

**EFFECT OF DEEP CERVICAL FLEXOR TRAINING v/s SCAPULAR STABILISATION
EXERCISES ON FORWARD HEAD POSTURE AMONG IT PROFESSIONALS
A RANDOMISED CLINICAL TRIAL**

**Dissertation Submitted to the
UTKAL UNIVERSITY Bhubaneswar , Odisha**

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In Partial fulfillment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY (M.P.T)

In

ORTHOPAEDICS PHYSIOTHERAPY

Under the guidance of

DR. CHINMAY KUMAR PATRA

PRINCIPAL



**ABHINAV BINDRA SPORTS MEDICINE & RESEARCH INSTITUTE
Bhubaneswar, Odisha
2022-2024**

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled “EFFECT OF DEEP CERVICAL FLEXOR TRAINING v/s SCAPULAR STABILISATION EXERCISES ON FORWARD HEAD POSTURE AMONG IT PROFESSIONALS- A RANDOMISED CLINICAL TRIAL ” is a bonafide and genuine research work carried out by me under the guidance of Dr.Chinmay Kumar Patra, Principal and co-guidance of Dr Arpita Panda Head of department , Abhinav Bindra Sports Medicine and Research Institute, Odisha

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Place: ODISHA

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Date:
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AB - BREVIATION

FHP - Forward Head Posture

DCF - Deep Cervical Flexors

CVA - Craniovertebral Angle

NDI - Neck Disability Index

ABSTRACT

Title :

Effect of deep cervical flexor training v/s scapular stabilisation exercises on forward head posture among IT professionals - A randomised clinical trial

Background and objective:

The study aimed to find out the effectiveness of deep cervical flexors strengthening for 4 weeks on forward head posture . The study sought to determine the effectiveness of scapular stabilisation exercise for 4 weeks on forward head posture and also to compare the effect of deep cervical flexor training v/s scapular stabilisation exercises among IT professionals with forward head posture.

Methods :

The study included 30 participants each randomly divided into 3 groups including 10 participants each ,comprising of males and females working in IT departments.

The selected participants head posture which is the Craniovertebral angle was analysed using MB Ruler software and for pain evaluation NPRS scale was also obtained . To obtain the data for the Neck disability index scale was obtained from all the participants. Subjects who had forward head posture were grouped randomly into 3 groups .

Group 1 received deep cervical flexor training using pressure biofeedback , 4 sets of 10 repetitions, followed by 2 mins of rest; 5 days per week for 4 weeks

Group 2 received scapular stabilisation exercise 4 sets of 10 repetitions, followed by 2 mins of rest ; 5 days per week for 4 weeks.

Group 3 received neck isometric exercises along with stretching 4 sets of 10 repetitions , 5 days per week for 4 weeks .

Statistical analyses were conducted to find out the effectiveness of deep cervical flexor training vs scapular stabilisation exercises on forward head posture within each group as well as between the groups as well.

Results :

The results indicated a statistically significant difference ($p < 0.05$) between the scapular stabilisation groups .

From the results and tables of this study revealed that CVA angle , pain and disability measured using outcome CVA angle ,NPRS scale and Neck disability index improved in all 3 groups, but statistically significant improvements were seen in Scapular stabilisation group. The control group did not show statistically significant improvements ($p > 0.05$) when compared to the other two experimental groups.

Conclusion :

The study concluded that scapular stabilisation exercises were effective in improving the Craniovertebral angle as well as in improving the pain and neck disability .

Thus this study suggests the effectiveness of scapular stabilisation exercises on improving forward head posture .

Keywords :

Forward head posture , deep cervical flexor training , CVA angle , scapular stabilisation exercises, IT professionals.

INTRODUCTION

The most appropriate alignment of the spinal segments and every body part in relation to the next segment and the entire trunk is known as correct upright posture. One of the indicators of a healthy musculoskeletal system is an upright posture.

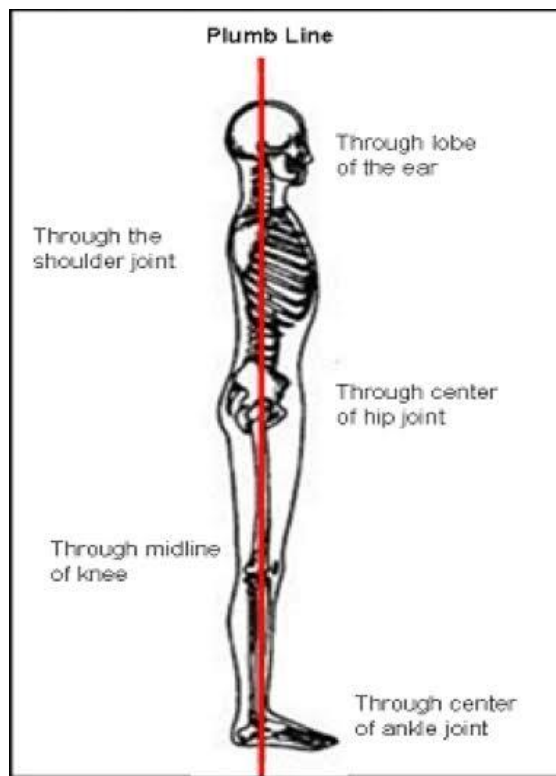


Figure 1 : Good posture

Good posture is defined as "the state of muscular and skeletal balance which protects the supporting structures of the body against injury or progressive deformity,

irrespective of the position (erect, lying, squatting, or stooping) in which these structures are working or resting" by the American Academy of Orthopedic Surgeons Posture Committee. Standing and sitting with proper alignment of the spine promotes effective work with less wear and tear on the muscles and ligaments in the body. A musculoskeletal equilibrium that involves the least amount of tension or strain on the body is considered to be a normal posture. A large portion of human motor activity has been adversely impacted by modern living because of a growing tendency toward sedentary lifestyles.

The most prevalent postural abnormality is thought to be forward head position. The aberrant position known as "forward head posture" occurs when the head seems to be in front of the body and protrudes forward from the sagittal plane. Six Hertling et al. described Forward Head Posture (FHP) as follows: "The line of vision will extend downward when the head is held anteriorly, provided that the normal angle at which the head and neck meet is maintained." The head tilts backward (posteriorcranial rotation, or PCR), the neck flexes across the thorax, and the jaw migrates posteriorly to accommodate visual demands. In a study of people with neck discomfort, those with more severe symptoms showed higher degrees of impairment.



Figure 2. Forward head posture

The forward head position results in aberrant and sustained contraction of the suboccipital, neck, and shoulder muscles. It also increases the flexion of the upper cervical and lower thoracic vertebrae and the extension of the atlanto-occipital joint. The center of gravity (COG) of the head changes antero-superiorly in forward head position, increasing the strain on the neck and leading to musculoskeletal system dysfunction. Forward head position affects the muscles around the head and shoulder, such as the sternocleidomastoid, temporal, suboccipital, and trapezius. This exacerbates postural deformity. Rounding of the shoulder develops to compensate for this shortfall, which in turn creates excessive load on the muscles, fascia, and nerves of the neck and shoulders as a result of these alterations creating chronic and unnatural pressure in these areas.

According to a study by Griegel-Morris P, et al., there was a 66% incidence of forward head posture in the age group of 20 to 35 years old. It also showed that forward head posture had an increased incidence of cervical pain. The study focused on the incidence of common postural abnormalities in the cervical, shoulder, and thoracic

regions and their association with pain in two age groups of healthy subjects. People with forward head posture are frequently seen using computers, watching television, playing video games, using smartphones, carrying bulky backpacks, and resting on pillows that aren't appropriately positioned.



