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Riddhi Dinesh Pasad
PES Modern College of Physiotherapy, Shivajinagar, Pune, Maharashtra, India

Dr. Abhijit N Satralkar
PES Modern College of Physiotherapy, Shivajinagar, Pune, Maharashtra, India

Corresponding Author:
Riddhi Dinesh Pasad
PES Modern College of Physiotherapy, Shivajinagar, Pune, Maharashtra, India

Effectiveness of Feldenkrais exercise on chronic neck pain, forward head posture and cervical spine range of motion in young patients with upper cross syndrome at the end of 3 weeks - An experimental study

Riddhi Dinesh Pasad and Dr. Abhijit N Satralkar

Abstract

Objective: This study was undertaken to compare the Effectiveness of Feldenkrais Exercise on Chronic Neck Pain, Forward Head Posture and Cervical Spine Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.

Background: Upper cross syndrome (UCS) is a condition which mainly arises as a result of muscular imbalances that usually develops between tonic and phasic muscles. Tonic muscles are the muscles that most of the time become tight i.e. over facilitated whereas phasic muscles are the muscles that are shortened and inhibited. Upper Crossed Syndrome involves rounded shoulders and forward head posture which results in reduced craniovertebral angle, cervical spine range of motion and increased incidence of chronic neck pain due to muscular imbalances. A high incidence of postural abnormalities (forward head=66%, kyphosis=38%, right rounded shoulder=73%, left rounded shoulder=66%) was observed in the TCS [thoracic cervical shoulder] region in a group of healthy subjects between the ages of 20 and 50 years. The Feldenkrais Method improves the way in which the brain coordinates posture and movement. By engaging the brains ability to relearn and change, the Feldenkrais method improves the exchange of relevant information between the nervous system and muscles, and as a result movement becomes more comfortable.

Outcome Measures: Visual analogue Scale (VAS), Craniovertebral angle measurement (CVA), Cervical Spine ROM.

Method: This study included 40 subjects having Upper Cross Syndrome with 20 subjects in each group. Group A received Feldenkrais Exercise along with Conventional Treatment and Group B received only Conventional Treatment with 5 treatment sessions per week over a period of 3 weeks.

Result: Intergroup analysis was done using unpaired t-test which showed significant improvement in Group A subjects (Feldenkrais Exercise along with Conventional Treatment) for reducing chronic neck pain ($p<0.001$), improving forward head posture ($p<0.001$) and improving cervical spine range of motion ($p<0.001$) post treatment.

Conclusion: The study showed significant difference in reducing chronic neck pain, improving forward head posture and in improving cervical spine range of motion in both the group. Inter group analysis showed that Feldenkrais Exercise along with Conventional Treatment was more effective than only Conventional Treatment in reducing chronic neck pain, improving forward head posture and improving cervical spine range of motion in young patients with upper cross syndrome at the end of 3 weeks.

Keywords: Upper Cross Syndrome, Forward Head Posture, Feldenkrais Exercise, Awareness through Movement, Craniovertebral angle.

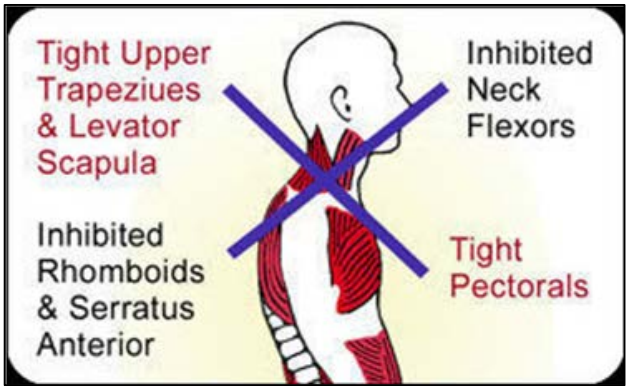
Introduction

Upper crossed syndrome is a common postural dysfunctional pattern that describes the dysfunctional tone of the musculature of the shoulder girdle/cervicothoracic region of the body. This condition is given its name because an "X", in other words a cross, can be drawn across the upper body. One arm of the cross indicates the muscles that are typically tight/overly facilitated and the other arm of the cross indicates the muscles that are typically weak/ overly inhibited [1]. Upper-Crossed Syndrome (UCS) is also referred to as proximal or shoulder girdle crossed syndrome. In UCS, tightness of the upper trapezius and levator scapula on the dorsal side crosses with tightness of the pectoralis major and minor.

Weakness of the deep cervical flexors ventrally crosses with weakness of the middle and lower trapezius. This pattern of imbalance creates joint dysfunction, particularly at the Atlanto-occipital joint, C4-C5 segment, cervicothoracic joint, glen humeral joint, and T4-T5 segment. Specific postural changes are seen in UCS, including forward head posture, increased cervical Lordosis and thoracic kyphosis, elevated and protracted shoulders, and rotation or abduction and winging of the scapulae. These postural changes decrease glen humeral stability as the glenoid fossa becomes more vertical due to serratus anterior weakness leading to abduction, rotation, and winging of the scapulae. This loss of stability requires the levator scapula and upper trapezius to increase activation to maintain glen humeral centration [2].

Muscles involved in upper crossed syndrome are

- Short and Tight (Overactive) Muscles: Sub occipital muscles, upper trapezius, Levator scapulae, pectoralis major and minor.
- Weak and Lengthened (Inhibited) Muscles: Deep neck flexors, middle and lower trapezius, rhomboids and serratus anterior.



A high incidence of postural abnormalities (forward head=66%, kyphosis=38%, right rounded shoulder=73%, left rounded shoulder=66%) was observed in the TCS [thoracic cervical shoulder] region in a group of healthy subjects between the ages of 20 and 50 years. A relationship between the severity of postural deviations and the severity and frequency of pain in the TCS region was not found. A significantly higher incidence of pain, however, was found in subjects with more severe postural abnormalities" [3].

The primary cause of upper crossed syndrome is chronic postural stress to the upper body. Most tasks that we perform require us to work down and in front of ourselves, causing us to flex the upper spine, protract the shoulder girdles, and medially (internally) rotate the arms at the glen humeral joints. Examples include working at a keyboard, using a smart phone, reading a book in our lap, or tending to a baby (Figure 2). Maintaining this posture necessitates the contraction and shortening of certain muscles and the inhibition and lengthening of others most cases develop through poor posture, specifically sitting or standing with the head forward for prolonged periods and a hunched upper back. Activities that promote this postural position include: computer and laptop use, driving, watching TV, cell phone browsing, texting, app, or game use, reading, biking [1].

The first and most obvious sign of upper crossed syndrome is the characteristic postural dysfunction of protracted scapulae, medially rotated humeri, hyperkyphotic (overly flexed) upper thoracic spine, and a protracted/anteriorly held head, which is created by hypolordosis or even kyphosis (excessive flexion) of the lower cervical spine, hyperlordosis (excessive extension) of the upper cervical spine and head, and anterior translation of the head upon the atlas. The client will usually feel restriction of the following motions: retraction of the scapula, lateral rotation of the arm, extension of the upper thoracic spine, and retraction of the head. Efficiency of breathing will also become compromised because the postural collapse forward into thoracic flexion makes it more difficult to open the thoracic cavity and fill the lungs with air [4].

The imbalanced muscles associated with UCS put stress on the surrounding muscles, tendons, bones, and joints, causing most people to develop symptoms that include:

- Headaches
- Neck pain or strain in the back of the neck
- Chest pain and tightness
- Pain in the upper back, especially the shoulders
- Difficulty sitting, reading, watching television, or driving for long periods of time
- Restricted range of motion in the neck or shoulders
- Numbness, tingling, and pain in the upper arms [5].

Feldenkrais exercise

The method was developed by Dr. Moshe Feldenkrais (1904-1984), an Israeli born in Russia. The Feldenkrais Method is a form of sensory motor education. It helps to restore proprioception and coordinated movement, by combining an understanding of complexities of movement with the understanding of learning process. This leads to improved function and reduced tension and pain [10].

The Feldenkrais Method is the way of learning – learning to move more freely and easily, to carry less stress in your body, to stop doing the things that cause pain. Through gentle movement and directed attention, it enhances your self-awareness to put you back in touch with yourself with the fluid, easy movement that is your birth right. We call this kind of learning as somatic education.

Awareness through Movement (ATM) and Functional Integration (FI) are variants of the Feldenkrais Technique. By slowing down and noticing how your body function, you gain feedback upon which your nervous system can build enhanced self-awareness and improved functioning.

