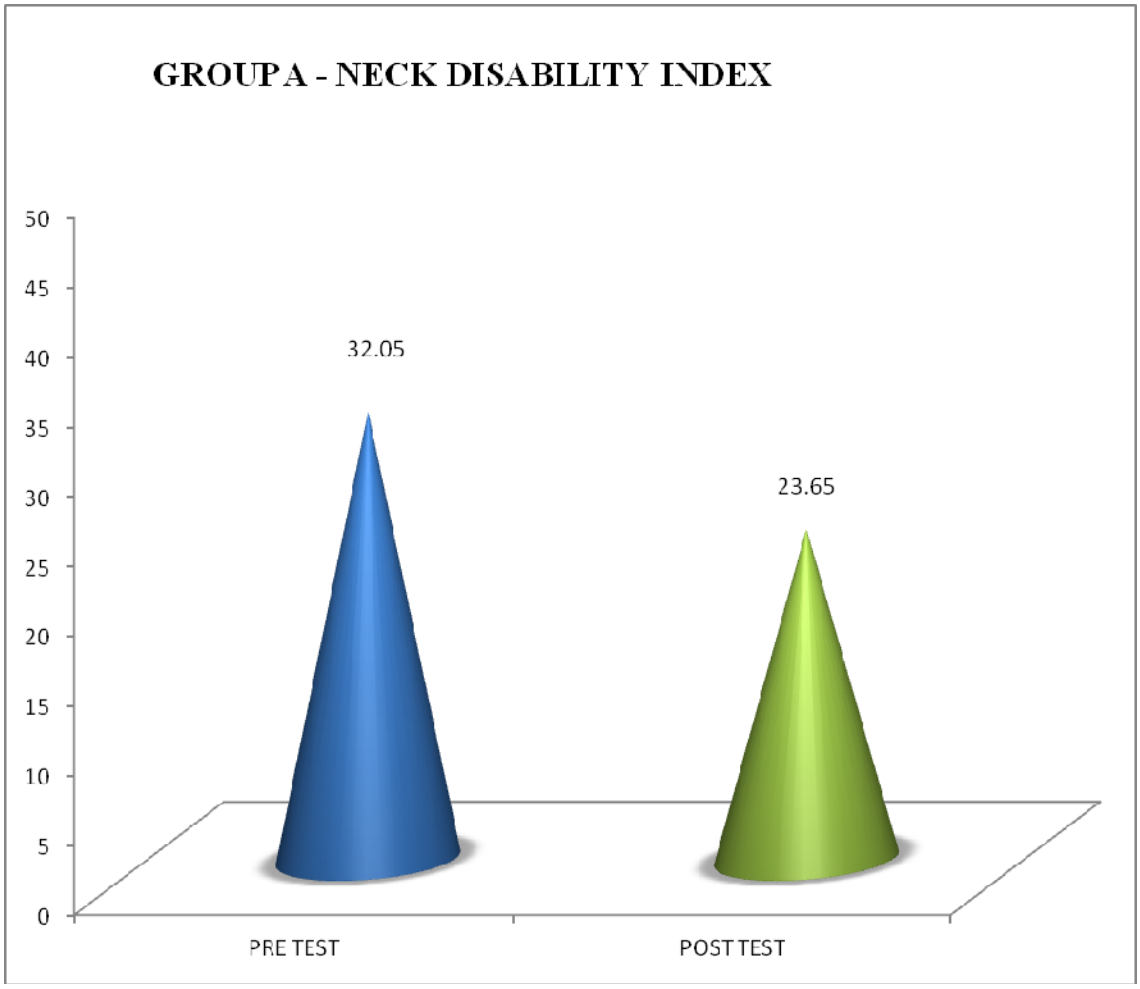


TABLE-III

PAIRED ‘t’ TEST

PRE TEST AND POST TEST VALUES OF GROUP B

GROUP B – CRANIOCERVICAL FLEXION EXERCISES

NECK DISABILITY INDEX

The comparative mean values, mean differences, standard deviation and Paired ‘t’ test values of Group B who were treated with Craniocervical flexion exercises.

S.NO	GROUP B	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED ‘t’ VALUE
1.	PRETEST	31.85	20.95	2.962	29.71
2.	POSTTEST	10.9			

The table III shows analysis of NDI on paired ‘t’ test. The test value for Group B was 29.71 at 0.05 % level of significance, which was greater than the tabulated‘t’ value 2.093. The result shows that there was marked difference between pre test and post test values.

GRAPH-III

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP B (CRANIOCERVICAL FLEXION EXERCISES)

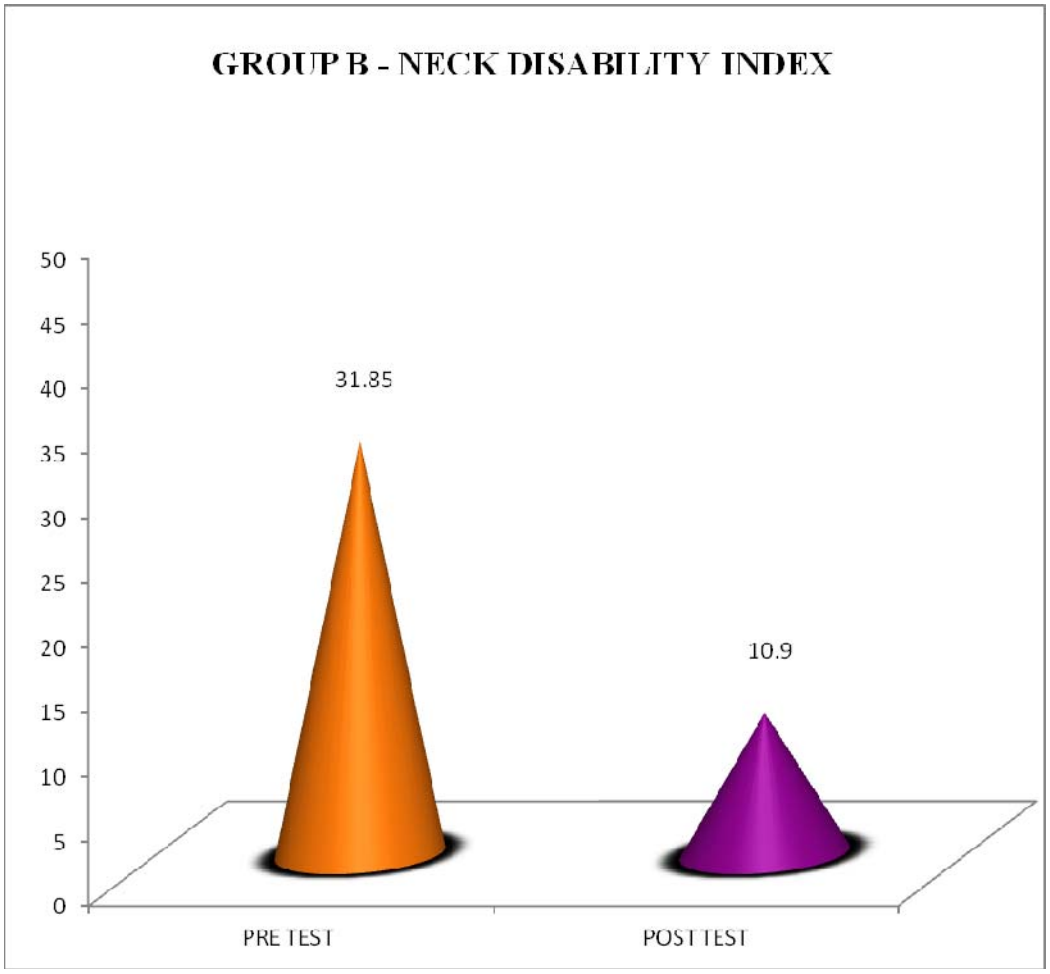


TABLE-IV

PAIRED ‘t’ TEST

PRE TEST AND POST TEST VALUES OF GROUP A

GROUP A – CONVENTIONAL NECK EXERCISES

PRESSURE BIOFEEDBACK UNIT

The comparative mean values, mean differences, standard deviation and Paired ‘t’ test values of Group A who were treated with Conventional Neck Exercises.