Figure 3 - Risk factors for forward head posture

Tension neck syndrome, which causes neck and trapezius muscular rigidity, soreness, and tenderness, is linked to FHP. Many people find that their trigger points or spasms in the trapezius muscle and surrounding neck area make it difficult for them to move their shoulders and cervical spine. This syndrome may not just cause discomfort in the neck;

it may also cause pain in the space between the shoulder blades, down the arms, or even up into the head.¹⁰ Affection to the cervical joint position sensation also arises with FHP. Degradation of cervical proprioception coupled with muscular exhaustion was demonstrated in a study by Pinsault et al. wherein cervical joint proprioception was examined utilizing the cervico-cephalic relocation test to the neutral head position.

Forward head position is linked to shortening of the opposing cervical extensor and pectoralis muscles as well as weakness in the mid-thoracic scapular retractor, which includes the rhomboids and middle and lower fibers of the trapezius. The primary cause of forward head posture is a weakening in the anterior cervical neck flexor muscles, which leads to sternocleidomastoid muscle stiffness. The capacity and neuromuscular control of the deep cervical flexor muscles, such as the longus colli and longus capitis, are improved with craniocervical flexor muscle training. Numerous studies have shown that treating cervical dystrophy with craniocervical flexor exercise reduces pain and neck impairment while also improving activation of the deep and superficial cervical flexors.

Forward head posture reduces the dispersion of biomechanical loading and therefore causes degeneration of the neck muscles and structural changes. In addition, compensatory actions, such as spinal curve changes, rounded shoulders, and abnormal muscle activity can be observed.

Specifically, the deep cervical flexors and scapular retractors are weakened, and there is increased tension and thickness of the sternocleidomastoid. Furthermore, a decline in the serratus anterior muscle is observed. Finally, the upper trapezius and lower trapezius are overly activated because of the upper rotator disability of the scapula. This causes malalignment of the neck, a tilting in posture, and an imbalance of the muscles and leads to pain.

NEED OF THE STUDY

- These days, forward head position is highly prevalent. Take a look at anyone who works at a desk, students, or young adults who gaze at an electronic gadget for the most part of the day. Every day, more and more tasks involving laptops are being completed, especially in the fields of education, business, publishing, banking, and even entertainment. Screen height and distance adjustments are not possible because most laptops are built with the screen attached to the keyboard.
- Due to this, the cervical spine experiences prolonged flexion, which raises the activity of the upper trapezius and cervical erector spinae muscles, resulting in a posture where the trunk is slightly tilted forward. This causes a fixed postural habit of the forward head and trunk flexion that follows
- Deep cervical flexor (DCF) has a major postural function in supporting and straightening the cervical lordosis. To maintain a correct posture in the cervical region. Studies have shown that in the case of FHP a rehabilitation approach will be more effective if DCF muscles are used properly before strengthening of global cervical muscles.
- Studies have also shown that in order to correct head and neck posture , it is important to improve the thoracic spine for which scapular stabilisation exercises have been effective .

- So there was need to evaluate effect of deep cervical muscle flexor training v/s scapular stabilisation exercises on forward head posture and to find out correlation between neck disability index and craniovertebral angle.

AIM AND OBJECTIVE OF THE STUDY

AIM

TO STUDY THE EFFECT OF DEEP CERVICAL FLEXOR TRAINING v/s SCAPULAR STABILISATION EXERCISES ON FORWARD HEAD POSTURE AMONG IT PROFESSIONALS .

OBJECTIVES :

1. To find out the effectiveness of deep cervical flexors strengthening for 4 weeks on forward head posture
2. To determine the effectiveness of scapular stabilisation exercise for 4 weeks on forward head posture
3. To compare the effect of deep cervical flexor training v/s scapular stabilisation exercises among IT professionals with forward head posture.

HYPOTHESIS AND NULL HYPOTHESIS

HYPOTHESIS

1. H1: There will be significant effect of deep cervical flexors training on forward head posture.
2. H2 : There will be significant effect of scapular stabilization exercise on forward neck posture.
3. H3: There will be significant difference between deep cervical flexors training and scapular stabilization exercise among forward head posture.

NULL HYPOTHESIS

1. H1: There will be no significant effect of deep cervical flexors training on forward head posture.
2. H2 : There will be no significant effect of scapular stabilization exercise on forward neck posture.
3. H3 : There will be no significant difference between deep cervical flexors training and scapular stabilization exercise among forward head posture.

REVIEW OF LITERATURE

- **Thavatchai Suvarnnato, Rungthip Puntumetakul et.al (2020)** conducted a randomized controlled trial on Effect of specific deep cervical muscle exercises on functional disability, pain intensity, craniovertebral angle, and neck-muscle strength in chronic mechanical neck pain. A total of 54 individuals with chronic mechanical neck pain were randomly allocated to three groups: extensor training, flexor training, or control. A Thai version of the Neck Disability Index, numeric pain scale (NPS), CV angle, and neck-muscle strength were measured at baseline, immediately after 6 weeks of training, and at 1- and 3 -month follow-up. Neck Disability Index scores improved significantly more in the exercise groups than in the control group after 6 weeks training and at 1- and 3-month follow-up in both the extensor ($P=0.001$) and flexor groups ($P=0.003$, $P=0.001$, $P=0.004$, respectively). NPS scores also improved significantly more in the exercise groups than in the control group after 6 weeks training in both the extensor ($P<0.0001$) and flexor groups ($P=0.029$). In both exercise groups, the CV angle improved significantly compared with the control group at 6 weeks and 3 months (extensor group, $P=0.008$ and $P=0.01$, respectively; flexor group, $P=0.002$ and $P=0.009$, respectively). They concluded that 6 weeks of training in both exercise groups can improves neck disability, pain intensity, CV angle, and neck-muscle strength in chronic mechanical neck pain

- **M Karthi, A D Gopalswami et.al (2019)** conducted a study on efficacy of endurance training on deep cervical flexor muscles using pressure feedback in mechanical neck pain. 60 subjects (male 33, female 27) with mechanical neck pain who fulfilled the inclusion criteria were chosen. After baseline evaluation of history, NPRS, cervical range of motion and Deep Cervical Flexor Endurance (DCF), the subjects were allocated into three groups which received DCF training by modifying the use of pressure biofeedback. Group 1 received DCF Training with Visual Pressure Biofeedback 10 repetition for three sets. Group 2 received DCF training without Visual Pressure Biofeedback 10 repetition three sets. And Group 3 received DCF training with Pressure Biofeedback (without visual input) 3 set of 10 repetitions. After 15 days of intervention, post-intervention measures of the variables were obtained. Subjects in Group 1 have a statistically and clinically significant improvement ($p\text{-value} < .005$), pain (NPRS), cervical ROM, DCF endurance and Neck Disability Index when compared to the Group 2 and 3. They concluded that deep cervical flexor training with visual pressure biofeedback provides better clinical improvement in terms of pain reduction, cervical flexion and extension ROM, DCF endurance, and Neck Disability Index score.
- **Saad Ammar Al-Harbi and Dr. Shaik Daria Hussain et.al (2017)** conducted a study on Compare the effects of deep neck flexor strengthening exercises verses electrotherapy modalities on head forward postures resulting from the use of smartphones. Thirty participants were divided into three groups; first group G1 (vehicle group, $n = 10$), second group G2 ($n = 10$) who given deep neck flexor strengthening exercises and the third group G3 ($n = 10$) given Electrotherapy

Modalities (Ultra sound and IFT). G1 using Pressure Biofeedback Unit (PBU); these exercises were performed on a hard therapy table to measure changes in the pressure gage accurately. The subjects maintained static contraction for ten seconds, and then took a rest for five seconds, which was defined as a one-time exercise. One set of exercises consisted of ten-time exercises, and a total of five sets were performed each day. The subjected performed the exercises three times each week for a four-week period. G2 exposed to Ultrasound for 10 min. and IFT for 10 min., three sessions per a week for four weeks. After treatment at 4th week the scores of PF, GH, BP and VT in treatment group all improved significantly compared with those before treatment ($p < 0.05$). They concluded that deep cervical flexor training with a pressure biofeedback unit is a useful method for maintaining neck mobility and muscular endurance in people with forward head posture.