In Awareness through Movement (ATM) you attend to and learn from the feedback provided by your own movement, while in functional integration that feedback is enhanced by the practitioner's trained awareness and skilled touch. The Feldenkrais Method does not treat medical conditions, it helps you learn to become more self-aware and to move in more efficient, less painful ways. This can help you reduce limitations and discomfort caused by the way you organise your movements and your ways of being in the world [10].

Various studies have been performed using Feldenkrais Method Awareness through Movement on pain, anxiety, balance, mobility, gait performance, hamstring length, head posture, progressive muscle relaxation, quality of life, etc.

Studies reported statistically significant, positive benefits compared to control interventions on pain and anxiety reduction, improved balance, mobility and gait performance, increase in the length of hamstring muscle, improved body image, progressive muscle relaxation and improved quality of life.

Benefits of Feldenkrais exercise

The Feldenkrais Method improves the way in which the brain coordinates posture and movement. By engaging the brains ability to relearn and change, the Feldenkrais method improves the exchange of relevant information between the nervous system and muscles, and as a result movement becomes more comfortable. Although Feldenkrais exercise are not aerobic, they provide many of the benefits commonly associated with exercise, including increased production of synovial fluid that act as a lubricant inside your joints, increased flexibility, better circulation, improved respiratory function better coordination and balance, and an overall sense of well-being [6].

Need of study

Each year, Millions of people suffer from a condition known as Upper Cross Syndrome. Sedentary lifestyles, excessive hours working at a desk or computer, texting, postural changes and even improper weight lifting can lead to Upper Cross Syndrome. It is a problem that many people suffer from, but often don't identify. As various studies have been carried out to check the effectiveness of physiotherapy treatments on Upper Cross Syndrome, there are no studies which emphasis on awareness through movement or learning from the feedback provided by your own movement which improves the way in which brain coordinates posture and movement and restores proprioception.

Feldenkrais exercise facilitates the learning of strategies for improving organization and coordination of body movement by developing spatial and kinesthetic awareness of body-segment relationships at rest and during motion.

Thus the need of this study is to find the effectiveness of Feldenkrais exercise on chronic neck pain, cervical range of motion and forward head posture in young patients with upper cross syndrome

Aim

- To find the effectiveness of Feldenkrais Exercise on Chronic Neck pain, Forward Head Posture and Cervical Spine Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.

Objective

- To find the effectiveness of Feldenkrais Exercise on Chronic Neck Pain, Forward Head Posture and Cervical Spine Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.
- To find the effectiveness of Conventional Treatment on Chronic Neck Pain, Forward Head Posture and Cervical Spine Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.
- To compare the effectiveness of Feldenkrais Exercise and Conventional Treatment on Chronic Neck Pain, Forward Head Posture and Cervical Spine Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.

Hypothesis

- **Null Hypothesis:** There will be no difference between Feldenkrais Exercise and Conventional Treatment on Chronic Neck Pain, Cervical Range of Motion and Forward Head Posture in young patients of Upper Cross Syndrome at the end of 3 weeks.
- **Alternate Hypothesis**

H1A: Feldenkrais Exercise will be more effective than Conventional Treatment on Chronic Neck Pain in young patients with Upper Cross Syndrome at the end of 3 weeks.
H1B: Feldenkrais Exercise will be more effective than Conventional Treatment on Cervical Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.
H1C: Feldenkrais Exercise will be more effective than Conventional Treatment on Forward Head Posture in young patients with Upper Cross Syndrome at the end of 3 weeks.

H2A: Conventional Treatment will be more effective than Feldenkrais Exercise on Chronic Neck Pain in young patients with Upper Cross Syndrome at the end of 3 weeks.
H2B: Conventional Treatment will be more effective than Feldenkrais Exercise on Cervical Range of Motion in young patients with Upper Cross Syndrome at the end of 3 weeks.
H2C: Conventional Treatment will be more effective than Feldenkrais Exercise on Forward Head Posture in young patients with Upper Cross Syndrome at the end of 3 weeks.

Review of Literature

1) Leonard Joseph Henry *et al.* July (2015)

Conducted a study on "Feldenkrais method and movement education-An alternate therapy in musculoskeletal rehabilitation" This current review paper made an effort to provide conventional scientific explanation about this method that suits the medical paradigm. In this paper, a brief introduction followed by description of the technique is given with a clinical example toward its application. Furthermore, the neurophysiologic explanation and mechanical concepts are provided in the conventional scientific manner. Indications, contra-indications and clinical implications were also discussed to accommodate the clinical practice in musculoskeletal rehabilitation. Concluded that Feldenkrais exercise can be used as an alternative therapy in musculoskeletal rehabilitation for movement education.

2) Lars-Olov Lundqvist *et al.* (2014)

Conducted a study on "Effects of Feldenkrais Method on chronic neck pain/ scapular pain in people with visual impairment: A randomized controlled trial with one year follow-up". 61 participants with visual impairment and non-specific chronic neck/scapular pain were taken. Participants were randomly assigned to the Feldenkrais method group or untreated control group. Patients in the treatment group underwent one 2 hour Feldenkrais session per week for 12 consecutive weeks. Results showed that patients undergoing Feldenkrais method reported significantly less pain than the controls according to VAS and Visual, Musculoskeletal and Balance complaints questionnaire ratings at post treatment follow-up and 1 year follow-up. There were no significant differences regarding the Medical Outcome Study 36-Item Short Form Health Survey bodily pain scale ratings. From this study, it was concluded that Feldenkrais method is an effective intervention for chronic neck/scapular pain in patients with visual impairment.

3) June Quek *et al.* July (2013)

Conducted a study on "Effects of thoracic kyphosis and forward head posture on cervical range of motion in older adults".51older adults with cervical spine dysfunction- that is cervical pain with or without referred pain, numbness or

paraesthesia- participated. Pain related disability was measured using the neck disability index. Thoracic kyphosis was measured using flexicurve. Forward head posture was assessed via the craniovertebral angle measured from a digitized, lateral- view photograph of each subject. Cervical ROM- namely upper and general cervical rotation and flexion was measured by the cervical ROM device. Results showed that greater thoracic kyphosis was significantly associated with lesser CVA. Results also showed that FHP mediated the relationship between thoracic kyphosis and cervical ROM.

4) Ian Ahearn *et al.* April (2011)
Has conducted a study on "Kinesio tape's effect on musculature associated with upper cross syndrome". A convenience sample of 20 Logan College of chiropractic students of normal BMI were used for the purpose of studying the effects of Kinesio tape on upper cross syndrome. A surface electromyography reading was taken on the upper and lower trapezius during arm abduction. The EMG was retaken directly after the application of Kinesio tape and then taken again after the participants had worn the tape for 24 hours. It concluded that there is a significantly decrease in the EMG of the upper trapezius from before the Kinesio tape was applied and the EMG 24 hours later. Also, there is a significant increase in the EMG of the lower trapezius from before the tape was applied to 24 hour later and from directly after the tape was applied to 24 hours later.

5) Aliaa A Diab *et al.* September (2011)
Conducted a study on the "Efficacy of forward head correction on the nerve root function and pain in cervical spondylotic radiculopathy: a randomized trail".96 patients with unilateral lower cervical spondylotic radiculopathy and craniovertebral angle measured less than or equal to 50^{o} were randomly assigned to an exercise or a control group. The control group received ultrasound and infrared radiation, whereas the exercise group received a posture corrective exercise programme in addition to ultrasound and infrared radiation. It concluded that forward head posture correction using posture corrective exercise programme in addition to ultrasound and infrared radiation decreased pain and craniovertebral angle and increased the peak-to-peak amplitude of dermatomal somatosensory evoked potentials for C6 and C 7 in cases of lower cervical spondylotic radiculopathy.

6) Michelle James *et al.* (1998)
Conducted a study on the "Effects of Feldenkrais program and relaxation procedures on hamstring length". The current study investigated the effects of the Feldenkrais method on hamstring length.48 healthy undergraduate participants were randomly allocated into either Feldenkrais, relaxation, or control groups. All subjects had their right hamstring measured using a modified active knee extension test prior to the first session, prior to the fourth (final) session, and after the final session of intervention. Two way analysis of variance with time of measurement repeated revealed no significantly differences between the groups.