S.NO	GROUP A	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED ‘t’ VALUE
1.	PRETEST	3.90	2.1	0.726	11.019
2.	POSTTEST	6			

The table IV shows analysis of PBU on paired ‘t’ test. The test value for Group A was 11.019 at 0.05 % level of significance, which was greater than the tabulated ‘t’ value 2.093. The result shows that there was marked difference between pre test and post test values.

GRAPH-IV

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP A (CONVENTIONAL NECK EXERCISES)

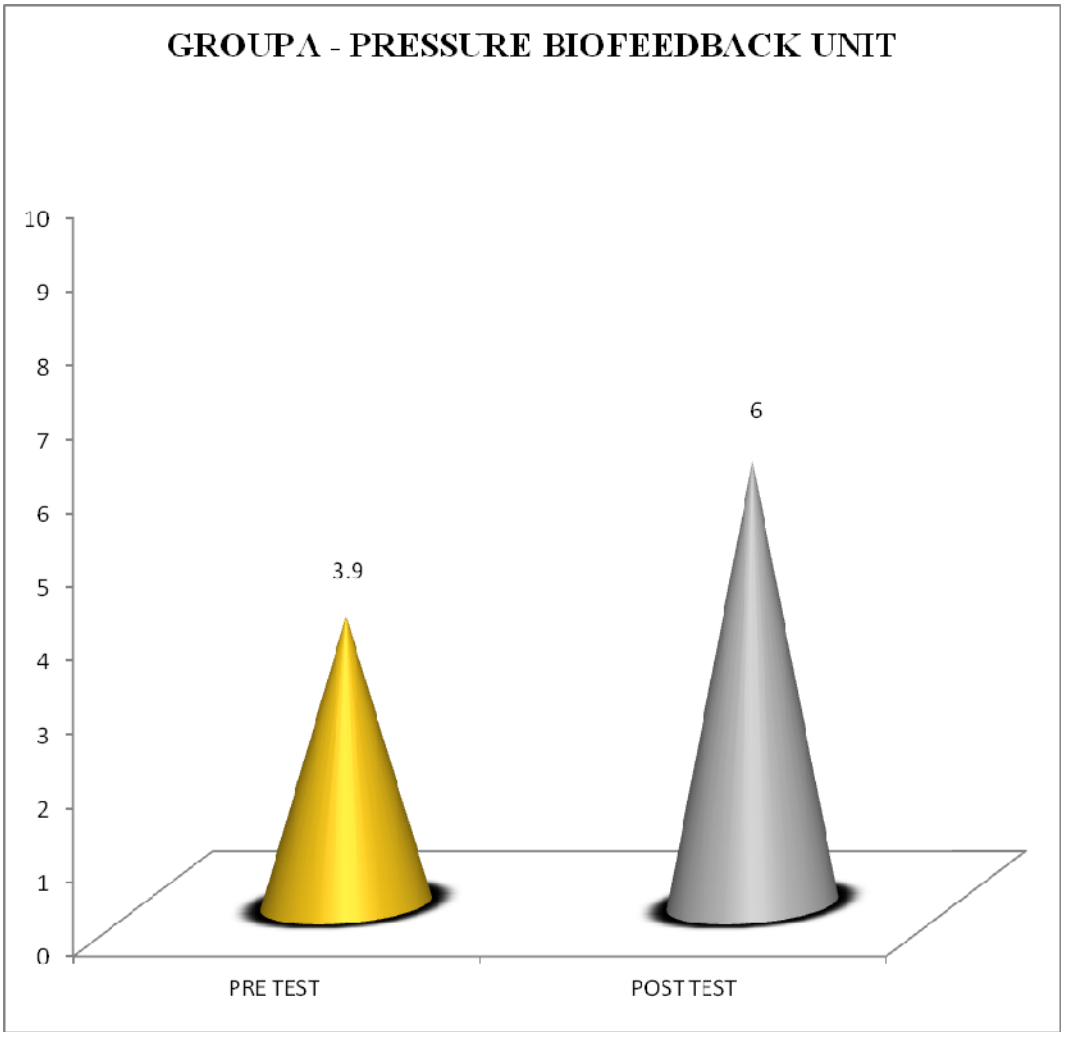


TABLE-V

PAIRED 't' TEST

PRE TEST AND POST TEST VALUES OF GROUP B

GROUP B – CRANIOCERVICAL FLEXION EXERCISES

PRESSURE BIOFEEDBACK UNIT

The comparative mean values, mean differences, standard deviation and Paired 't' test values of Group B who were treated with Craniocervical flexion exercises.

S.NO	GROUP A	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED 't' VALUE
1.	PRETEST	4.05	4.6	1.27	16.157
2.	POSTTEST	8.65			

The table V shows analysis of PBU on paired 't' test. The test value for Group A was 16.157 at 0.05 % level of significance, which was greater than the tabulated 't' value 2.093. The result shows that there was marked difference between pre test and post test values.

GRAPH-V

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP B (CRANIOCERVICAL FLEXION EXERCISES)