- **Dong Yeon Kang (2015)** conducted a study on deep cervical flexor training with a pressure biofeedback unit is an effective method for maintaining neck mobility and muscular endurance in college students with forward head posture. Twenty college students were recruited and randomly assigned to groups that underwent either deep cervical flexor training with a pressure biofeedback unit (experimental group, $n=10$) or conventional deep cervical flexor training (control group, $n=10$). The craniovertebral angle of each subject was measured with a lateral-view picture. Neck mobility was assessed using a cervical range of motion device and muscular endurance was measured using a pressure biofeedback unit. Both groups performed conventional deep cervical flexor exercises three times a week

for six weeks. The experimental group underwent a pressure biofeedback unit training was 5 to 10 minutes/day, thrice a week. They concluded that deep cervical flexor training with a pressure biofeedback unit is a useful method for maintaining neck mobility and muscular endurance in people with forward head posture.

- **Bhuvan Deep Gupta ,Shagun Agrawal et.al(2013)** conducted a study on effects of Deep Cervical Flexor Training vs. Conventional Isometric Training on Forward Head Posture, Pain, neck Disability Index in dentists suffering from Chronic Neck Pain. Total of 30 subjects were selected, based on inclusion and exclusion criteria, who were further divided into Experimental and Control groups. Baseline information of dependent variables was taken at the beginning of study on day one, for Visual Analogue Scale (VAS) and Neck disability Index (NDI). Forward head posture was measured on day one using digital photograph technique. Then, Experimental group was given DCF training and Control group was given conventional isometrics training (CIT) for 4 weeks under supervision of examiner. All measurements were repeated at end of 4th week. They concluded that DCF training is more effective than CIT in improving forward head posture, decreasing pain and disability in dentists suffering from chronic neck pain.
- **Zaheen Ahmed Iqbal, Reena Rajan et.al (2013)** conducted a study on effect of deep cervical flexor muscles training using pressure biofeedback on pain and disability of school teachers with neck pain. Thirty teachers aged 25–45 years with neck pain and poor craniocervical flexion test participated in this study. A pretest posttest experimental group design was used in which experimental

group has received training with pressure biofeedback and conventional exercises while control group received conventional exercises only. Measurements of dependent variables were taken at baseline, and after 2 and 4 weeks of training. Pain intensity was assessed using a numeric pain rating scale and functional disability was assessed using the neck disability index. They concluded that Addition of pressure biofeedback for deep cervical flexor muscles training gave a better result than conventional exercises alone. Feedback helps motor learning which is the set of processes associated with practice or experience leading to permanent changes in ability to respond.

- **Jinal A. Mamania, Deepak Anap (2019)** conducted a cross sectional study on prevalence of Forward Head Posture amongst Physiotherapy Students. Total 50 participants were included in the study. Participants were evaluated for FHP using 'ON Protractor' mobile application via craniovertebral and cranio-horizontal angle. Seventy percent of participants had forward head posture. They concluded that Prevalence of FHP is high amongst physiotherapy students.
- **Apurva Nitin Worlikar, Dr. Mayuri Rajesh Shah (2019)** conducted a study on incidence of forward head posture and associated problems in desktop Users. The objective of this study was to find the percentage of forward head posture in laptop users in adults using MB ruler and to find the associated problems of forward head posture in desktop users on Visual Analogue Scale and Cervical Range of Motion. Age group of 30-40 years both males and females were included. 100 individuals were included. Means of Range of Motion and Visual Analogue Scale were compared. Spearman's Correlation Test and Chi Square

Test were applied. In all variable the $P>0.05$ was considered to be not significant. They concluded that there is no relation between forward head posture and pain, and forward head posture and range of motion of cervical spine.

- **Zeynep Hazar, Gul Oznur Karabicak et.al (2015)** conducted a study on Reliability of photographic posture analysis of adolescents. Subjects were 30 adolescents (15 girls and 15 boys, mean age: 16.4 ± 0.4 years, mean height 166.3 ± 6.7 cm, mean weight 63.8 ± 15.1 kg) and photographs of their habitual standing posture photographs were taken in the sagittal plane. For the evaluation of postural angles, reflective markers were placed on anatomical landmarks. For angular measurements, MB-ruler (Markus Bader- MB Software Solutions, triangular screen ruler) was used. Photographic evaluations were performed by two observers with a repetition after a week. Test-retest and inter-rater reliability evaluations were calculated using intra-class correlation coefficients (ICC). Study concluded that Inter-rater ($ICC>0.972$) and test-retest ($ICC>0.774$) reliability were found to be in the range of acceptable to excellent. Reference angles for postural evaluation were found to be reliable and repeatable. The present method was found to be an easy and non-invasive method and it may be utilized by researchers who are in search of an alternative method for Photographic postural assessments.
- **Hyun Choi,Young-Jun Moon,Joon-Su Park(2018)** conducted a study on effect of scapular stabilization exercise on neck alignment and muscle activity in patients with forward head posture For four weeks, a sample of 30 patients with forward head position took part in an intervention for 30 minutes a day, three

times a week. The scapular stabilisation exercise group consisted of 15 patients, whereas the neck stabilisation exercise group contained another 15 patients. The CVA cranial rotation angle (CRA), and neck muscle activity were all evaluated prior to the intervention. These three variables were re-measured and examined four weeks later. Both groups showed statistically significant within-group changes in CVA and CRA. There were only statistically significant between-group differences in the CVA group. All groups showed statistically significant variations in the within-group changes in muscle activity. Through the contraction of the neck muscles, lower trapezius, and serratus anterior, scapular stabilisation improved posture. Therefore, by minimising the compensatory movements of the muscles responsible for forward head posture, the intervention has a positive impact on neck alignment.

MATERIALS AND METHODOLOGY

- **STUDY DESIGN** - Randomised Clinical Trial
- **STUDY SETTING** - IT Department ,Bhubaneswar
- **DURATION OF STUDY** - 1 year
- **TARGET POPULATION** - IT Professionals with forward head posture.
- **INCLUSION CRITERIA** -
 - 1) Subjects with informed consent.
 - 2) IT professionals who use computers regularly for 4-5 hrs.
 - 3) Both gender.
 - 4) Age between 30-45 years.
 - 5) All subjects having forward head posture. (CVA less than 49 degree)
 - 6) NPRS score between mild to moderate. (2-6)
- **EXCLUSION CRITERIA-**
 - 1) Any recent of trauma of cervical region.
 - 2) History of cervical spine pathology.
 - 3) History of dizziness and vertigo .
 - 4) Postural abnormalities like scoliosis or Torticollis.

MATERIALS:

1. Digital camera
2. MB ruler software (ICC = 0.88) for measuring CVA
3. Pressure biofeedback device
4. Reflective adhesive skin markers to denote anatomical landmarks.
5. Pen
6. Data sheets

7. OUTCOME MEASURES :

• PRIMARY OUTCOME

- **MB ruler software (ICC = 0.88) for measuring craniovertebral angle -** The craniovertebral angle (CVA) that is the angle between the horizontal line passing through C7 and a line extending from the tragus of the ear to C7.
- FHP was measured by taking lateral photographs, and then, these photographs was analysed . The CVA was measured by **MB RULER SOFTWARE** by drawing a line from the tragus of the ear to the 7th cervical vertebrae. The angle this line makes with horizontal is the CVA.
- The subjects was asked to sit on a chair. From the subject, the camera was placed at the level of the subject's head and neck region. The camera base was adjusted to the subject's shoulder height. The subjects was asked to look directly ahead , C7 spinous process was palpated; C7 spinous process and tragus of the ear was marked.
- A retroreflective marker was placed over the skin at the level of the C7 spinous.