7) Barbara Brown *et al.* (1996)
Conducted a study on "Effects on Feldenkrais based mobility program on function of a healthy, elderly sample". The purpose of this study was to explore whether a program of mobility exercises, based on Feldenkrais Method, would result in an increase in the range the motion and function, as measured by the Functional Reach (FR), modified Functional Reach, and Timed "Up" and "Go" tests. 28 healthy elderly volunteers participated in the study. The experimental group participated in the program three times a week for six weeks the Timed "Up" and "Go" tests improved significantly in the experimental group when the age was accounted for right ankle dorsiflexion also increased significantly. The FR and modified FR did not demonstrate a significant change. Measurements were taken before and after the six week program. It concluded that Feldenkrais based program may improve function in healthy elderly individuals.

8) Suzanne Ruth, MS, PT *et al.* July (1992)
Conducted study on "Facilitating Cervical Flexion Using Feldenkrais Method: Awareness through Movement" The purpose of this study was to quantify the results of a Feldenkrais method-Awareness through movement-involving a neck flexion task. The study examined 30 normal subjects to determine if a Feldenkrais Awareness through Movement sequence would result in an increase in neck flexion range of motion and if the subjects would indicate significantly lower level of perceived effort post-test. Measurements of range of motion were taken using gravity- based cervical range of motion goniometer. The subjects recorded their perceived efforts on a visual analogue scale. The range of motion were analyzed using a one way ANOVA. The visual analogue scale data were analyzed with a Mann-Whitney U test. The data supported both hypotheses. Based on these findings, further investigations of Feldenkrais method in the treatment of patient appears warranted.

Tools and materials
- ✓ Pen, Paper
- ✓ Digital camera
- ✓ Adhesive tape
- ✓ Universal Goniometer (360^{o}) (Reliability-0.93 and Validity-0.98) [15].
- ✓ Visual Analogue Scale (Reliability 0.94)
- ✓ Plumb Line
- ✓ Consent Forms
- ✓ Assessment Form
- ✓ Image J Tool for measuring craniovertebral angle (Reliability-0.88 to 0.98) [7].

Methodology
- **Study Design:** Pre and post Experimental Study
- **Study Type:** Comparative Study
- **Sample size:** 40
- **Sampling method:** Convenient Sampling
- **Study population:** Upper Cross Syndrome patients
- **Study setting:** OPD, Hospitals in and around city
- **Duration of treatment:** 3 weeks
- **Duration of study:** 6 months

Inclusion Criteria
- Patients diagnosed with upper cross Syndrome
- Both male and female subjects between 20-50 years [3].
- VAS: 1-7

- Cervical Ranges: Flexion<40^0, Extension <50^0, Lateral Flexion<45°, Rotation<70° [15].
- Cranio-vertebral angle less than 50 degrees
- Subjects who had been experiencing neck pain for more than 3 months [8].

Exclusion criteria

- Surgeries of the cervical spine within past 1 year.
- Surgeries or fracture to the shoulder joint [12].
- Cervical instability [12].
- Cervical Radiculopathy
- Thoracic outlet syndrome.
- Subjects taking analgesics and/or muscle relaxants.
- Failing the postural screening.
- Trauma to cervical spine within past 1 year.
- No congenital or acquired musculoskeletal deformities.

Diagnostic criteria

A. Posture evaluation on plumb line

Anterior / Posterior View

- Elevated and protracted shoulders.
- Rotation or abduction and winging of scapulae.

Lateral View

- Forward Head Posture
- Increased cervical Lordosis
- Increased thoracic kyphosis
- A hunched upper back.

B. Screening of Pectoralis major tightness

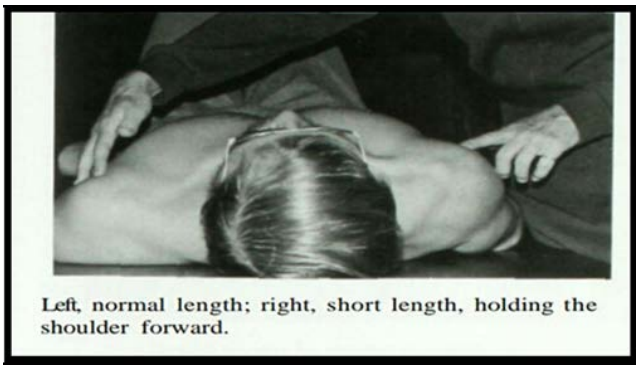
- **For Lower Fibres**
- **Starting Position**: supine, with the knees bent and the low back flat on the table.
- **Test movement for lower (sternal) part**: The examiner places the subject's arm in a position of approximately 135^0 of abduction, with the elbow extended. The shoulder will be in lateral rotation.
- **Normal length**: Arm drops to the table level, with the low back remaining flat on the table.
- **Shortness**: The extended arm does not drop down to table level [9].

For Upper Fibres

- **Starting Position:** Supine, with the knees bent and the low back flat on the table.
- **Test movement for upper (Clavicular) Part:** The examiner places the subject's arm in horizontal abduction, with the elbow extended and the shoulder in lateral rotation (palm upward).
- **Normal length:** Full horizontal abduction, with lateral rotation, the arm flat on the table, and without trunk rotation.
- **Shortness:** The arm does not drop to table level. Limitation may be recorded as slight, moderate, or marked; measured in inches using a ruler to record the number of inches between the table and the lateral epicondyle [9].

C. Screening for Pectoralis Minor Tightness

- **Starting position**: Supine, with the arms at the sides, elbows extended, palms upward, knees bent and lower back flat on the table.
- **Test:** The examiner stands at the head of the table and observes the position of the shoulder girdle. The amount of tightness is measured by the extent to which the shoulder is raised from the table [9].



Left, normal length; right, short length, holding the shoulder forward.

D. Screening for Levator scapulae and upper trapezius tightness

- In a seated position with the arm at the subject's side and elbow flexed to ninety degrees, the researchers evaluated the Levator scapulae and upper trapezius. While the subjects abducted their arm (Figure 2 (Position A), the researcher evaluated for shoulder hike within the first sixty degrees to indicate tight Levator scapulae and upper trapezius respectively (Figure 2 (Position B).

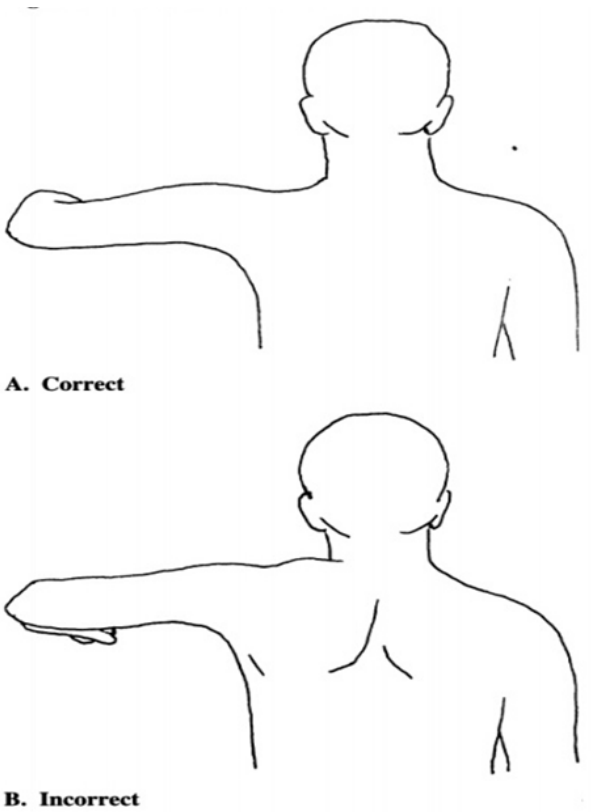


Fig 2: Shoulder Abduction Test

E. Screening for serratus Anterior Weakness (Push up test)

- Subjects conducted the push up test for evaluation of the serratus anterior. The subjects lay prone on a table and performed a push up (Figure 3 (Position A). Evaluation of the scapula for winging off the dorsal surface of the thoracic cage is an indication of weakened and lengthened serratus anterior musculature (Fig 3 Position B).