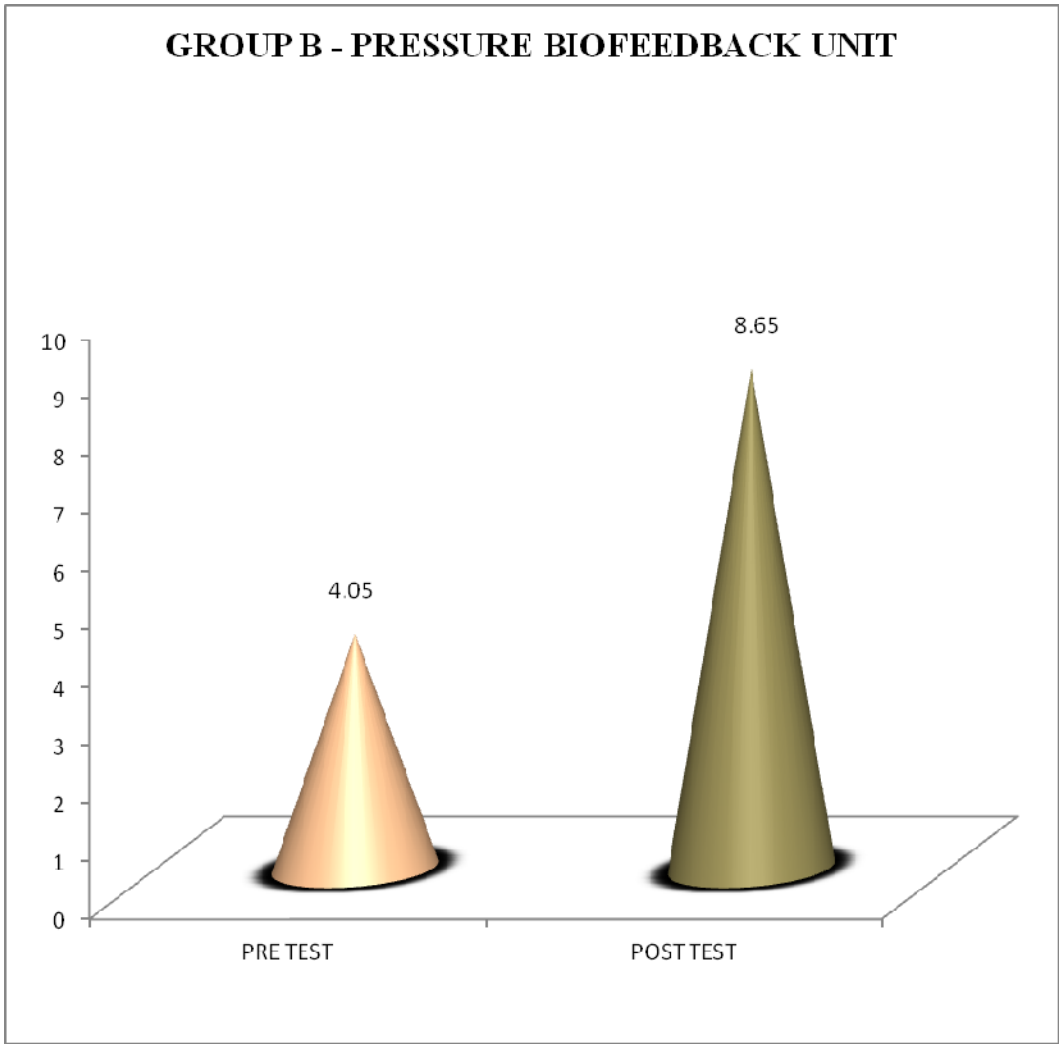


TABLE-VI

UNPAIRED‘t’ TEST

COMPARISON BETWEEN THE PRE TEST VALUES OF GROUP A AND GROUP B

NECK DISABILITY INDEX

The comparative mean values, mean differences, standard deviation and Unpaired ‘t’ test values of Group A and Group B who were treated with Conventional neck exercises and craniocervical flexion exercises.

S.NO	GROUPS	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED ‘t’ VALUE
1.	GROUP A	32.05	0.2	1.97	0.318
2.	GROUP B	31.85			

The table VI shows analysis of NDI on paired ‘t’ test. The pre test value for Group A and Group B was 0.318 at 0.05 % level of significance, which was lesser than the tabulated ‘t’ value 1.960. The result shows that there was no marked difference between pre test and post test values.

GRAPH-VI

GRAPHICAL REPRESENTATION OF PRE TEST VALUES FOR GROUP A AND GROUP B

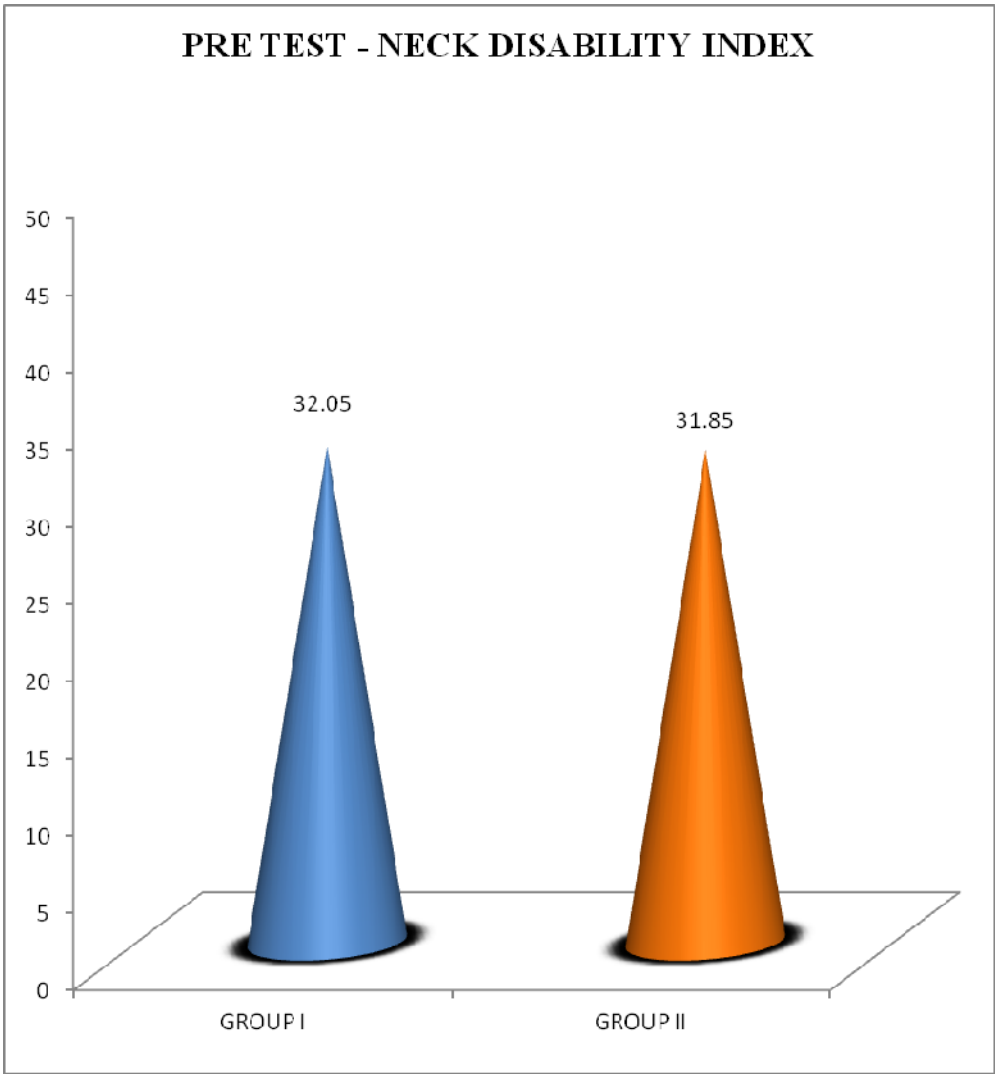


TABLE-VII

UNPAIRED ‘t’ TEST

COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

NECK DISABILITY INDEX

The comparative mean values, mean differences, standard deviation and Unpaired ‘t’ test values of Group A and Group B who were treated with Conventional neck exercises and craniocervical flexion exercises.

S.NO	GROUPS	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED ‘t’ VALUE
1.	GROUP A	23.65	12.75	2.35	17.13
2.	GROUP B	10.9			

The table VII shows analysis of NDI on paired ‘t’ test. The post test value for Group A and Group B was 17.13 at 0.05 % level of significance, which was greater than the tabulated ‘t’ value 1.960. The result shows that there was marked difference between pre test and post test values.