- **SECONDARY OUTCOME**

- **Neck disability index (NDI) -** This questionnaire has been designed to give us information as to how your neck pain has affected your ability to manage in everyday life.
- Each section is scored on a 0 to 5 rating scale, in which zero means 'No pain' and 5 means 'Worst imaginable pain'.
- Points summed to a total score.
- The test can be interpreted as a raw score, with a maximum score of 50, or as a percentage.
- 0 points or 0% means : no activity limitations ,
- 50 points or 100% means complete activity limitation.
- A higher score indicates more patient-rated disability.
- The NDI has a fair to moderate test-retest reliability in patients with mechanical neck pain.
- The NDI has a good construct validity.

- **NUMERIC PAIN RATING SCALE (NPRS) :**

- The Numeric Pain Rating Scale (NPRS) (an outcome measure) that is a unidimensional measure of pain intensity in adults.

- The 11-point numeric scale ranges from '0' representing one pain extreme (e.g. “no pain”) to '10' representing the other pain extreme (e.g. “pain as bad as you can imagine” or “worst pain imaginable”)
- High test–retest reliability has been observed in both literate and illiterate patients ($r = 0.96$ and 0.95 , respectively)
- For construct validity, the NPRS was shown to be highly correlated with the VAS (correlations range from 0.86 to 0.95).

- **VARIABLES :**

1. DEPENDENT VARIABLES

- i. Age
- ii. Gender
- iii. Neck Disability index
- iv. NPRS

INDEPENDENT VARIABLES

- i. MB ruler software
- ii. Cervical flexor strengthening
- iii. Scapular stabilisation exercises .

-

- **RESEARCH DESIGN AND METHODOLOGY**

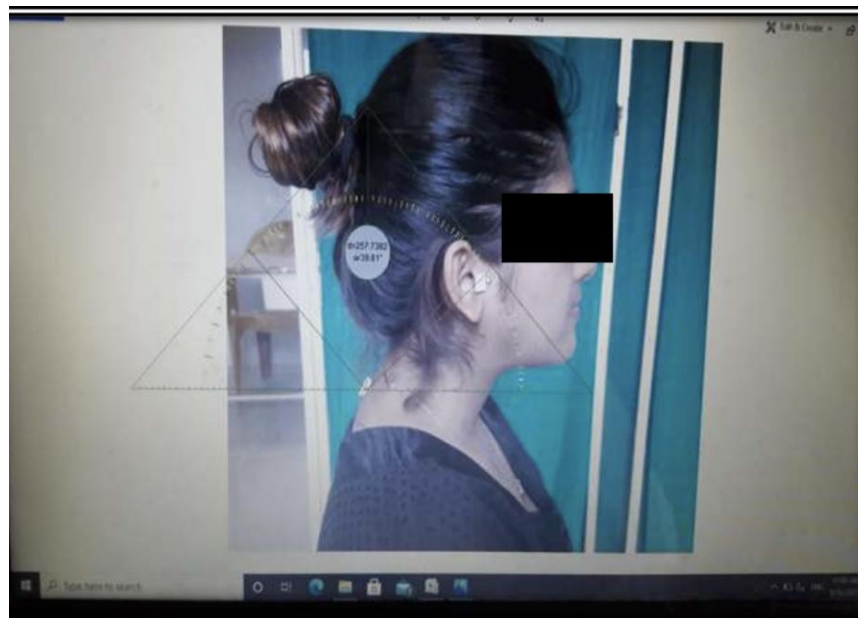
1. Sample size - sample size calculation was based on effect sizes reported in previously published study by Isha Shikha , Chandan Chawla et. Al titled “ effect of deep cervical flexor training on forward head posture , neck pain and functional status on adolescents using computers regularly, a total of 30 participants were required for the study.

- The estimated sample size was 30.
- Sampling technique : Purposive sampling technique.
- Research design : Randomised clinical trial
- Duration of study - 2 year
- Study instrument/ Data collection tool - MB ruler software.
- Statistical analysis -
- Statistical test - ‘ Paired T test’ was used
- ‘One way ANOVA’ was used

PROCEDURE

- Ethical clearance was obtained from the institutional ethical committee.
- The purpose & procedure of the study was explained to participant.
- Subjects were screened according to the inclusion and exclusion criteria.
- A written consent was obtained.
- Total 30 subjects were included in the study.
- Selected participants head posture (craniovertebral angle) were assessed using a valid & reliable photogrammatic method – MB ruler software (ICC = 0.88).
- Selected participants NDI and NPRS data was also obtained.
- Subjects who had forward head posture were grouped randomly into 3 groups .
- Group 1 received deep cervical flexor training using pressure biofeedback , 4 sets of 10 repetitions, followed by 2 mins of rest; 5 days per week for 4 weeks.
- Group 2 received scapular stabilisation exercise 4 sets of 10 repetitions, followed by 2 mins of rest ; 5 days per week for 4 weeks.
- Group 3 received neck isometric exercises along with stretching 4 sets of 10 repetitions , 5 days per week for 4 weeks .

- **Assessment of forward head posture (measurement of craniovertebral angle) using MB ruler software**
- Subjects were assessed for any deviation of head posture using valid & reliable computerized photogrammetry with emphasis on craniocervical segment.
- The subjects were sitting over stool and looking forward in a relaxed posture. Skin over the anatomical landmarks was wiped with cotton soaked in spirit to remove skin secretions for proper fixation of adhesive markers.
- Adhesive markers were fixed over the anatomical landmarks. Anatomical landmarks are: spinous process of C7, tragus of the left or right ears.
- The photographs were analyzed that is the angle between the horizontal line passing through C7 and a line extending from the tragus of the ear to C7 was obtained.



- **Neck Disability Index and NPRS scale data was obtained**
- Subjects were explained the neck disability index and were asked to fill the questionnaire according to their daily activity limitations and then the scoring was obtained .
- Similarly the subjects were asked to mark their neck pain on the NPRS accordingly and the scoring was obtained.

- **Deep cervical flexors strengthening using pressure biofeedback**
- The exercise procedure with pressure biofeedback (craniocervical flexor exercise) was explained to the subject.
- Pressure biofeedback instrument is used as an intervention tool
- In this, subjects were positioned in supine lying. Then pressure biofeedback was placed between the plinth and the posterior aspect of the cervical spine just below the craniocervical junction.
- The subject's head and neck was positioned to ensure a neutral cervical spine and craniocervical position.
- The pressure sensor was inflated to 20 mm of Hg so that the space can be filled between the back of the neck and the plinth then asked the subject to posterior retraction of chin to push neck directly back on the sensor.

- Each subject was given sufficient time to practice the same exercise with pressure biofeedback unit. The dial was kept in front of the subject so that he can monitor any deflection of the pointer during holding phase which was 10 second.
- The feedback which was given by the pressure sensor showed the subject's ability to hold the position in a controlled manner.
- Each subjects perform the neck Cranio-Cervical Flexion (CCF) movement at 5 different pressure levels (22, 24, 26, 28 and 30 mmHg) with 10 sec hold at each level and 30 sec rest between each level.
- The testing procedure was terminated if subject could not hold 10 sec at specific pressure level.
- The maximum pressure level achieved (activation score) with 10 sec hold was recorded for further strengthening protocol. Dosages:- 4 sets of 10 repetitions, followed by 2 min of rest; 5 days per week for 4 weeks.
- Home exercise program - The subjects were asked to place a 4 inches towel roll under the neck at place of pressure biofeedback unit and perform the same procedure of exercise. After 4 weeks the outcome measures were assessed again for craniovertebral angle , NDI , NPRS by same procedure which was already described.