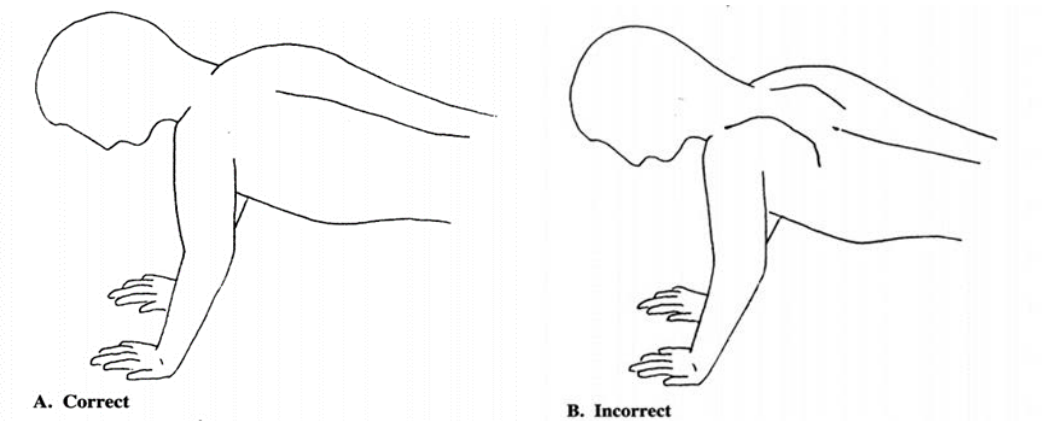


Fig 3: Push-up Test

F. Screening for deep neck flexors Weakness (Janda Test)

- **Janda's Cervical Flexion text** – Evaluation of the deep cervical muscles (patient supine asked to lift his head from the couch and the smoothness of the movement is observed).
- **Janda test:** Patient supine tries to elevate the head from the couch. Normally the lordosis will disappear and the chin will touch the sternum. Otherwise pathological picture shows that the head is lifted with the very tense sternocleidomastoids.

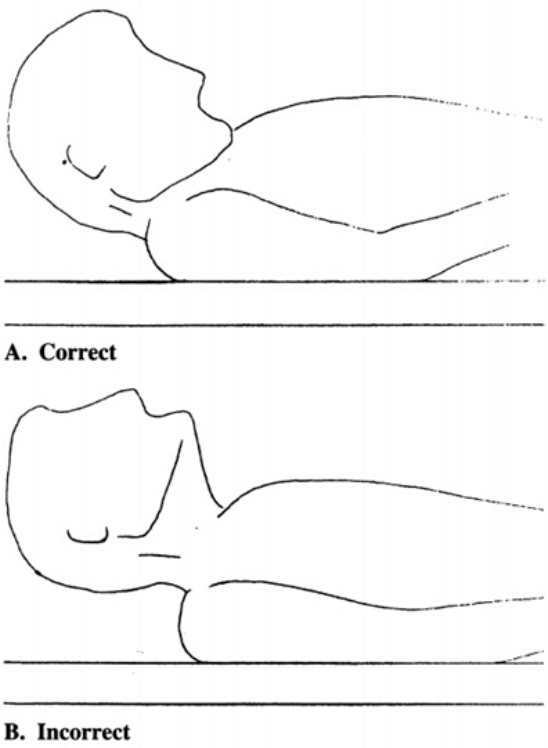


Fig 4: Head/neck Flexion Test

G. Visual Ana log Scale (Vas) (Reliability 0.94)

- It is a horizontal 10 com line with words anchored as "no pain" at one end and "worst pain" at the other end.
- VAS: 1-7

H. Cranio-Vertebral Angle

- Cranio-vertebral angle presented with high test –retest reliability in standing position (ICC=0.92-0.94)
- CVA < 50º
- Procedure: Craniovertebral angle will be measured using a digital camera and data will be assessed using Image J image analysis software (ICC= 0.78-0.99).The digital camera will be set perpendicular to the ground with lens pointing directly parallel and 80 cms away from lateral aspect of subject's shoulder. The subject will be instructed to assume a relax and natural standing position. Subject will be asked to fix their gaze on a mark on a wall directly in front of them. Two body markers will be attached for reference, one on tragus of ear and other on spinous process of C7 vertebra. Lateral photographs of patient's upper body will be taken. Craniovertebral angle will be measured as the angle between the line from tragus of ear to spinous process of C7 vertebra and horizontal line passing through C7 spinous process.
- Patients testing positive for the above diagnostic criteria will be considered as positive for Upper Cross Syndrome.

Outcome Measures

- Visual Analog Scale (VAS) – Pain (RELIABILITY 0.94)
- Cranio-vertebral angle – Forward Head Posture (ICC= 0.92-0.94) [13].
- Goniometry – Cervical Range of Motion (ROM) (Validity for Spine 0.98 Reliability – 0.79- 0.92) [15].

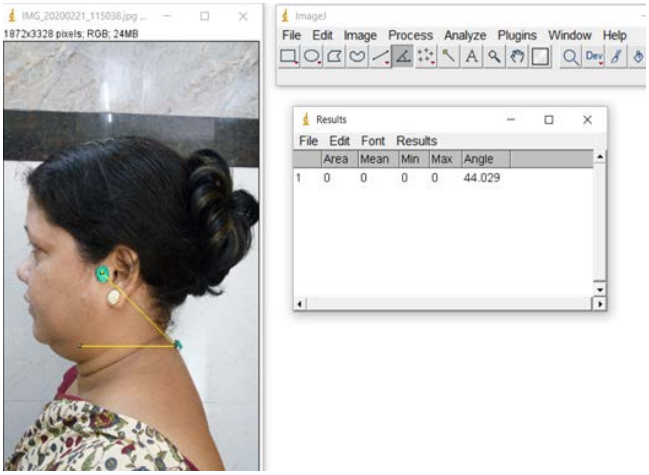
❖ **Visual Analog Scale (Vas)**

- VAS consists of a straight line with the endpoints defining extreme limits such as 'no pain' and 'most severe pain'
- The patient is asked to mark the pain level on the line between the endpoints.
- The distance between 'no pain' and the mark then defines the subject's pain.

❖ **Cranio-Vertebral Angle**

Forward Head Posture can be assessed using a digitized, lateral view photograph of the subject in his /her usual standing posture. Again, to minimize image distortion, a circular spirit level can be placed at the base of the camera to ensure that the camera was perpendicular to the horizontal. Next, the tragus of the subject's ear is marked, and a plastic pointer is attached to the skin overlying the C7 vertebra. Once the photograph is obtained, we use Image J, to measure FHP, quantified by the craniovertebral angle (i.e. the angle between the horizontal line passing through C7

and a line extending from tragus of the ear to C7. FHP measurements showed good test-retest reliability in previous studies (intraclass correlation coefficients ranged 0.88 to 0.98) [7].



Goniometry

A) Cervical Flexion/Cervical Extension

- Center the fulcrum of the goniometer over the external auditory meatus.
- Align the proximal arm so that it is either perpendicular or parallel to the ground.
- Align the distal arm with the base of the nares [15].

B) Cervical Lateral Flexion

- Center the fulcrum of the goniometer over the spinous process of the C7 vertebra.
- Align the proximal arm with the spinous processes of the thoracic vertebra so that the arm is perpendicular to the ground.
- Align the distal arm with the dorsal midline of the head, using the occipital protuberance for reference [15].

C) Cervical Rotation

- Center the fulcrum of the goniometer over the center of the cranial aspect of the head [15].
- Align the proximal arm parallel to an imaginary line between the two acromial processes.
- Align the distal arm with the tip of the nose.

Procedure

Ethical clearance was taken from the ethical committee of the college.

Patients of age between 20-50 years with chronic neck pain were taken into considerations.

From these patients, the Upper Cross Syndrome subjects are selected by proper screening and fulfilling the inclusive and exclusive criteria and were divided into 2 group - Group A & Group B.

Informed consent was taken from each of the patients prior to participation. Patients provided their demographic details prior to the study. All outcome measures was taken at baseline & at the end of the treatment sessions after 3 weeks. Instructions was given to the patients about the techniques performed.

The subject will be explained about the study in detail. Consent will be taken from the patients who are eligible according to the inclusion criteria and wish to participate in the study.

Subjects will be assured that the collected data will not be misused in any form.

Prior to the intervention, outcome measures for neck pain, cervical ranges and forward head posture will be taken.

Patient preparation prior to treatment: Patient's upper body is exposed for measuring the craniovertebral angle. Patient should be given a relaxed and comfortable position. The atmosphere should be quiet and calm.

At the end of intervention outcome measures will be taken again.

Both groups will receive given conventional exercises.

Group A: Will receive FELDENKRAIS EXERCISE along with CONVENTIONAL TREATMENT for 3 weeks.