GRAPH-VII

GRAPHICAL REPRESENTATION OF POST TEST VALUES FOR GROUP A AND GROUP B

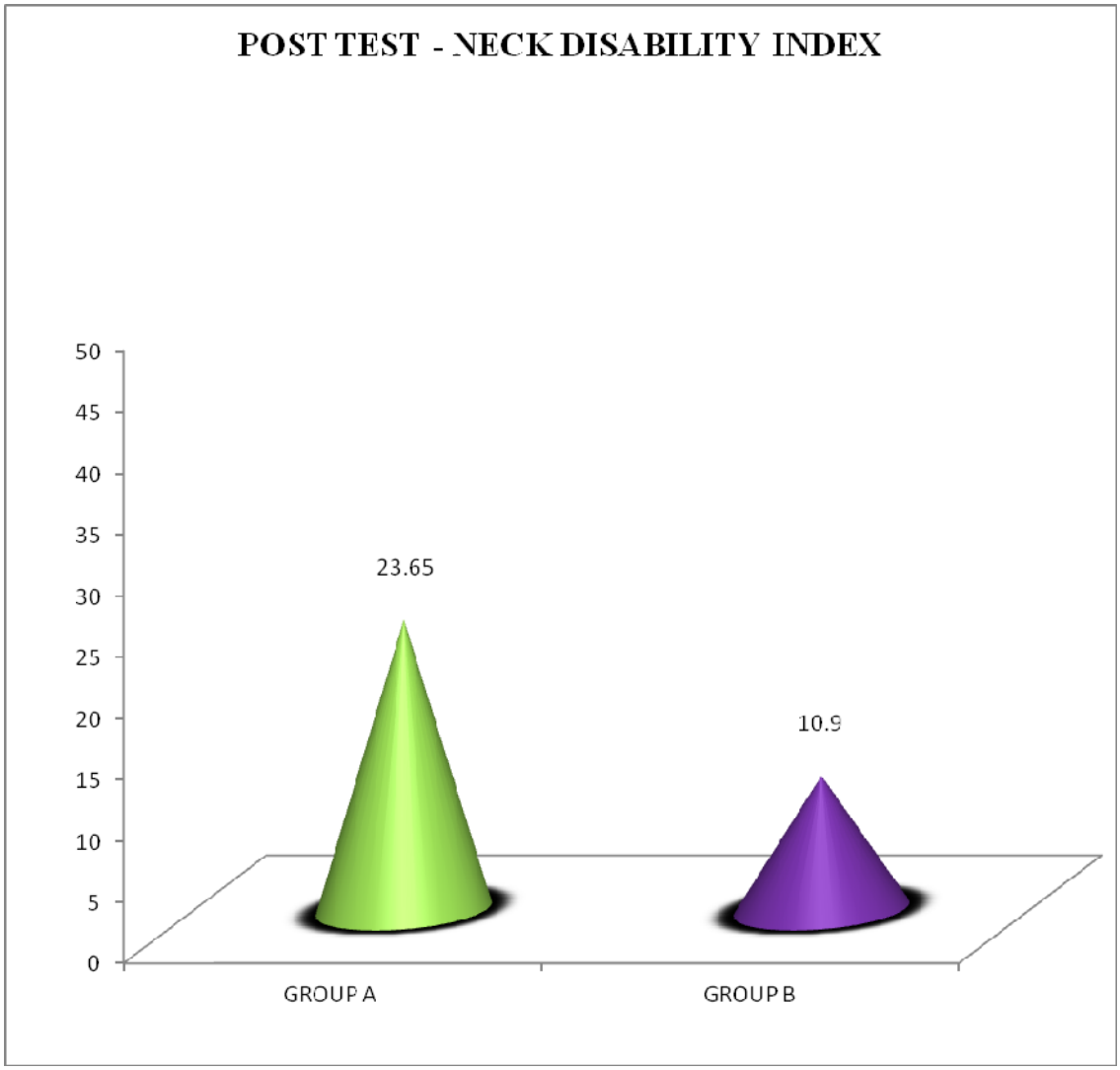


TABLE-VIII

UNPAIRED‘t’ TEST

COMPARISON BETWEEN THE PRE TEST VALUES OF GROUP A AND GROUP B

PRESSURE BIOFEEDBACK UNIT

The comparative mean values, mean differences, standard deviation and Unpaired ‘t’ test values of Group A and Group B who were treated with Conventional neck exercises and craniocervical flexion exercises.

S.NO	GROUPS	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED ‘t’ VALUE
1.	GROUP A	3.9	0.15	0.85	0.565
2.	GROUP B	4.05			

The table VIII shows analysis of PBU on paired ‘t’ test. The pre test value for Group A and Group B was 0.565 at 0.05 % level of significance, which was lesser than the tabulated ‘t’ value 1.960. The result shows that there was no marked difference between pre test and post test values.