- **Scapular stabilisation exercises**

- Exercises such as - chin tucks
- Horizontal pull apart
- Serratus anterior punches
- Retraction plus external rotation
- TYI exercises
- Chest press
- Scapular retraction were asked to perform by the subjects and the resistance was increased gradually within the week .
- Dosage - 4 sets of 10 repetitions, followed by 2 mins of rest ; 5 days a week for 4 weeks .
- Home exercises program - Same exercises to be performed with the same dosage .
- After 4 weeks the outcome measures were assessed again for craniovertebral angle, NDI , NPRS by same procedure which was already described.

- **Neck isometrics and stretching**

- Neck isometrics were taught to the subjects .
- Dosage - 4 sets 10 repetitions with 10 secs hold
- Stretching of the upper trapezius, scalene , levator scapulae etc were taught with sustained stretching hold for 10-15 secs.

DATA ANALYSIS

- The entire data of the study was entered in MS Excel before it was statistically analysed in SPSS . All the results are shown in tabular as well as graphical format to visualise the statistically difference more clearly.
- The data on quantitative characteristics was presented as Mean and standard deviation (SD) across study group .
- The Statistical significance of difference of pre treatment and post treatment quantitative characteristics in study group (intra-group comparison) was tested using paired 't' test after confirming the underlying normality assumption of pre and post treatment difference of parameters.
- The statistical significance of difference of pre treatment and post treatment quantitative characteristics in between the groups was tested using "one way ANOVA' .

OBSERVATION AND TABLES

Table 1) The age wise distribution of study subjects.

Age in years	No. of subjects (n=30)
35-36	12
37-38	<u>6</u>
39-40	<u>13</u>

In the study group 12 subjects were between 35-36 years of age , 6 subjects were between 37-38 years of age , 13 subjects were between 39-40 years of age.

Graph 1) The age wise distribution of subjects

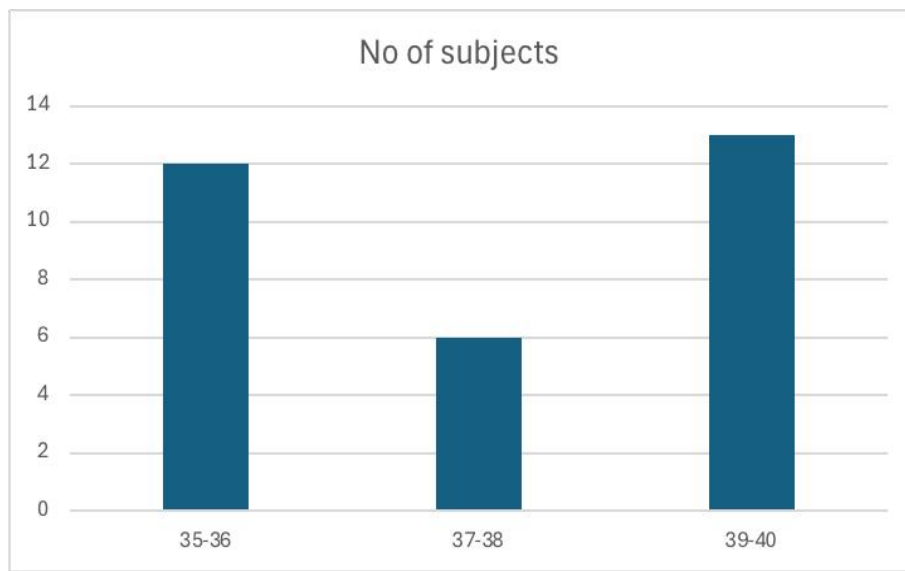
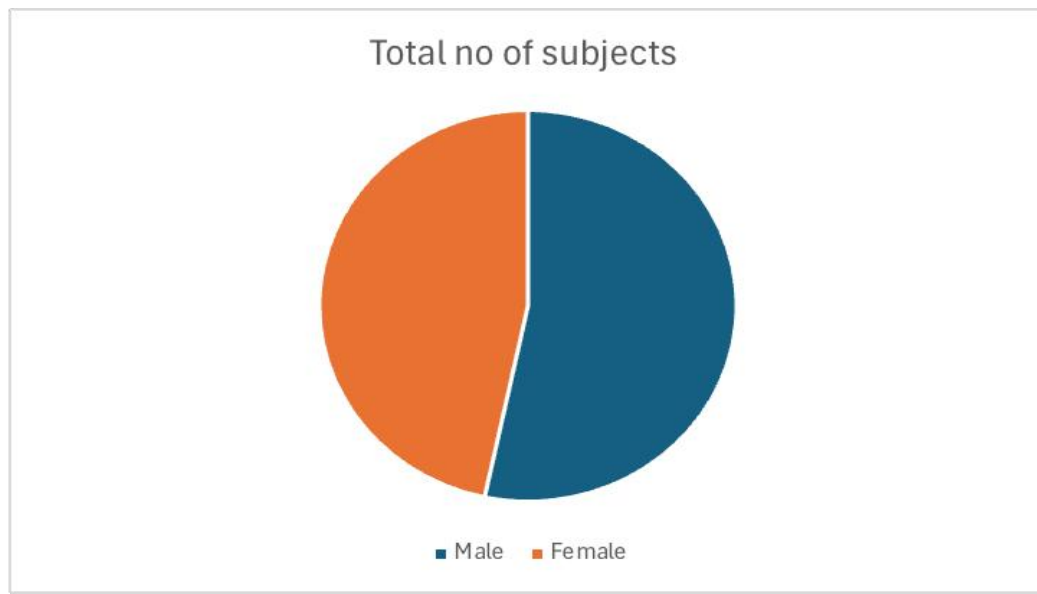


Table 2) Gender wise distribution of subjects

<u>Gender</u>	<u>Total no of subjects</u>
<u>Male</u>	<u>16</u>
<u>Female</u>	<u>14</u>

Graph 2) Gender wise distribution of subjects



The above pie chart shows gender distribution of subjects .

There were 16 males and 14 females included in the study .

Table 3) Pre intervention data along with the outcome measures

A comparison of the Pre intervention Craniovertebral angle (CVA) , NPRS and Neck Disability Index (NDI) among the three groups revealed no statistically significant difference in the Pre intervention data (p value >0.05)

<u>FACTORS</u>	<u>GROUP A</u>	<u>GROUP B</u>	<u>GROUP C</u>	<u>p value</u>
<u>CVA Angle</u>	2.27	3.75	0.47	p>0.05
<u>NPRS</u>	2.80	2.90	0.60	p>0.05
<u>NDI</u>	3.20	2.49	0.80	p>0.05