Group B: Will receive CONVENTIONAL TREATMENT for 3 weeks.

Treatment program, lasting for 15 sessions (5 session/week)

Treatment intervention

Group A

Feldenkrais Exercise

1) Relax your shoulders and neck: Pay attention on the tension in your upper body. Lift and then lower down one of your shoulders slowly for duration of one minute. Just concentrate on this specific movement. But always keep the range of motion small.

2) Roll the neck: Do small circles using head from one side to the other. Roll the head slowly and gently towards back and then to the other side. Press your ear to your shoulder as far as you can and bring it around to front, lowering the chin towards chest. Keep on repeating this for duration of a minute. This movement in the Feldenkrais method is designed to lessen the tension.

3) Do ear to the shoulder exercise: In this, lower your ear to the shoulder and bring the head back to the normal, center position. Note which all body parts are involved in the movement. Do continue it for duration of one minute and then switch the sides.

4) Lean the ear to the shoulder as given in the step above. Then bring the head back to the center position. This time, do lift the shoulder to the ear and then return it to the center. Alternate the steps for duration of one minute and then repeat the same for opposite side. Don't strain while doing this exercise.

5) Sitting on the forward edge of a chair with a flat seat, slowly turn your upper body, as if to look to the right a little bit. Then return slowly to face forward and rest for a moment before doing the movement again. Keep your feet flat on the floor, and repeat this movement 6–10 times. Notice exactly how far to the right you can see easily, without feeling any strain.

6) Focus your eyes on an object or spot straight ahead of you. While your eyes continue to look at the spot or object, slowly turn your head and upper body a little bit to the right. Then slowly return to facing forward and pause. Repeat this movement 6–10 times. Don't stretch or strain, use force, or turn farther than is truly comfortable. Notice how keeping

your eyes fixed restricts your turning. Relax your neck, jaw, shoulders, chest, abdomen, and legs abdomen, and legs.

7) Do movement #1 again: Slowly turn your upper body, as if to look to the right. Then slowly return to facing forward and rest. Repeat this movement 2–4 times. Is there any improvement in your ease of movement as you turn? Can you see a little farther to the right? Rest in the middle, and notice whether your left shoulder and the left side of your neck feel more relaxed.

8) Now do the movement again, but keep both your head and eyes facing forward. Repeat this movement very slowly 6–10 times. As you turn, notice how your left shoulder moves forward, and your right shoulder moves back. Relax your face, neck, shoulders, and stomach. Try to reduce any unnecessary muscular effort.

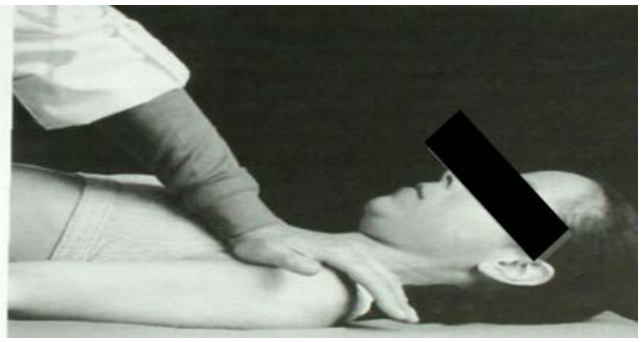
9) Do movement #1 again: Slowly turn your upper body, as if to look to the right. Then slowly return to facing forward and rest. Repeat this movement 2–4 times. Is there any improvement in your ease of movement as yu turn? Can you see a little farther to the right? Rest a moment and notice: Does your left side feel more relaxed than your right side.

10) Keeping your feet flat on the floor, simply move your left knee forward slightly. Repeat this movement very slowly 6–10 times. After each movement, let your knee return to the starting position and rest. Relax your leg and reduce any unnecessary muscular effort. Notice how your left buttock and hip move forward a little. Feel how your head, eyes, and shoulders turn slightly to the right as the left knee moves forward.

11) Move your left knee forward while turning your head, eyes, and upper body to the right a little bit. Repeat this movement very slowly 6–10 times. Reduce unnecessary muscular effort and notice how your left hip moves forward as you turn. Do you feel any improvement in your ease of movement while turning? Can you see farther to the right? For comparison, turn to the right and then turn to the left. Feel the difference? [6].

Group B
Conventional treatment
Stretching of tight muscles

Pectoralis Minor: To stretch the pectoralis minor, place the subject in a supine position, and press the shoulder backward and downward. One hand should be "cupped" just medial to the glenoids, avoiding direct pressure on the shoulder joints using firm, uniform pressure that helps to rotate the shoulder girdle back. Hold 15-30 secs for 3 repetitions [9].



Upper Trapezius: Gently grasp Right/Left side of head while reaching behind the back with the other hand. Tilt head away until a gentle stretch is felt. Note that the main difference between the sstretch below is that the head is not rotated. Hold 15-30 seconds. Repeat opposite side for 3 repetitions [11].

- **Levator scapulae:** Tip the head down and to the side. Place opposite hand behind back, use hand of same side to maximize stretch. Hold 15-30 seconds. Repeat opposite side for 3 repetitions [11].

- **Sub occipital Release:** The patient should be positioned supine on the table with the operator seated at the head of the table. The finger pads should be

placed over the Sub occipital muscles bilaterally, just inferior to the superior nuchal line down to at approximately the level of C2.
The patient's head should be lifted so the weight of it is supported upon the pads of the fingers. Traction is then applied with the fingers in an anterior, lateral, and cephalad direction. The amount of traction that is used results in a force being applied to the tissues without producing significant movement of the structures this position is then held until the tissues relax, which may take anywhere from 15 seconds to a minute.

Strengthening of weak muscles

Deep neck flexors-chin tucks: Strengthening deep cervical flexors through chin tucks in supine lying with the head in contact with the floor, the progression of this exercise was to lift the head off the floor in a tucked position and hold it for varying lengths of time (this was to progress by two second holds starting at two seconds i.e. 2, 4, 6, and 8 seconds) [13].

Fig 11: Chin Tuck

Fig 12: Progression-Head lift with chin tucked

Rhomboids-Scapular Retraction: Strengthen retractors first while standing by pulling the shoulder back. The patient was asked to pinch scapulae together without elevation or extension in the shoulder holding this position for at least six seconds then relaxing. The first progression was by conducting the shoulder retraction from a prone position hands behind the head (short lever). The second progression was by elbow extended (long lever). If they could complete three sets of 12 repetitions correctly for the strengthening, they were progressed to the second progression [14].

Middle and lower trapezius: Exercise to strengthen the middle and lower trapezius muscles using a short lever arm for resistance. The patient is asked to contract the middle and lower trapezius muscles, focusing on quality and control of activation without the compensatory use of the upper trapezius and posterior deltoid muscles. The patient is asked to lift the elbows towards the ceiling.

Fig 13: Short Lever

Exercise to strengthen the middle trapezius muscle using a long lever arm for resistance. The patient is asked to contract the middle trapezius muscle, focusing on quality and control of the activation without the compensatory use of the upper trapezius and posterior deltoid muscles. With the elbows straight, the patient retracts and adducts the scapulae, lifting the arms towards the ceiling.

Fig 14: Long Lever

Serratus Anterior: The dynamic hug was performed while standing with the back toward the wall, knees slightly bent, and the feet shoulder-width apart. The subject began with the elbow flexed 45°, the arm abducted 60°, and the shoulder internally rotated 45°. The subject then horizontally flexed the humerus by following an arc described by his hands (hugging action) (Fig. 5). Once the subject's hands touched together (maximum scapular protraction), he slowly returned to the starting position.