GRAPH-VIII

GRAPHICAL REPRESENTATION OF PRE TEST VALUES FOR GROUP A AND GROUP B

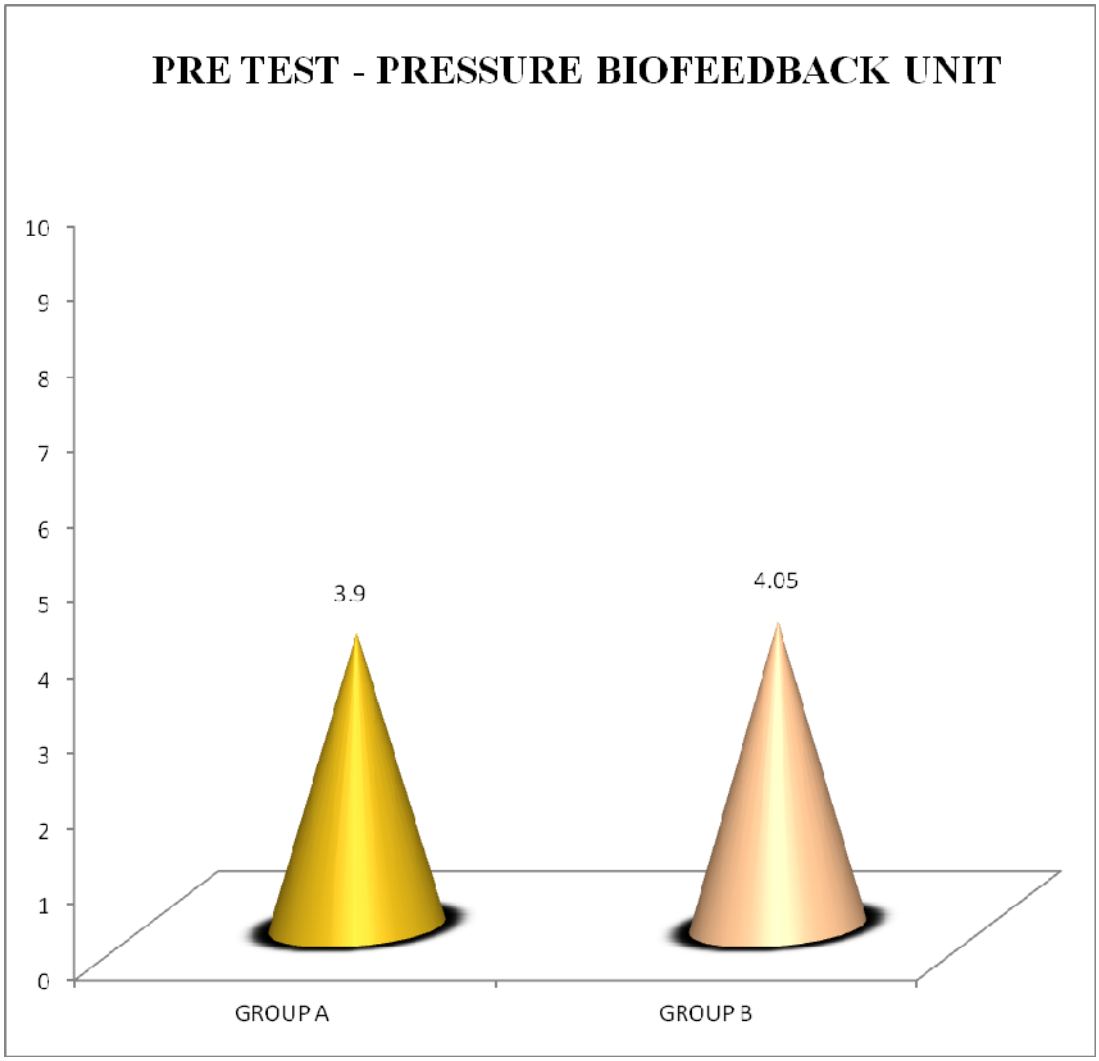


TABLE-IX

UNPAIRED 't' TEST

COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

PRESSURE BIOFEEDBACK UNIT

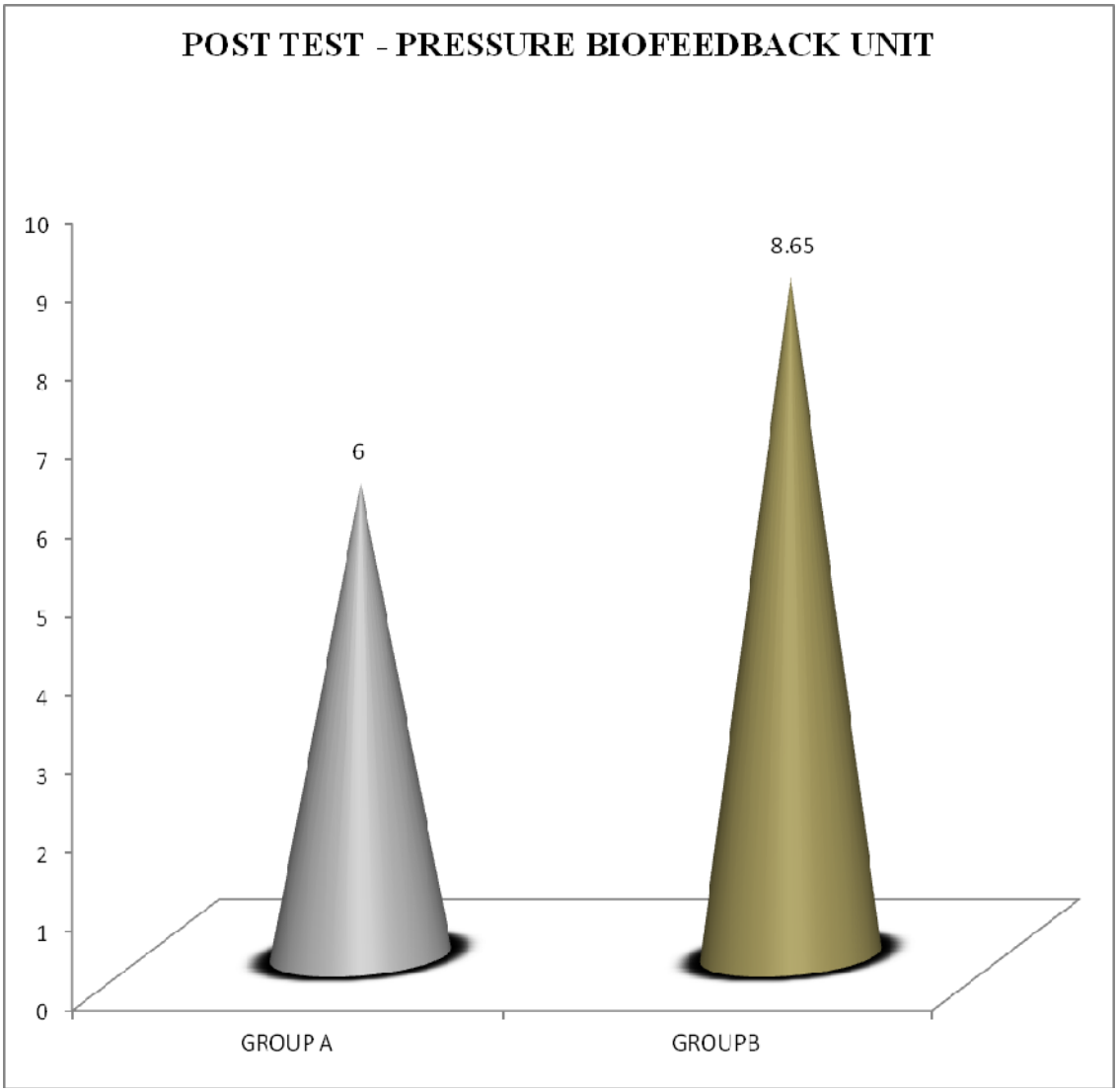
The comparative mean values, mean differences, standard deviation and Unpaired 't' test values of Group A and Group B who were treated with Conventional neck exercises and craniocervical flexion exercises.

S.NO	GROUPS	MEAN	MEAN DIFFERENCE	STANDARD DEVIATION	PAIRED 't' VALUE
1.	GROUP A	6	2.65	0.86	9.668
2.	GROUP B	8.65			

The table IX shows analysis of PBU on paired 't' test. The post test value for Group A and Group B was 9.668 at 0.05 % level of significance, which was greater than the tabulated 't' value 1.960. The result shows that there was marked difference between pre test and post test values.

GRAPH-IX

GRAPHICAL REPRESENTATION OF POST TEST VALUES FOR GROUP A AND GROUP B



V RESULTS

The demographic representations of the groups are given in table I. Treatment duration was not analyzed since all underwent same duration. Age group of the participants varies from 25 years to 35 years and about 30 % from 34—35 years, 27.5% from 25—27 years, 22.5% from 31—33 years and 20% from 28—30 years.

The Paired 't' test analyses for the pre test and post test variable for the Neck disability index for measuring disability in chronic neck pain which is shown in table II and III. Both the groups shows a significant difference between the pre test and post test values. The 't' value for the Group A is 10.2, the 't' value for the Group B is 29.71.

The unpaired 't' test analysis for the Post test variables for Both groups for the Neck disability index for measuring disability in chronic neck pain is shown in the table VII. There was a significant difference shown between the Groups. Group B subjects show superior to that of Group A. The 't' value for the post test variables for both groups is 17.13.

The Paired 't' test analyses for the pre test and post test variable for the Neck muscle endurance measured with Pressure bio feedback unit is shown in table IV and V. Both the groups show a significant difference between the pre test and post test values. The 't' value for the Group A is 11.019, the 't' value for the Group B is 16.157.