Graph 3) Pre intervention data along with the outcome measures

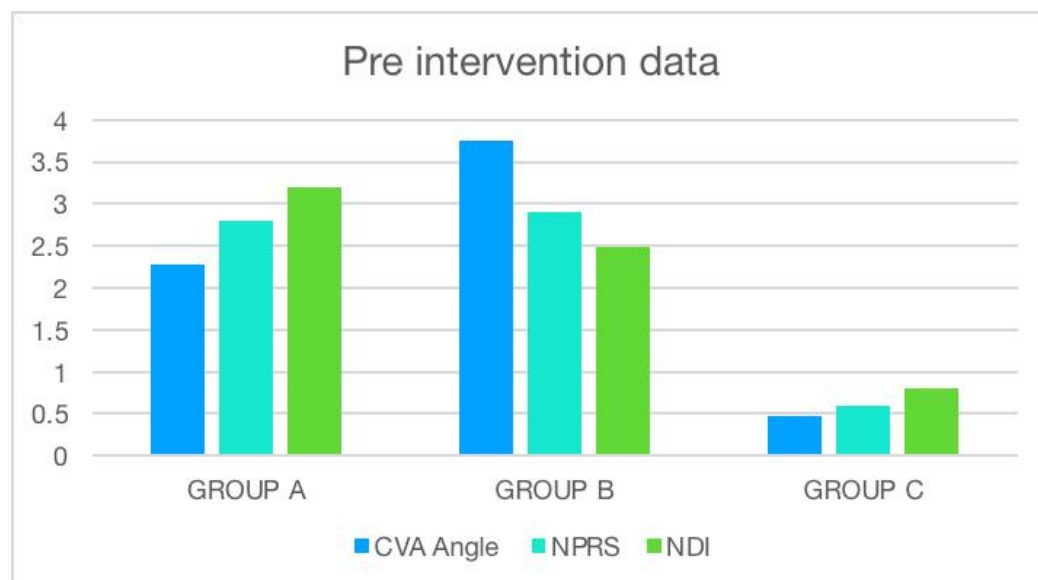


Table 4) Comparison of CVA angle within group comparison

<u>GROUPS</u>	<u>PRE</u>	<u>POST</u>	<u>MEAN DIFFERENCE</u>	<u>p VALUE</u>
<u>DCF group</u>	47.7	49.9	2.27	p<0.05
<u>SSE group</u>	46.6	50.3	3.71	p<0.05
<u>Control group</u>	45.7	46.2	0.51	p<0.05

Group A ,B, C showed improvements in pain ,disability with p values of <0.05 which is statistically significant, in a within group comparison of the Pre and post intervention of the Craniovertebral angle (CVA)

Graph 4- Comparison of CVA angle within group comparison

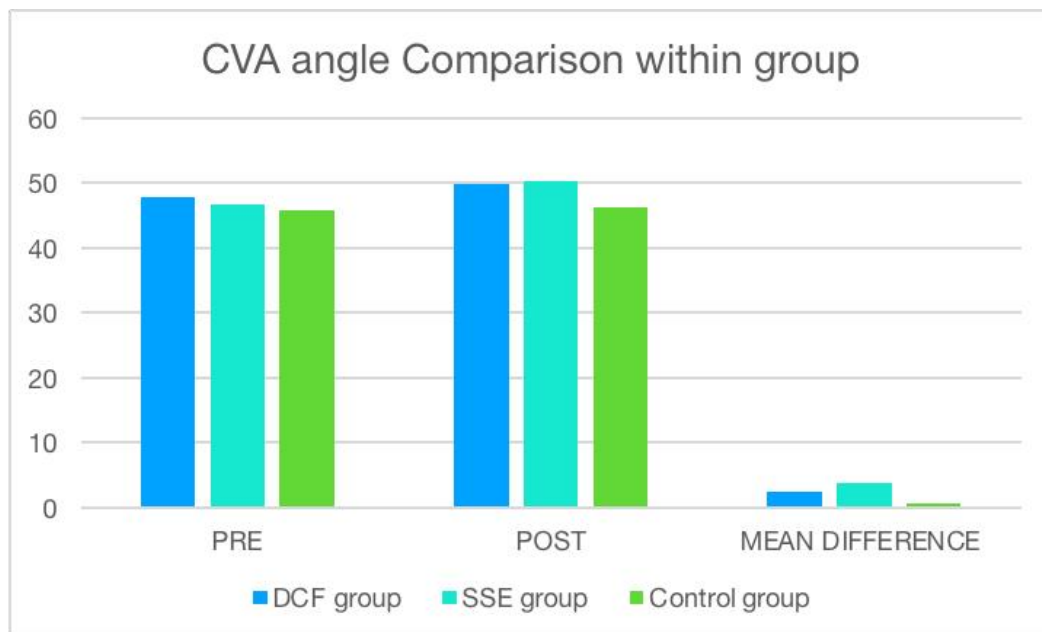


Table 5) Comparison of NPRS for within group comparison

<u>GROUPS</u>	<u>PRE</u>	<u>POST</u>	<u>MEAN DIFFERENCE</u>	<u>p VALUE</u>
<u>DCF GROUP</u>	6.7	3.9	2.8	p <0.05
<u>SSE GROUP</u>	6.9	4	2.9	p < 0.05
<u>CONTROL GROUP</u>	5.3	4.7	0.6	p<0.05

Within group comparison of pre and post intervention of the NPRS in Group A and group B demonstrated improvement in pain with p values of <0.05 which is statistically significant.

Group C showed no statistically difference with p value >0.05

Graph 5 - Comparison of NPRS within group

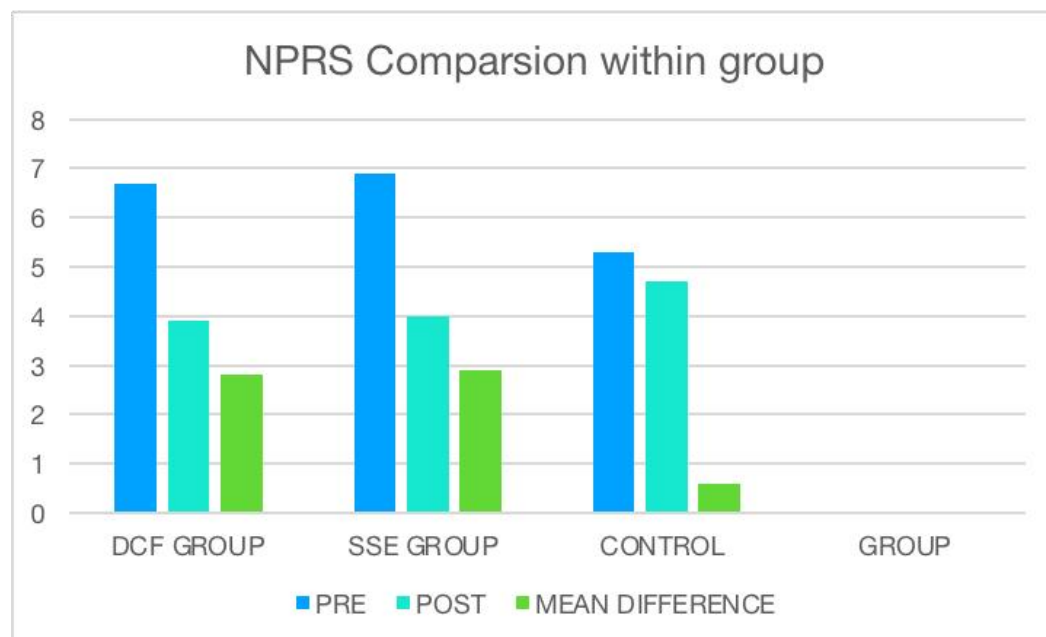


Table 6) Comparison of Neck Disability Index (NDI) for within group comparison

<u>GROUPS</u>	<u>PRE</u>	<u>POST</u>	<u>MEAN DIFFERENCE</u>	<u>p VALUE</u>
<u>DCF GROUP</u>	10.4	13.6	3.2	p <0.05
<u>SSE GROUP</u>	10.6	14.9	4.2	p <0.05
<u>CONTROL GROUP</u>	15.9	16.7	0.8	p <0.05

The above table show that there was a statistically significant improvement in disability within Group A, B when comparing their pre and post intervention scores on the Neck disability index (NDI) whereas in Group C there was no significant difference.