Active movements of cervical joint

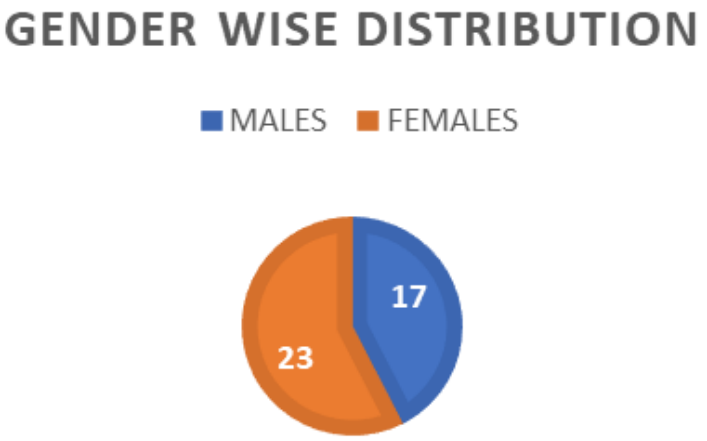
- Cervical Flexion
- Cervical Extension
- Right Cervical Lateral Flexion
- Left Cervical Lateral Flexion
- Right Cervical Rotation
- Left Cervical Rotation

Data analysis

- Improvement in Craniovertebral Angle, Cervical ROM and reduction in Pain was assessed by Image J software, Goniometry and VAS respectively.
- The data was entered in Excel spread sheet, tabulated and subjected to Statistical Analysis.
- The data entered was analysed using Primer of Biostatistics Version 7.0 checking effectiveness of Feldenkrais Technique in young patients with upper Cross Syndrome.

Gender wise distribution of demographic data

Gender	NO
Males	17
Females	23



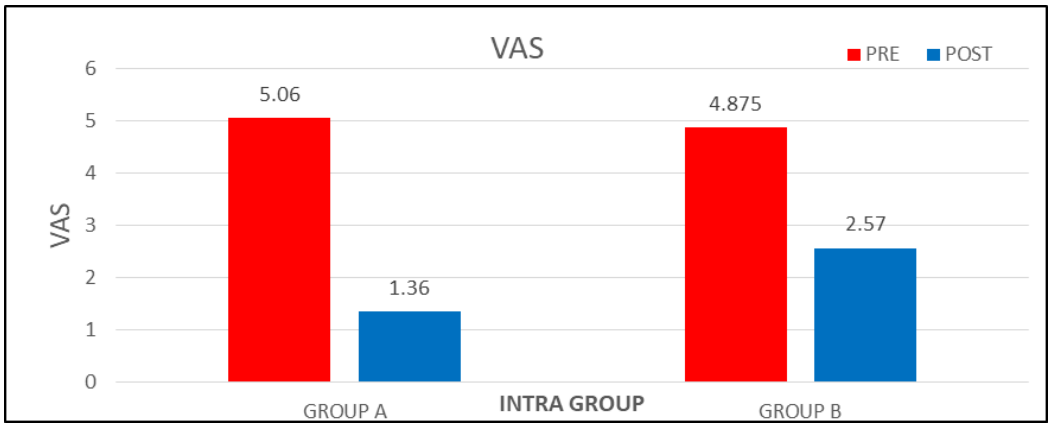
Statistical Analysis

- Data analysis was done for Group A and Group B using outcome measures Visual Analogue Scale (VAS), Craniovertebral Angle measurement (CVA) and Cervical Spine ROM (Goniometry).
- Pre and Post data analysis for VAS, CVA and Cervical Spine ROM (Goniometry) was done by paired t-test for both Group A and Group B.
- Group A and Group B inter group analysis was done using unpaired t-test.

Vas Group A and Group B (Intra Group)

Table 1: Vas Score Values Pre and Post treatment in Group A and B

Outcome Measure/Group	Pre T/T Mean±SD	Post T/T Mean ± SD	T Value	P Value	Result
VAS (A)	5.06 ± 1.295	1.36 ± 0.9719	17.321	<0.0001	Highly Significant
VAS (B)	4.875 ± 1.138	2.57 ± 1.119	11.559	<0.0001	Highly Significant

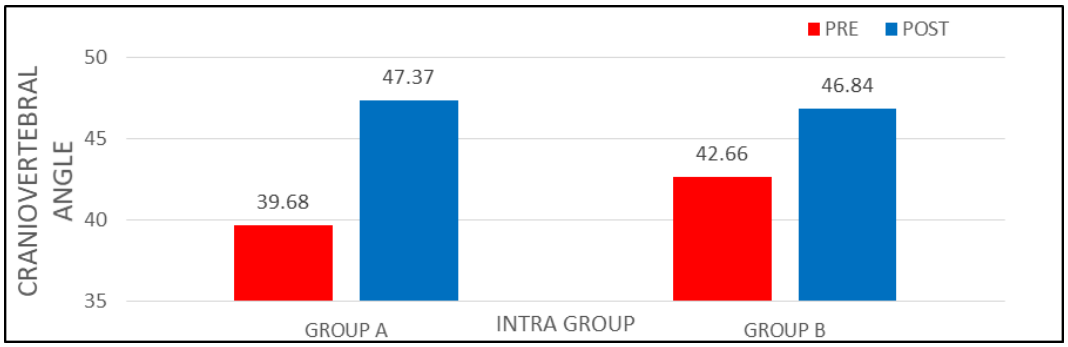


Graph 1: Comparison of VAS score values pre and post treatment in Group A and Group B

CVA Group A and Group B (Intra Group B)

Table 2: CVA score values pre and post treatment in Group A and Group B

Outcome Measure/Group	Pre t/t mean±SD	Post t/t mean ± SD	T value	P value	Result
CVA (A)	39.68 ± 4.376	47.37 ± 4.131	-7.685	<0.0001	Highly Significant
CVA (B)	42.66 ± 3.968	46.84 ± 3.978	-12.491	<0.0001	Highly Significant

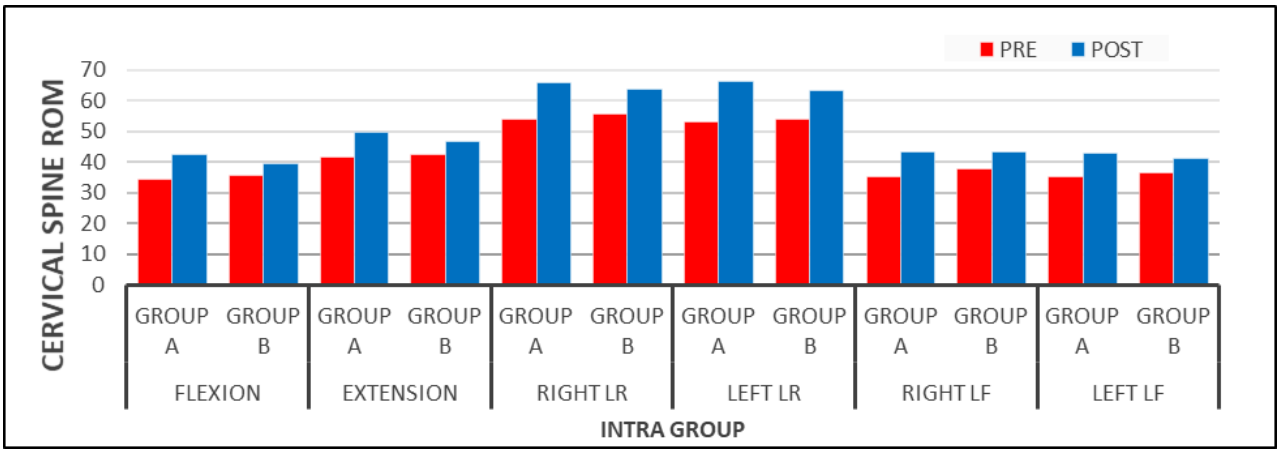


Graph 2: Comparison of CVA score values pre and post treatment in Group A and Group B

Cervical Spine Rom (Intra Group)

Table 3: Cervical Spine ROM values pre and post treatment in Group A and Group B

	Outcome Measure	Pre T/T Mean ±SD	Post T/T MEAN ± SD	T Value	P Value	Result
Cervical	Flexion (A)	34.75±3.878	42.25±3.177	-9.156	<0.0001	Highly Significant
	Flexion(B)	35.5±3.103	39.3±3.466	-5.908	<0.0001	Highly Significant
	Extension (A)	41.6±4.512	49.5±2.351	-9.904	<0.0001	Highly Significant
	Extension (B)	42.3±4.194	46.55±3.441	-17.764	<0.0001	Highly Significant
Lateral Rotation	Right (A)	53.7±6.309	65.7±4.497	-20.059	<0.0001	Highly Significant
	Right (B)	55.75±6.576	63.8±4.618	-12.218	<0.0001	Highly Significant
	Left (A)	53.2±6.118	66.3±3.629	-13.1	<0.0001	Highly Significant
	Left (B)	53.8±6.756	63.15±5.122	-8.764	<0.0001	Highly Significant
Lateral Flexion	Right (A)	35.2±5.69	43.15±3.937	-9.181	<0.0001	Highly Significant
	Right (B)	37.75±4.633	43.15±2.231	-7.429	<0.0001	Highly Significant
	Left (A)	35±5.685	42.75±4.229	-6.589	<0.0001	Highly Significant
	Left (B)	36.4±4.581	40.95±3.268	-5.786	<0.0001	Highly Significant