The unpaired ‘t’ test analyses for the Post test variables for Both groups measuring Neck muscle endurance using Pressure bio feedback unit is shown in table IX. There was a significant difference shown between the Groups. Group B subjects show superior to that of Group A. The ‘t’ value for the post test variables for both groups is 9.668.

VI DISCUSSION

The purpose of the study is is to find the efficacy of neck stabilization exercises in the improvement of muscle endurance and function in subjects with chronic neck pain. 40 subjects with chronic neck pain were selected for the study and divided into two equal groups. 20 subjects in each group. Group A subjects underwent Conventional neck exercises where as Group B subjects underwent Craniocervical flexion exercises. The study was done for duration of 8 weeks, following that the disability and the neck muscle endurance were found.

The most recent population-based data on chronic neck pain list lifetime prevalence at around 13% to 14%. In general, work involving repetitive and forceful movements, as well as awkward postures of the head and neck, particularly when found in combination, is associated with the development of a musculoskeletal neck disorder, with odd ratios ranging from 1.5 to 5.7.

In view of this high prevalence, it is important to identify the main determinants of neck pain and, especially, the risk factors that are potentially modifiable. Occupational activities have sometimes been implicated as cause of neck disorders (Hagberg M, et al., 1987, 1995, Bernard B 1997). A recent review concluded that there was “some evidence” for a relation between neck pain and several factors, including neck flexion, arm force, arm posture, duration of sitting, twisting or bending, hand-arm vibration, and workplace design (Ariens GAM, et al., 2000).

A sustained forward flexion posture of the spine has been associated with increased cervical compressive loading and a creep response in the connective tissue. It would not be unreasonable to consider that a sustained forward head posture associated with prolonged sitting could aggravate, if not initiate, neck pain. There is some evidence that has linked prolonged static posture with increased muscle loading and subsequent risk for the development of symptoms in the upper body.

A reduced ability to maintain an upright posture of the cervical spine when distracted during sitting might be considered as a measure of impairment in the postural supporting muscles during a functional task, an outcome that can be easily replicated clinically.

Overall studies indicate that compared to normal subjects patients suffering from neck-related disorders present with significant reduction in cervical muscle strength, whereas women are weaker than men by about 40%. Evaluation of the strength of neck musculature is an important component of the total assessment of the neck-injured patient. Neurological deficits, pain, disuse, trauma, apprehension, and joint dysfunction can contribute strength deficits of various muscles in neck-injured patients. (Dvir Z, Prushansky T. 2008).

Pain may prevent full effort during strength tests and hence the production of maximal force. Thus in patients with chronic neck pain the results do not always describe true maximal strength, but rather the patients ability to bare strain, which may considerably be influenced by their painful condition.

The results of the present study suggest that rehabilitation in cases of chronic neck pain should aim at raising tolerance to mechanical strain. (Ylinen J, et al., 2004).

Group A subjects underwent conventional neck exercises which shown a mild improvement. Paired ‘t’ test shown a greater improvement between the Pre test and Post test variables.

Exercise therapy is a widely used treatment for neck pain. There appears to be a role for exercises in the treatment of neck pain. There is limited evidence of benefit for stretching and strengthening exercises for neck disorder with headache. There is limited evidence of benefit for active range-of-motion exercises or a home exercise program for acute mechanical neck disorder including whiplash associated disorder. (Kay TM et al., 2005).

Exercise to improve the performance of the cervical spine muscles has been shown to be an effective means of alleviating chronic neck pain (O'Leary S et al., 2009, Sterling M et al., 2003). Although weakness of anterior cervical muscles is postulated to contribute to persistent neck pain in patients with mechanical neck pain, quantization of weakness has never been reported. (Silverman JL, et al., 1991).

Over the last decade, functional impairment of suboccipital and deep cervical flexor muscles, and cervical mechanoreceptive dysfunction, has been thought to affect proprioception in neck of patients with chronic cervical pain (Rix GD et al., 2001). Neck pain may alter proprioceptive function, there is no

clear consensus in the literature. Chronic neck pain may be linked to reduced cervicocephalic kinesthetic sensibility and postural balance (Michaelson P et al., 2003, Treleaven J et al., 2005).

From a general functional perspective the role of the neck muscles can be seen as a means by which the head moves and maintains a variety of positions allowing efficient use of the heads sensory systems. It has been argued that the demands placed on the neck muscles to achieve this function are best replicated by exercises that facilitate precision and endurance at low and moderate contraction intensities (O'Leary et al 2009).

Group B subjects underwent Cranio cervical flexion exercises has shown a mild improvement. Paired ‘t’ test shows a greater improvement between the Pre test and Post test variables. The results suggest that improved proprioceptive acuity following intervention with the exercise protocol which may occur through an improved quality of cervical afferent input or by addressing input through direct training of relocation sense. (Gwendolen Jull et al., 2007).

Weakness of the cervical flexor muscles occurs secondary to reflex inhibition via the muscle spindle system. A lack of inhibition of the cervical extensors keeps these muscles in spasm.(Olsen LS, et al., 2000). This weakness, in turn, predisposes the patient to develop a head forward posture which causes persistent chronic pain in the neck region. (Flor H et al., 2001).

Cervicocephalic kinesthetic sensibility is week in patients with chronic cervical pain compared to healthy subjects. (Haughie L, et al.,1998). This finding justifies the use of exercises in aiming to improve the proprioception of neck in rehabilitation program for cervicalgic patients. (Koskimies K et al., 2000). There is evidence to support that there is a significant relation between neck pain and cervical mobility, consequently, it will influence the functional activity, mood and work state.

The exercise program intended to improve postural control, strength, muscle length as well as kinesthetic accuracy. Harms-Ringdahl and Ekholm1986 have shown that they held the head between full flexion and upright, leading to overuse of cervical erector spinae to maintain head in position. This constant contraction of erector spinae accompanied by weakness of anterior cervical flexor muscles leading to chronic neck pain. (Silverman JL, 1981, Richard LA: 1999, Falla D 2003). So strengthening of weak muscles and stretching of extensors improved both pain and cervical mobility. (Gross AR, et al., 2000, Goodman R et al., 2000).

Brosseau et al., 2001, postulated that therapeutic exercises that included proprioceptive reeducation demonstrated higher significant improvement in both pain and functional status.

Adaptations of the neuromuscular system to training appear to be related specifically to the characteristics of the exercise, referred to as “specificity of training.”. (Jull G, et al., 2002). Changes in muscle performance may be specific to exercise characteristics, such as movement pattern, velocity of contraction, type of contraction, and joint angle. (Kanehisa H et al., 1983, Lindh M 1979.)

Craniocervical Flexors Endurance Training is effective in improving pain and disability in patients with cervical spondylosis. The effect of conventional Isometric Exercises cannot be neglected. It is suggested that these can be integrated into the rehabilitation regimen once there is reestablishment of muscular balance between the deep segmental and superficial cervical flexor muscles.(Gupta Shweta et al., 2010).

Study showed that people with chronic neck pain demonstrate a reduced ability to maintain an upright posture when distracted. Following intervention with an exercise program targeted at training the craniocervical flexor muscles, subjects with neck pain demonstrated an improved ability to maintain a neutral cervical posture during prolonged sitting. (Deborah Falla et al., 2007).