Graph 6- Comparison of Neck Disability Index (NDI) for within group

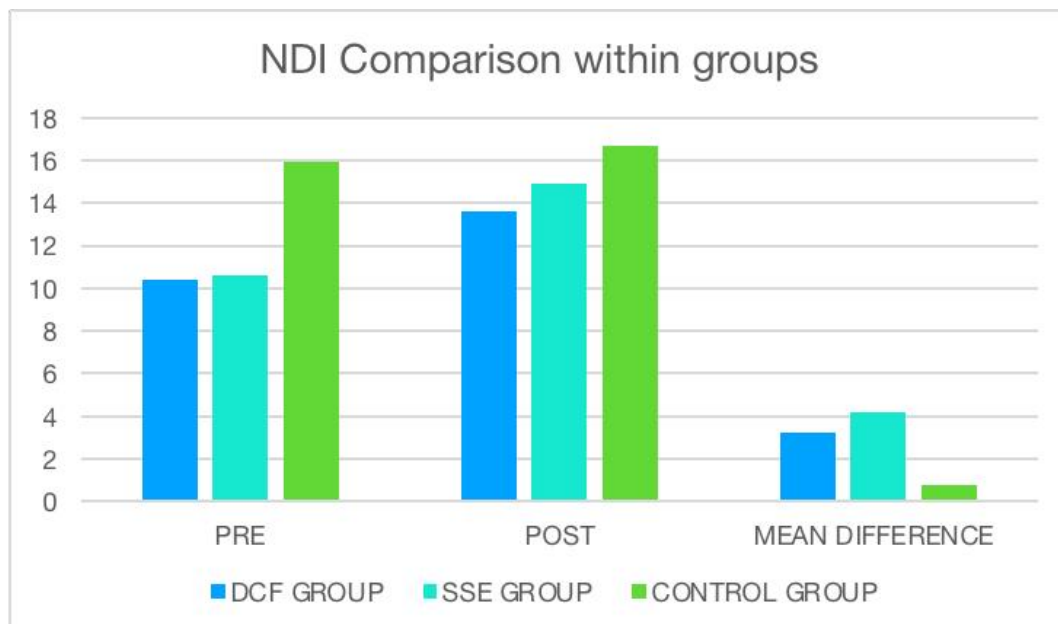


Table 7) Between group analysis of mean differences

<u>Outcome measure</u>	<u>Groups</u>	<u>Baseline mean</u>	<u>Post mean</u>	<u>Mean difference</u>	<u>Between group ANOVA F value</u>	<u>Between group ANOVA p value</u>
CVA angle	DCF group	47.7	49.9	2.27	11.72	p<0.05*
	SSE group	46.6	50.3*	3.71*		
	Control group	45.7	46.2	0.51		
NPRS	DCF group	6.7	3.9	2.8	41.86	p<0.05*
	SSE group	6.9	4*	2.9*		
	Control group	5.3	4.7	0.6		
NDI	DCF group	10.4	13.6	3.2	6.20	p<0.05*
	SSE group	10.6	14.9*	4.2*		
	Control group	15.9	16.7	0.8		

Based on these within and between group comparisons using paired t-tests and one way ANOVA, respectively, all three groups showed improvement in the pain and disability by using Craniovertebral angle , NPRS and Neck Disability index , but Scapular Stabilisation Exercises resulted in greater improvements compared to the other two groups, which was statistically significant and Group C did not show statistically significant improvement in the NPRS scale for pain.

DISCUSSION

- Forward head posture (FHP) is the anterior positioning of the cervical spine .
Most people employed in economic activities complain neck pain. In particular, when one uses a computer or smartphone in an inappropriate posture for a long time, the centerline of the head moves forward and upward, which causes an increase in the weight of the head supported by the neck, ultimately resulting in changes in the head, neck, and areas connecting the shoulders. If the head is located anteriorly for long periods, the bending moment of the head increases, and compensatory excessive straightening of the upper neck joints and atlanto-occipital joints is required to fix the gaze to the front. This can cause shortening of the posterior head and neck muscles, and the upper neck bones can protrude relatively forward when the face is oriented upward.
- The present study was carried out to see the effect of deep cervical flexor training using pressure biofeedback and scapular stabilisation exercises on Craniovertebral angle , pain and disability. Total of 30 subjects were recruited into the study .
- Study subjects performed strengthening exercise of deep cervical flexor using pressure biofeedback and scapular stabilisation exercises on group B and Control group was given isometrics for cervical. Outcome measures used were Mb ruler software for craniovertebral angle measurement and NPRS scale for

- pain and Neck Disability Index for disability respectively. Pre intervention and post intervention assessment (at the end of 4 weeks) were taken .
- The result found in our study is accordance with study done by Thavatchai Suvarnnato & Rungthip Puntumetakul (2020) on Effect of specific deep cervical muscle exercises on functional disability, pain intensity, craniovertebral angle, and neck-muscle strength in chronic mechanical neck pain concluded that 6 weeks of training in both exercise groups can improve neck disability, pain intensity, CV angle, and neck-muscle strength in chronic mechanical neck pain.⁵⁰ The current study showed that deep cervical flexor-muscle exercise significantly reduced pain intensity immediately at the conclusion of 4 weeks of training cervical flexor training enhanced the ability and improved neuromuscular control of deep cervical flexor muscles,
- Outcome measures in the study group showed following results
- **VARIABLE 1 : Craniovertebral angle**
- Effect of deep cervical flexor training using pressure biofeedback , scapular stabilisation exercises and control group .
- Forward head posture leads to a decrease in CVA angle .
- Ideal CVA for a normal individual is around 48-50 degrees.
- Using paired t test for analysis on data the mean of pre treatment CVA of the study was 47.7 and post treatment was 49.9 for DCF group , For SSE group the pre treatment CVA was 46.6 and post treatment was 50.3 whereas for control group the pre treatment was 45.7 and post treatment was 46.2 . Therefore in all the three groups showed significant improvement in CVA angle .

- **VARIABLE 2 : NPRS scale for pain evaluation**

- Using paired t test for analysis on data the mean of pre treatment NPRS of the study was 6.7 and post treatment was 5.9 for DCF group , For SSE group the pre treatment CVA was 6.9 and post treatment was 4 whereas for control group the pre treatment was 5.3 and post treatment was 4.7 . Therefore in group A and B showed significant improvement in pain whereas in group C there was no significant difference for pain.

- **VARIABLE 3 : Neck disability index (NDI)**

- Using paired t test for analysis on data the mean of pre treatment NDI of the study was 10.4 and post treatment was 13.6 for DCF group , For SSE group the pre treatment CVA was 10.6 and post treatment was 14.9 whereas for control group the pre treatment was 15.9 and post treatment was 16.7. Therefore in all the three groups group A and B showed significant improvement in pain whereas in group C there was no significant difference for disability.
- For between groups analysis one way ANOVA was used and it showed that among the three groups major differences in mean was seen with the scapular stabilisation exercises for CVA angle which was 3.71 , for NPRS it was 2.9 and for NDI it was 4.2.
- From the results and tables of this study revealed that CVA angle , pain and disability measured using outcome CVA angle ,NPRS scale and Neck disability index improved in all 3 groups ,but statistically significant improvements were seen in Scapular stabilisation group . The control group did not show statistically significant improvements when compared to the other two experimental groups.

- Thus from the results of this study it can be stated that forward head posture can be improved by using Scapular Stabilisation exercises in individuals with forward head posture among IT professionals.
- Scapular stabilization brought about improvement in posture through activation of the neck muscles, the lower trapezius, and the serratus anterior. Therefore, the intervention has a positive effect on neck alignment by reducing the compensatory movements of the muscles involved in forward head posture.(Young jun moon et al) 2018.

CONCLUSION

The result of the study showed that -

- The study subjects showed scapular stabilisation exercises was effective in improving craniovertebral angle.
- The study subjects showed scapular stabilisation exercises was effective in improving pain and disability.

The null hypothesis is rejected in favour of the hypothesis “There is significant effect of scapular stabilisation exercises on forward head posture. This study suggests that this training is effective on improving the forward head posture.

Thus, this study concluded that effect of scapular stabilisation exercises is effective on improving forward head posture among IT professionals.