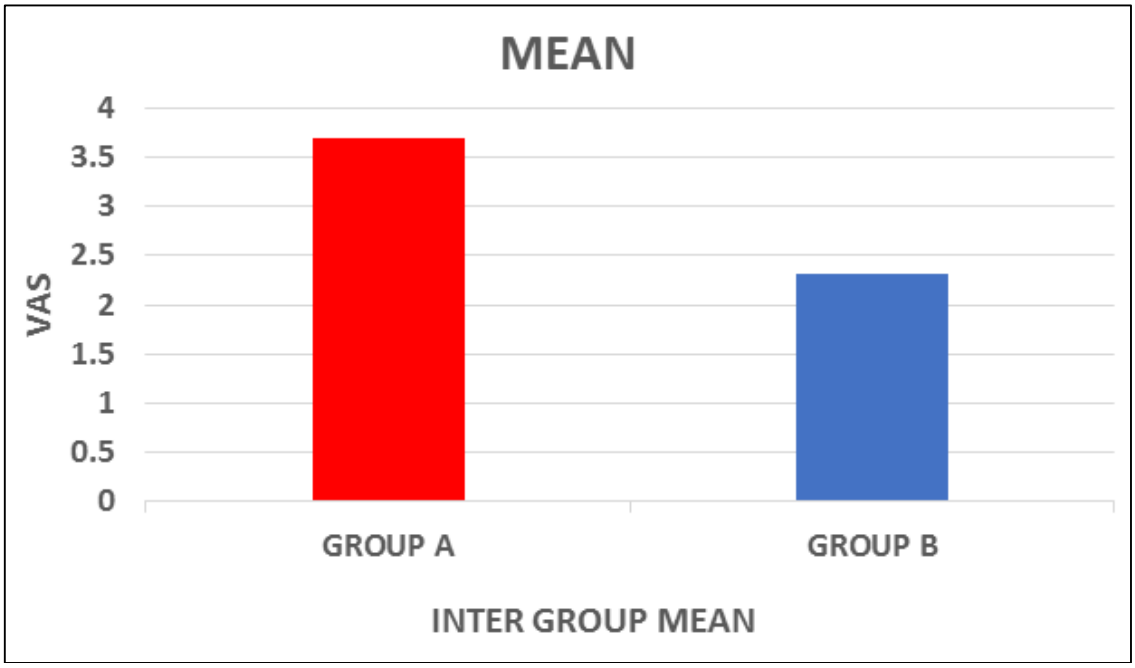


Graph 3: Comparison of Cervical Spine ROM values pre and post treatment in Group A and Group B

4) VAS Inter Group Analysis (Group A V/S Group B)

Table 4: Mean Difference of VAS score value in Group A and Group B

Outcome measure	Group a ± SD	Group b ± SD	T value	P value	Result
VAS	3.7 ± 0.9553	2.305 ± 0.8918	4.774	<0.0001	Highly Significant

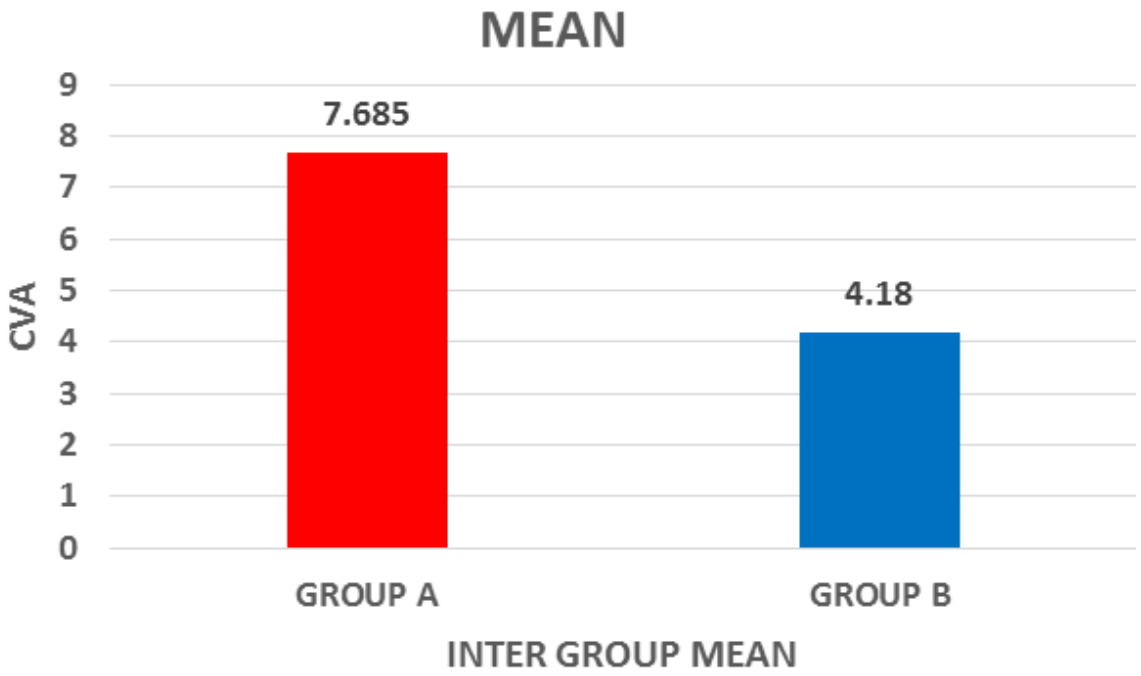


Graph 4: Representing Mean Difference of VAS score value in Group A and Group B

CVA Inter Group Analysis (Group A V/S Group B)

Table 5: Mean difference of CVA score value in Group A and Group B

Outcome Measure	Group A ± SD	Group B ± SD	T Value	P Value	Result
CVA	7.685 ± 1.332	4.18 ± 1.497	7.823	<0.0001	Highly Significant

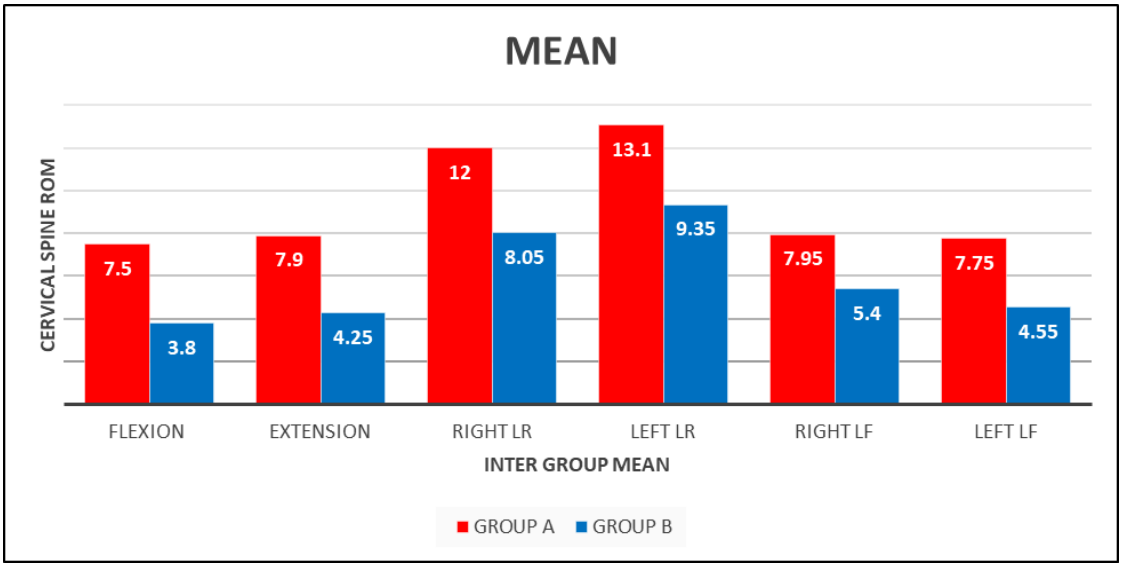


Graph 5: Mean Difference of CVA score value in Group A and Group B

Cervical Spine Rom Inter Group Analysis (Group A V/S Group B)

Table 6: Mean Difference of Cervical Spine ROM value in Group A and Group B

Outcome Measure	Group A ± SD	Group B ± SD	T Value	P Value	Result
Flexion	7.5 ± 3.663	3.8 ± 2.876	3.553	0.001	Highly Significant
Extension	7.9 ± 3.567	4.25 ± 1.07	4.383	<0.0001	Highly Significant
Right lR	12 ± 2.675	8.05 ± 2.946	4.439	<0.0001	Highly Significant
Left lR	13.1 ± 4.599	9.35 ± 4.771	2.531	0.016	Highly Significant
Right Lf	7.95 ±3.873	5.4 ± 3.251	2.255	0.030	Highly Significant
Left Lf	7.75 ± 5.26	4.55 ± 3.517	2.262	0.030	Highly Significant



Graph 6: Mean Difference of Cervical Spine ROM values in Group A and Group B

Results

- The techniques used in this study are Feldenkrais Exercise along with Conventional Exercises (Group A) and Conventional Exercise (Group B) for young patients with Upper Cross Syndrome.
- Paired t-test was used to compare the values of VAS score, CVA score and Cervical Spine ROM values before and after treatment in Group A and Group B. Unpaired t- test was used to compare values of VAS score, CVA score and Cervical Spine ROM values between Group A and Group B.
- The comparison of VAS scale values of Group A and Group B was analysed. Mean of Group A was 3.7 ± 0.9553 while that of Group B was 2.305 ± 0.8918. The 't' value obtained was 4.774 and 'p' value <0.0001 indicating the value was highly significant for VAS in Group A.
- The comparison of CVA scale values of Group A and Group B was analysed. Mean of Group A was 7.685 ± 1.332 while that of Group B was 4.18 ± 1.497. The 't' value obtained was 7.823 and 'p' value < 0.0001 indicating the value was highly significant for CVA in Group A.
- The comparison of Cervical Spine ROM values of Group A and Group B was analysed.

Flexion: values of Group A and Group B was analysed. Mean of Group A was 7.5 ± 3.663 while that of Group B was 3.8 ± 2.876. The 't' value obtained was 3.553 and 'p' value 0.001 indicating the value was highly significant for flexion in Group A.

Extension: values of Group A and Group B was analysed. Mean of Group A was 7.9 ± 3.567 while that of Group B was 4.25 ± 1.07. The 't' value obtained was 4.383 and 'p' value <0.0001 indicating the value was highly significant for flexion in Group A.

Right lateral rotation: values of Group A and Group B was analysed. Mean of Group A was 12 ± 2.675 while that of Group B was 8.05 ± 2.946. The 't' value obtained was 4.439 and 'p' value <0.0001 indicating the value was highly significant for flexion in Group A.

Left lateral rotation: values of Group A and Group B was analysed. Mean of Group A was 13.1 ± 4.599 while that of Group B was 9.35 ± 4.771. The 't' value obtained was 02.531 and 'p' value 0.016 indicating the value was highly significant for flexion in Group A.

Right lateral flexion: values of Group A and Group B was analysed. Mean of Group A was 7.95 ± 3.873 while that of Group B was 5.4 ± 3.251. The 't' value obtained was 2.255 and 'p' value 0.030 indicating the value was highly significant for flexion in Group A.

Left lateral rotation: values of Group A and Group B was analysed. Mean of Group A was 7.75 ± 5.26 while that of Group B was 4.55 ± 3.5517. The 't' value obtained was 2.262 and 'p' value 0.030 indicating the value was highly significant for flexion in Group A.

Discussion

The objective of this study was to find the effectiveness of Feldenkrais Exercise on Chronic Neck Pain (VAS), Forward Head Posture (CVA) and Cervical Range of Motion (Goniometry) in young patients with Upper Cross Syndrome at the end of 3 weeks.

Upper crossed syndrome is a common postural dysfunctional pattern that describes the dysfunctional tone of the musculature of the shoulder girdle/cervicothoracic region of the body. This condition is given its name because an "X," in other words a cross, can be drawn across the upper body. One arm of the cross indicates the muscles that are typically tight/overly facilitated and the other arm of the cross indicates the muscles that are typically weak/ overly inhibited. In UCS, tightness of the upper trapezius and Levator scapula on the dorsal side crosses with tightness of the pectoralis major and minor. Weakness of the deep cervical flexors ventrally crosses with weakness of the middle and lower trapezius. Specific postural changes are seen in UCS, including forward head posture, increased cervical Lordosis and thoracic kyphosis, elevated and protracted shoulders, and rotation or abduction and winging of the scapulae.

This study included 40 subjects within age group of 20 to 50 years of age, the mean age being 33.2 ± 8.817 years for Group A and 39.6 ± 7.625 years for Group B. The number of female subjects were more than males. The gender distribution in each group was such that Group A consisted of 12 females and 8 males and Group B consisted of 11 females and 9 males. Group A patients were given Awareness Through Movement (ATM) variant of Feldenkrais Exercise along with Conventional Exercises and Group B patients were given only Conventional Exercises which consisted of strengthening for serratus anterior, rhomboids, middle and lower trapezius and deep neck flexor muscles; and stretching of upper trapezius, Levator scapulae and pectorals.

The treatment duration was 3 weeks with 5 treatment sessions per weeks. Paired t-test was used to compare the values of VAS score, CVA score and Cervical Spine ROM values before and after treatment in Group A and Group B. Unpaired t- test was used to compare values of VAS score, CVA score and Cervical Spine ROM values between Group A and Group B.

Movement: is controlled by the sensory motor system via the central nervous system. Sensory information (such as proprioception or joint position sense) is sent via the sensory neurons (or nerve cells), up the spinal cord, to the brain. From the brain, a response is sent back down the spinal cord via the motor neurons. Neurons transmit a series of electrochemical impulses through the body. Impulses are sent from one neuron to the next, forming neuronal pathways from the brain to the muscles. As a movement takes places, proprioceptive information (or information about the body's new position in space) is sent back to the brain via the sensory neurons. Again this is as a series of impulses with each neuron connecting to the next neuron in the chain.

Pre and Post data analysis in Group A (Feldenkrais Exercise along with Conventional Exercises) was analyzed by using paired t-test within the group which revealed significant reduction in Chronic Neck Pain (VAS) and in improving CVA and Cervical Spine ROM.

David Zemach – Bersin and Mark Hirshfield (2013) in their studies suggested that Feldenkrais Exercise improves the way in which the brain coordinates posture and movement. By engaging the brain's ability to relearn and change, Feldenkrais Method improves the exchange of relevant information between the nervous system and the muscles,

and as a result, movement becomes more comfortable. There is also an increased production of the synovial fluid that acts as a lubricant inside the joints, increased flexibility, better circulation, improved respiratory function, better coordination and balance, and an overall sense of well-being and can interrupt cycles of pain and tension.

Suzanne Ruth and Sam Kegerreis also stated in their study that Awareness through Movement (ATM) leads to the creation of new habits by redirecting the brain's habitual patterns of response to the movement in a gravitational field using more natural and efficient paths for the mobility and deployment of body energy.

The inter group analysis was done using unpaired t-test which revealed that both the treatment methods Group A: Feldenkrais Exercise along with Conventional Exercises and Group B: Conventional Exercises were individually effective in reducing Chronic Neck Pain (VAS) and in improving Forward Head Posture (CVA) and Cervical Spine Range of Motion, but Group A: Feldenkrais Exercise along with Conventional Exercise was more effective in Comparison to Group B: Conventional Exercises Only.

Thus, Feldenkrais Exercise can be given along with Conventional Exercises in order to reduce Chronic Neck Pain, improve Forward Head Posture and Cervical Spine Range of Motion in Young Patients with Upper Cross Syndrome at the end of 3 weeks.

Conclusion

- ✓ This study concluded that Feldenkrais Exercise along with Conventional Exercises is more effective than only Conventional Exercises in reducing Chronic Neck Pain, improving Forward Head Posture and Cervical Spine ROM in young patients with Upper Cross Syndrome at the end of 3 weeks.

Limitations

- Homogeneity was not maintained in genders as in this study number of female participants were more than the number of male participants.

Future scope of study

- The same treatment techniques could be implemented in different populations like desk workers, medical students, school students, etc.
- Further research can be carried out on Functional Integration variant of Feldenkrais Exercise to relieve Chronic Neck Pain and improve Forward Head Posture and Cervical Spine Range of Motion.

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