The importance of neck strengthening exercises, as part of the management of this patient group, has also been highlighted by findings that motor deficits can be identified early in the history of patients with neck pain and do not automatically return to normal once the patient’s symptoms subside or resolve (Jull 2002, Sterling 2003). However, consensus on the best exercises

and exercise parameters to facilitate the return of optimal motor control has yet to be reached.

Falla et al., 2003 recently demonstrated that the deep neck flexors are increasingly active during craniocervical flexion (chin tuck). Endurance deficiencies of the deep cervical flexors are associated with pain, increased lordosis, and headache. The deep neck flexors muscles are small stabilizing muscles located on the anterior and anterolateral surfaces of the cervical spine deep to Sternocleidomastoid muscles. The location of the deep neck flexors suggests that they potentially play an important role in stabilizing the cervical spine.

It is theorized that when muscle performance is impaired, the balance between the stabilizers on the posterior aspect of the neck and the deep neck flexors will be disrupted, resulting in loss of proper alignment and posture, which is then likely to contribute to cervical impairment.

VII SUMMARY AND CONCLUSION

The purpose of the study is to find the efficacy of neck stabilization exercises in the improvement of muscle endurance and function in subjects with chronic neck pain. 40 subjects with chronic neck pain were selected for the study and divided into two equal groups. The subjects were selected using simple random sampling method. All the subjects selected were divided into two equal groups, 20 subjects in each. Group A subjects underwent conventional neck exercises where as Group B subjects underwent Cranio cervical flexion exercises. The study was done for duration of 8 weeks, treatment was applied for thrice weekly, a clear exercise schedule was given to every individual participants.

Outcome measured used in the study are Disability and Muscle endurance. The tools used are neck disability index and pressure bio feedback.

The pre test of the outcome was measured before the initiation of the therapy, and the post test outcomes were measured after 8 weeks. The student ‘t’ test was used to find out the significant difference in the improvements of the treatment.

Based on the statistical analysis the subjects in Group B shown a marked improvement in muscular endurance as well as significant reduction of disability when compared with the subjects in Group A.

Conclusion:

1. There is a significant improvement in muscular endurance in both the groups.
2. There is a significant reduction in neck disability in both the groups.
3. When compared with Group A (Control group), Group B showed a marked improvement on muscle endurance.
4. When compared with Group A (Control group), Group B showed a marked Reduction of neck disability as measured with neck disability index.

So this study concludes that the disability following neck pain and muscular endurance of neck were significantly improved through application of craniocervical flexion exercises than conventional neck exercises.

VIII LIMITATIONS AND RECOMMENDATIONS

LIMITATION OF THE STUDY

- The study was done for a short duration, long-term study need for further explorations.
- Intra rater and Inter rater reliability is not tested.
- No standard protocol of treatment was used for this study.
- Long term effect of exercises was not found.
- Certain factors like climate conditions, nutrition, time of testing, psychological factors, regular activities of daily living could not be controlled during the testing period.
- Only desk top workers are focused in this study.

FUTURE RECOMMENDATIONS

- ✓ Other work related musculoskeletal injuries can be considered in future.
- ✓ Study recommends comparison of various manual techniques in treatment of low back pain.
- ✓ Long term effect of ergonomic exercises and work station modification has to be analyzed in future.
- ✓ Similar study can be done for neck pain
- ✓ Other professionals are also included for this similar study.
- ✓ Laptop users can included in future studies.

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X.APPENDIX

APPENDIX-I

NECK DISABILITY INDEX

The Neck disability index is an instruct to assess the neck pain complaints. It was developed from oswestry index for back pain disability index. The authors are from the Canadian memorial chiropractic college in Toronto, Canada.

The NDI has become a standard instrument for measuring self-rated disability due to neck pain and is used by clinicians and researchers alike.

Each of the 10 items is scored from 0 - 5. The maximum score is therefore 50. The obtained score can be multiplied by 2 to produce a percentage score. Occasionally, a respondent will not complete one question or another. The average of all other items is then added to the completed items.

Pain instructions:

The questionnaire has been desired to give the doctor information as to how your neck pain affected your ability to manage his everyday life. Please answer every section which applies to you. We realize you may consider that two of the statements in any one section relate to you which most closely describes your problem.

QUESTION 1: Pain Intensity

- A. I have no pain at the moment. (0 pts)
- B. The pain is mild at the moment. (1 pt)
- C. The pain comes & goes & is moderate. (2 pts)
- D. The pain is moderate & does not very much. (3 pts)
- E. The pain is severe but comes & goes. (4 pts)
- F. The pain is severe & does not very much. (5 pts)

QUESTION 2: Personal Care (Washing, Dressing etc.)

- A. I can look after myself without causing extra pain. (0 pts)
- B. I can look after myself normally but it causes extra pain. (1 pts)
- C. It is painful to look after myself and I am slow & careful. (2 pts)
- D. I need some help but manage most of my personal care. (3 pts)
- E. I need help every day in most aspects of self-care. (4 pts)
- F. I do not get dressed; I wash with difficulty and stay in bed. (5 pts)

QUESTION 3: Lifting

- A. I can lift heavy weights without extra pain. (0 pts)
- B. I can lift heavy weights, but it causes extra pain. (1 pt)
- C. Pain prevents me from lifting heavy weights off the floor, but I can if they are conveniently positioned, for example on a table. (2 pts)

- D. Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned. (3 pts)
- E. I can only lift very light weights. (4 pts)
- F. I cannot lift or carry anything at all. (5 pts)

QUESTION 4: Reading

- A. I can read as much as I want to with no pain in my neck. (0 pts)
- B. I can read as much as I want with slight pain in my neck. (1 pts)
- C. I can read as much as I want with moderate pain in my neck. (2 pts)
- D. I cannot read as much as I want because of moderate pain in my neck. (3 pts)
- E. I cannot read as much as I want because of severe pain in my neck. (4pts)
- F. I cannot read at all because of neck pain. (5 pts)

QUESTION 5: Headache

- A. I have no headaches at all. (0 pts)
- B. I have slight headaches that come infrequently. (1 pt)
- C. I have moderate headaches that come in-frequently. (2 pts)
- D. I have moderate headaches that come frequently. (3 pts)
- E. I have severe headaches that come frequently. (4 pts)
- F. I have headaches almost all the time. (5 pts)

QUESTION 6: Concentration

- A. I can concentrate fully when I want to with no difficulty. (0 pts)
- B. I can concentrate fully when I want to with slight difficulty. (1 pts)
- C. I have a fair degree of difficulty in concentrating when I want to. (2pts)
- D. I have a lot of difficulty in concentrating when I want to. (3 pts)
- E. I have a great deal of difficulty in concentrating when I want to. (4 pts)
- F. I cannot concentrate at all. (5 pts)

QUESTION 7: Work

- A. I can do as much work as I want to. (0 pts)
- B. I can only do my usual work but no more. (1 pt)
- C. I can do most of my usual work but no more. (2 pts)
- D. I cannot do my usual work. (3 pts)
- E. I can hardly do any work at all. (4 pts)
- F. I cannot do any work at all. (5 pts)