LIMITATIONS AND SUGGESTIONS

1. The current study has less treatment duration so it can be extended upto 6-8 weeks .
2. To extend the study further studies using EMG to measure activation of cervical muscles can be used .
3. No follow up was down after the said duration of study hence long term outcomes of the treatment were not evaluated.
4. EMG biofeedback can be used to quantifly muscle activity.

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ANNEXURE 1

INFORMED CONSENT FORM

I willing to participate voluntarily as a subject for the dissertation entitled “EFFECT OF DEEP CERVICAL FLEXOR TRAINING v/s SCAPULAR STABILISATION EXERCISES ON FORWARD HEAD POSTURE AMONG IT PROFESSIONALS - A RANDOMISED CLINICAL TRIAL conducted by

I have been informed regarding the nature of study and the duration of work. I have no objection of undertake the required procedure and to undergo various testing procedures pertaining to the study.

The researchers has already assured me, that I would be treated well without any untoward effects and the rights of confidentiality protected.

Signature of the subject

Place :

Date :

ANNEXURE 2

EVALUATION SHEET

Name-

Age-

Gender-

Address-

PRE-INTERVENTION ASSESSMENT

CVA ANGLE	NPRS	NDI

POST INTERVENTION ASSESSMENT

CVA ANGLE	NPRS	NDI

ANNEXURE 3

ETHICAL CLEARANCE FORM



ABSMARI

ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2023/047

Date: 12/08/2023

APPROVAL LETTER

APPENDIX- VIII

To,

MEMBERS

Dr. Smaraki Mohanty,
Clinician

Dr. Satyajit Mohanty,
Basic Medical Scientist

Dr. Ashok Singh Chouhan
Basic Medical Scientist

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans,
Social Scientist

Ms. Subhashree Samal,
Lay Person

Mr. Deepak Ku. Pradhan,
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

ANSUMAN CHINARA
ABSMARI
273, PAHAL, BHUBANEWAR-752101

Protocol Title: Impact of eye exercises technique in combination with cognitive psychomotor training on visual reaction time among badminton players. -An Experimental Study

Protocol ID.: ABS-IEC-2023-PHY-006

Subject: Approval for the conduct of the above referenced study

Dear Mr./Mrs./Dr **ANSUMAN CHINARA**

With reference to your Submission letter dated 12/08/2023 the ABSMARI IEC has of the Ethics reviewed and discussed your application for conduct of clinical trial on dated 12/08/2023 (Sat Day).

The following documents were reviewed and discussed

S.N.	Documents	Document (Version/Date)
1	IEC Application Form	08-08-2023
2	Informed Consent Form	08-08-2023
3	Undertaking form PI	08-08-2023
4	CRF	08-08-2023
5	COI from the Investigators	08-08-2023

The following members were present at meeting held on 12-08-2023

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
1	Prof. Dr. E. Venkata Rao	Professor (MBBS, MD, Dept. of Community Med.) IMS & Sum Hospital, BBSR	Chair Person	M	N
2	Dr. Satyajit Mohanty	Director-Medicare Hospital, BBSR	Basic Medical Scientist	M	N
3	Dr. Ashok Singh Chouhan	PhD. Pharmacology, Assoc. Prof. Dept. of Pharmacology, Hi-Tech Medical College & Hospital, BBSR	Basic Medical Scientist	M	N



Utkal Signature, Plot No.-273, Ground Floor, Pahal, Bhubaneswar-752101
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ABSMARI ETHICS COMMITTEE

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE,
BHUBANESWAR, ODISHA

Prof. (Dr.) E. Venkata Rao
Chairperson

Mr. Chinmaya Kumar Patra
Member Secretary

Ref. No. ABSMARI/IEC/2023/050

Date: 12/08/2023

MEMBERS

Dr. Smaraki Mohanty,
Clinician

Dr. Satyajit Mohanty,
Basic Medical Scientist

Dr. Ashok Singh Chouhan
Basic Medical Scientist

Mr. Shib Shankar Mohanty
Legal Expert

Ms. Annie Hans,
Social Scientist

Ms. Subhashree Samal,
Lay Person

Mr. Deepak Ku. Pradhan,
Scientific Member

IEC-SECRETARIAT

Mr. Gouranga Ku. Padhy
Mr. Susant Ku. Raychudamani

S.N.	Name of the Member	Designation & Qualification	Representation as per NDCT 2019	Gender (M/F)	Affiliation with the Institution (Y/N)
4	Dr. Smaraki Mohanty	Asst. Prof-IMS & Sum Hospital/MBBS, MD (Community Med)	Clinician	F	N
5	Mr. Chinmaya Kumar Patra	Principal-ABSMARI, MPT	Member Secretary	M	Y
6	Mr. Shiba Sankar Mohanty	Junior Counsel-Lt. Ramachandra Sarangi's Chamber / BA LLB	Legal Expert	M	N
7	Ms. Annie Hans	Disability Inclusive Development Co-Ordinator in Humanity and Inclusion (India/Nepal/Srilanka). /MA in Social Work	Social Scientist	F	N
8	Ms. Subhashree Samal	Ref. Reader-Pol Sc.	Lay Person	F	N
9	Mr. Deepak Kumar Pradhan	Asst. Prof-ABSMARI, MPT	Scientific Member	M	Y

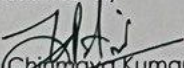
This is to confirm that only members who are independent of the Investigator and the Sponsor of the trial have voted/ provided opinion on the trial.

This Committee approves the documents and the conduct for the trial in the presented form with necessary recommendation.

The ABSMARI IEC must be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent and requests to be provided a copy of the final report.

The ABSMARI IEC follows procedures that are in compliance with the requirements of ICH (International Conference on Harmonization) guidance related to GCP (Good Clinical Practice) and applicable Indian regulations.

Yours sincerely


Mr. Chinmaya Kumar Patra
Member Secretary

ABSMARI ETHICS COMMITTEE
ABSMARI Ethics Committee
Pahal, Bhubaneswar



ANNEXURE 4

MASTERCHART

SR.no	Age	Gender	CVA pre	CVA post	NPRS pre	NPRS post	NDI pre	NDI post
1	36	M	48	48.3	5	8	15	10
2	35	F	47.08	48.5	4	6	7	7
3	39	M	47.67	49	3	6	18	15
4	35	M	48.6	50.5	4	6	11	9
5	38	M	49.5	51	2	5	7	7
6	37	F	46.8	49.5	3	7	20	18
7	36	M	48	51.6	3	6	24	15
8	36	F	47.5	48.26	6	8	10	7
9	35	M	48.6	52.6	4	7	16	11
10	38	F	45.4	50.6	5	8	8	5
11	40	M	46.9	52.5	5	8	15	10
12	39	M	47.08	52.6	4	7	7	7
13	35	M	47.67	49	3	6	18	15
14	36	M	48.1	52.7	4	6	11	9
15	39	F	45.6	49.5	2	5	22	14
16	39	F	47.61	50.2	3	5	24	16
17	40	M	45.28	52.5	6	9	15	10
18	35	F	44.88	46.61	4	7	16	11
19	40	M	47.83	47.8	5	8	10	6
20	36	F	45.58	46.1	4	8	11	8
21	38	F	45.28	46.72	6	7	14	14
22	39	F	45.84	45.84	4	5	9	7
23	40	F	41.23	42.5	6	7	16	14
24	40	F	45.8	46.1	5	5	14	14
25	35	M	48	48	6	6	19	19
26	39	M	45.09	46	3	3	23	23
27	38	M	45.2	45	3	5	20	18
28	40	F	47.5	48	6	6	16	16
29	37	M	45.9	45	5	5	17	17
30	40	F	48.6	49.3	3	4	19	17