QUESTION 8: Driving

- A. I can drive my car without neck pain. (0 pts)
- B. I can drive my car as long as I want with slight pain in my neck. (1 pt)
- C. I can drive my car as long as I want with moderate pain in my neck. (2pts)

- D. I cannot drive my car as long as I want because of moderate pain in my neck. (3 pts)
- E. I can hardly drive my car at all because of severe pain in my neck. (4pts)
- F. I cannot drive my car at all. (5 pts)

QUESTION 9: Sleeping

- A. I have no trouble sleeping. (0 pts)
- B. My sleep is slightly disturbed (less than 1 hour sleepless). (1 pt)
- C. My sleep is mildly disturbed (1-2 hours sleepless). (2 pts)
- D. My sleep is moderately disturbed (2-3 hours sleepless). (3 pts)
- E. My sleep is greatly disturbed (3-5 hours sleepless). (4 pts)
- F. My sleep is completely disturbed (5-7 hours sleepless). (5 pts)

QUESTION 10: Recreation

- A. I am able to engage in all recreational activities with no pain in my neck at all. (0 pts)
- B. A am able to engage in all recreational activities with some pain in my neck. (1 pt)
- C. I am able to engage in most, but not all, recreational activities because of pain in my neck. (2 pts)

- D. I am able to engage in only a few of my usual recreational activities because of pain in my neck. (3 pts)
- E. I can hardly do any recreational activities because of pain in my neck. (4 pts)
- F. I cannot do any recreational activities at all. (5 pts)

Simply add the score from your answers to the questions above and check the sum against the score.

Raw score	Level of disability
0-4	No disability
5-14	Mild disability
15-24	Moderate disability
25-34	Severe disability
35-50	Completely disability

APPENDIX II

PRESSURE BIO FEEDBACK UNIT

Pressure Bio feedback unit consist of an inelastic, three section air filled bag, which is inflated to fill the space between the target body area and a firm surface, and a pressure dial for monitoring the pressure in the bag for feedback on position. The bag inflated to an appropriate level for the purpose and the pressure recor\ded. Quite simply, movement of the Neck off the bag results in a decrease in pressure, while movement of the Neck onto the bag results in an increase in pressure. (Chattanooga Group, a Division of Encore Medical, 2002).

Pressure biofeedback objectively obtained through the use of endurance testing of the deep cervical flexor muscles of the Neck. The supine position will be used to test the for endurance of Deep cervical flexor muscles of the Neck (Stabilizer Manual Chattanooga Group Inc.,4717 Adams Road, Hixson TN 37343, USA). Apparatus is simple to operate and the visual feedback optimizes muscle control in the patient and understanding of the principles of attaining neutral alignment. The device itself registers changing pressure in an air filled pressure cell. This allows neck movement, especially cranio cervical movement, to be detected during exercise. A stopwatch was used to measure the maximal contraction time (s) of deep flexor muscles of the Neck.

APPENDIX-III

CRANIOCERVICAL FLEXION EXERCISES

The craniocervical flexion exercises targets the deep cervical flexor muscles of the upper cervical region, the longus colli and longus capitus muscles, rather than superficial flexors muscles, the sternocleidomastiod and anterior scalene, which flex the neck but not the head.

PROCEDURE:

IN SUPINE POSITION:

Craniocervical flexion exercises are done both supine and sitting position. In supine position patients are instructed to tuck their chin and lift the head off the table. Ask the patients to maintain this position. The exercises can be done 10 repetitions with maximum ability. Over activity of the SCM and scalene muscles should be avoided. (Multiple repetitions do without fatigue and head shaking).

IN SITTING POSITION:

In sitting position sit with erect position and head and neck should be in straight position. Patients instructed to tuck their chin. They should try to maintain this position. The exercises can be done 10 repetitions with maximum

ability. If over activity of the SCM and scalene muscles should be avoided. (Multiple repetitions do without fatigue and head shaking).

IN AGAINST THE WALL:

In Against the wall stand on erect position and head and neck should be in straight position. Patients instructed to tuck their chin with head against wall.They should try to maintain this position. The exercises can be done 10 repetitions with maximum ability. If over activity of the SCM and scalene muscles should be avoided. (Multiple repetitions do without fatigue and head shaking).

APPENDIX IV

CONVENTIONAL NECK EXERCISES

A conventional neck exercises consists of a progressive resisted exercise program for the neck flexors. Isometric neck exercises are given to improve the strength of the neck muscles.

NECK FLEXORS:

- Sit on the chair with comfortable positions.
- Hold both hands against the front of your head such as it covers frontal area.
- Use your hand to resist the flexion of the neck and hold it near neutral maintain isometric contraction for 10-15 seconds.
- Repeat for 10 times.

NECK EXTENSORS:

- Sit on the chair with comfortable positions.
- Hold both hands against the back of your head such as it covers occiput area.
- Use your hand to resist the extension of the neck and hold it near neutral maintain isometric contraction for 10-15 seconds.
- Repeat for 10 times.

NECK LATERAL FLEXORS:

- Sit on the chair with comfortable positions.
- Hold both hands against the side of your head such as it covers temporal area.
- Use your hand to resist the side flexion of the neck and hold it near neutral maintain isometric contraction for 10-15 seconds.
- Repeat for 10 times.

APPENDIX V

NECK DISABILITY INDEX

GROUP A

TEST VALUES

S.NO	PRE	POST
1	32	25
2	33	23
3	33	26
4	28	25
5	32	21
6	30	25
7	31	27
8	32	22
9	35	23
10	35	23
11	33	19
12	35	25
13	32	26
14	28	26
15	33	25
16	30	27
17	31	21
18	34	20
19	33	24
20	31	20

NECK DISABILITY INDEX

GROUP B

TEST VALUES

S.NO	PRE	POST
1	27	14
2	33	10
3	31	16
4	33	11
5	33	10
6	33	11
7	34	10
8	29	7
9	31	9
10	32	6
11	35	10
12	32	10
13	31	10
14	31	12
15	33	13
16	31	12
17	29	12
18	32	11
19	34	13
20	33	14

PRESSURE BIO FEEDBACK UNIT

GROUP A

TEST VALUES

S.NO	PRE	POST
1	4	7
2	5	7
3	6	7
4	5	8
5	4	6
6	3	5
7	4	6
8	3	6
9	2	6
10	3	5
11	4	6
12	3	6
13	5	6
14	4	6
15	4	5
16	3	5
17	4	6
18	5	6
19	4	5
20	3	6

PRESSURE BIO FEEDBACK UNIT

GROUP B

TEST VALUES

S.NO	PRE	POST
1	4	10
2	5	9
3	5	8
4	4	8
5	3	10
6	4	9
7	5	9
8	4	9
9	3	10
10	4	9
11	5	8
12	4	8
13	3	9
14	4	10
15	4	8
16	4	9
17	4	7
18	5	8
19	4	8
20	3	7

APPENDIX VI

CONSENT FORM

This is to certify that I _____ freely and voluntarily agree to participate in the study **"EFFICACY OF NECK STABILIZATION EXERCISES IN THE IMPROVEMENT OF MUSCLE ENDURANCE AND FUNCTION IN SUBJECTS WITH CHRONIC NECK PAIN".**

I have been explained about the procedures and the risks that would occur during the study.

Participant:

Witness:

Date:

I have explained and defined the procedure to which the subject has consented to participate.

Researcher:

Date: