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Original Research Article

Effectiveness of Scapular Stabilization Exercises Versus Kinesiotaping on Craniovertebral Angle Among Young Adults with Forward Head Posture

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ABSTRACT

INTRODUCTION: Body alignment is known as body posture, while optimum posture is the position in which the body maintains equilibrium with the least amount of musculoskeletal activity possible without producing pain or discomfort. Proper posture maintains musculoskeletal equilibrium, and Poor posture might result in muscular imbalance that causes a faulty relationship among various body parts. Forward head posture (FHP) is one of the most prevalent, poorly constructed, and/or habitual postures that can develop as a result of numerous postural or occupational demands, such as excessive computer and smartphone use.
AIM: The study aims to evaluate the effectiveness of Scapular stabilization exercises versus Kinesiotaping on craniovertebral angle among young adults with forward head posture.
METHODS: An Experimental study was conducted on Symptomatic young adults having the age group between 18-25 years. A total of 36 symptomatic young adults were selected and allocated into 2 groups. Two outcome measures, which are CVA (Craniovertebral angle) and NDI scale (Neck Disability index), were taken, and Subjects with a Baseline NDI score of less than 15 points, CRANIOVERTEBRALANGLE (CVA) less than 50°, were randomly assigned (Simple randomisation method) were assigned using a lottery method
RESULTS: The statistical analysis within the groups highlighted significant improvements for both CVA and NDI ($p < 0.001$) for both groups. Further, the comparison between the groups underscored the superiority of Group A (SSE along with kinesiotaping) in promoting better results for CVA ($p < 0.001$) and NDI ($p = 0.002$) when compared to Group B (Scapular Stabilization Exercise).
CONCLUSION: The study concludes that scapular stabilization exercises combined with kinesiotaping for 3 weeks provided significant effective in improving craniovertebral angle and reducing neck disability compared with scapular stabilization exercises alone in young adults with forward head posture.

Keywords: Forward head posture, Craniovertebral angle, Neck disability index, Kinesiotaping, Scapular stabilization exercises, young adults

INTRODUCTION

Body alignment is known as body posture, while optimum posture is the position in which the body maintains equilibrium with the least amount of musculoskeletal activity possible without producing pain or discomfort.[1] Proper posture maintains musculoskeletal equilibrium and poor posture might result in muscular imbalance that causes a faulty relationship among various body parts. [2] Proper posture is defined as a state in which the body experiences less stress and strain when musculoskeletal equilibrium is maintained. Numerous elements, such as vestibular function, the cerebellum, and eyesight, are known to affect balance maintenance.[3] Specifically, Barett et al. claimed that joint position sensation is crucial for maintenance. Muscle-based mechanoreceptors influence position sense, leading to the belief that muscle issues significantly impact balance.[3]

Forward head posture (FHP) can arise from a variety of postural or occupational demands, including prolonged use of computers and smartphones.[4]

The epidemic of forward head posture (FHP) has grown in recent years. Moreover, it is considered to be one of the most common postural malalignment found in today's youth. It is the anterior positioning of the cervical spine or any alignment. In this position, the external auditory meatus is in front of the plumb line across the shoulder joint as the head moves forward and the centre of gravity changes. The head is positioned anterior to the trunk as a result of the upper body drifting backward and the shoulders slumping forward to compensate for the change in the centre of gravity.[5,6] In this Condition, there is an increased external flexion torque to the vertebrae of the cervical spine, i.e., increased extension of the upper cervical spine (C1–C3) and increased flexion of the lower cervical spine (C4–C7) and upper thoracic spine, causing severe tension of the extensors of the neck and surrounding connective tissue. It is also called text neck, turtle neck, scholar's neck, wearies neck, I hunch, and reading neck. Moreover, it is considered to be one of the most common postural malalignments found in today's youth. [5,6]

Forward head posture is caused by the cervical spine's anterior position, which places 10 lbs (4.5 kg) more weight on the cervical spine and compromises the function of the musculoskeletal, neural, and circulatory systems for every inch the head is moved forward.[7] Patients with neck and shoulder disorders have more severe forward head posture as compared to those without such diseases, and their acromion process is protruding. To maintain good posture and neck stability, the deep flexor muscles of the neck, the longus capitis and longus colli, are thought to play a crucial role.[8]

The forward positioning of the head with respect to the shoulder is known as forward head posture (FHP), and it may be facilitated by neck flexion. This is the most prevalent. In the sagittal plane, cervical postural error is a condition that affects almost every population to varying degrees. [9] Lower cervical range of motion, especially in neck rotation and flexion, has been linked to higher FHP. [10, 11] Furthermore, it seems that FHP affects static balance control in asymptomatic individuals. [12–15]. However, some research has found a link between FHP and neck pain. [16–18]

In Asia, forward neck position affects 66% of individuals.[19] FHP has been the subject of numerous research studies, and it is one of the most prevalent postural abnormalities across various populations.[20, 21–24] It is estimated that between In Malaysia and India, FHP affects 60 and 70 percent of students, respectively.[22, 24] Normally, the scapulothoracic muscles, such as the rhomboids, middle trapezius, and lower trapezius, are thought to contribute to the postural stability of the cervical spine and reduce biomechanics loading of the cervicoscapular musculature.[25,26] Additionally, temporomandibular disorders, cervicogenic headaches, thoracic outlet syndrome, cervical spondylogenic alterations, loss of appropriate bowel function, and decreased vital capacity have all been linked to FHP.[27]

Symptoms of forward head posture include forward head position, chronic pain (neck, shoulders, upper, lower, and middle back), TM joint dysfunction, teeth clenching, fatigue, arthritis, pinched nerves, reduced mobility, overall height loss, myofascial pain syndrome, headaches and migraines, tingling or numbness in the hands and arms, muscle spasms, sore and tight neck and chest muscles, asthma, poor sports performance, sleep apnoea, disc degeneration, trigeminal neuralgia (facial pain), mouth breathing, and sleep apnoea.[28] (Greigel-Morris, 1992; Greenfield, Catlin, et al., 1995) Postural malalignment is thought to facilitate impairments of scapular dysfunction, such as altered scapular kinematics, coordination, strength, and muscle activity. It is believed that poor postural alignment alters the length-tension relationship of the surrounding muscles, which alters how the scapular muscles work and disrupts normal scapular kinematics, strength, muscular activation patterns, and coordination.[29]

As we age, our posture tends to deviate from its normal alignment, and certain changes can be seen, such as rounded shoulders, head and neck protracted in a forward direction, and the thoracic spine showing a kyphotic posture becoming more curved than usual. If left untreated, poor and deviated alignment of the body and bad posture can put abnormal stresses on the tissues, which leads to early arthritic and degenerative changes in the joint and can also cause pain. Altered posture has also been related to poor neuromuscular balance, and it can alter the gait pattern and functional abilities of the person. [30] Most of the occupations require sustained posture in which there is forward arm posture use in predominant flexor synergies, e.g., physical therapist, typist, and computer operator. In the coming time, as our profession evolves, the use of computers and other electronic devices, as well as automated devices, will require employees to adopt a seated posture, i.e., a flexor-dominated posture.[31]

Posture is essential to everyday life; the way an individual holds the body determines every movement pattern throughout their activities of daily living, their limitations, and how likely they are to become injured or experience pain. Infants have flawless posture and movement patterns from birth. But as people age, their muscles, joints, and bones grow and shift, which can have an impact on posture. Then, as adults, the process of activities of daily living has changed the neuromuscular system, resulting in muscle imbalances, which are the main contributors to poor posture.[32]

Janda described muscle imbalances as impaired relationships between muscles prone to tightness (stabilizing function) that lose extensibility and those prone to weakness (mobilizing function), It has been suggested that muscle when the upper trapezius gets tight and the middle and lower trapezius get weak, the scapulothoracic region becomes unbalanced. [33] This posture is associated with weakness in the deep cervical short flexor muscles and mid-thoracic scapular retractor (i.e., Longus colli, Longus capitis, Rhomboids, Serratus Anterior, middle and lower fibers of the Trapezius, Teres minor, and Infraspinatus) and shortening of the opposing cervical extensors (i.e., Upper trapezius, levator scapulae, sternocleidomastoid, and pectoralis minor and major muscles). [34]

Previous research had demonstrated that FHP is linked to a variety of musculoskeletal conditions, including temporomandibular disorder, tension-type headaches, shoulder and neck pain, trigger points in the suboccipital muscles, impaired vital capacity, and cervical and shoulder complex dyskinesia.[35, 36–38] The habit of repetitive use of computers, TV, mobile phones, video games, and even backpacks forces the body to exhibit bad posture.[39] The associated muscle shortening and elongation due to muscular imbalance leads to malfunctioning of various parts of the body. [40, 41,42]

FHP also causes vestibular hypofunction, subacromial impingement syndrome, thoracic outlet syndrome, higher centre of gravity movement velocity and reaction times, and impaired cervical proprioception. Therefore, it would appear that FHP correction could be crucial to controlling and averting these effects.[38,41,43-45] The cervical and thoracic spines are inappropriately altered by forward head posture, which might lead to other alterations in the thorax and respiratory system.[46] A recent review found that therapeutic exercise helped participants with FHP with their neck discomfort and CVA.[47] Also, there are many studies regarding neck pain, functional disorders, and improving posture through different exercise programs, such as extension exercises and muscle-strengthening exercises, and deep cervical flexor training of the cervical spine.[48,49]

A sagittal plane image's craniovertebral (CV) angle is used to calculate forward head position. A horizontal line across the seventh cervical vertebra (C7) and a line from the tragus of the ear to C7 comprise the CV angle.[50] In every age range, forward head posture is prevalent. The mean craniovertebral angle for males aged 22–44 is roughly 48.8 degrees and with a mean age range of 23–66 years, females typically have a craniovertebral angle of around 47.6-degree angle.In healthy individuals, the CV angle ranges from 48 to 50 degrees. A more forward head posture is indicated by a smaller CV angle. Using this method to measure the CV angle has been reported to have strong intra-rater and inter-rater reliability (ICC between 0.81 and 0.87).[51,52,53] When scapular anatomy and biomechanics work together to create effective shoulder movement, the scapula plays a significant role in supporting optimal shoulder function. Weakness or dysfunction in the scapular muscles can alter normal posture and scapular mechanics. [54,55] The thoracic spine must be improved in order to correct the posture of the head and neck.[56]

Scapular stabilisation exercises (SSE) are therefore a useful method for regaining the muscle and postural imbalance.[57] When it comes to early rehabilitation and balancing both sides of the trapezius with scapular mobility and pair motion, SSE works well. as well as for putting the thoracic cage in its proper central position, bringing the neck back into alignment, and resolving the neck's awkward posture by adjusting the scapula's position and kinematics. [57,58,59]

There are several treatments with the aim of improving posture and reducing posture-related pain. Strength training, body awareness training, motor control training, and workplace ergonomic modifications are a few examples.[60] Physical education. In addition to improving posture and movement behaviour, taping is another possible therapy option for neck discomfort and disability. In this context, taping techniques have developed as a complement to the treatment of musculoskeletal dysfunction and have improved over time to provide therapeutic effects that do not hinder the functionality of body segments.[61, 62, 63] Kinesiology tape, or Kinesio Taping (KT), can provide support and stability to muscles and joints without limiting range of motion due to its elasticity.[64] Since KT has been demonstrated to provide a higher reduction in the neck disability index (NDI), it may also have a little positive impact in helping injured athletes improve their strength and range of motion. [65]

Kenzo Kase, the creator of Kinesio tape, suggested a number of mechanisms for its effects, including decreased pain through neurological suppression, improved circulation of blood and lymph by eliminating tissue fluid or bleeding beneath the skin, altered muscle function, effects on weak muscles, repositioning of subluxed joints by releasing abnormal muscle tension, and assistance in fascia and muscle function.[66, 67] It has been suggested that kinesiotaping (KT) is a useful therapy for regaining muscular function and supporting proper posture. It imitates human skin's characteristics. [68, 69]

Previous studies had shown that forward head posture (FHP) is associated with numerous musculoskeletal disorders, such as temporomandibular disorder, tension-type headaches, shoulder and neck pain, trigger points in the suboccipital muscles, reduced vital capacity, and dyskinesia of the cervical spine and shoulder complex. Many studies have addressed the effects of different exercises and modalities on forward head posture (FHP), including Kendall's stretching and strengthening exercises, posture stabilizing exercises, elastic band exercises, dynamic neuromuscular stabilisation exercises, sensorimotor training, cervical stabilisation exercises (CSE), and proprioceptive training. Those studies considered a long duration of the interventions (8– 32 weeks). And the studies have proven the significant positive effects of different exercise protocols on improving forward head posture.

But the studies on combining two different interventions, that is, scapular stabilization exercises and kinesiotaping, had been insufficient. So, the present study chose a 3-week intervention program to investigate if using a shorter duration of intervention is effective in having similar changes by evaluating the effectiveness of scapular stabilization exercises versus kinesiotaping on craniovertebral angle among young adults with forward head posture.

MATERIALS & METHODS

The present study was conducted on symptomatic young adults having the age group between 18-25 years. Based on inclusion and exclusion criteria, 36 subjects were selected and informed consent from each was taken. Ethical clearance was taken from the institutional committee. All the subjects acknowledged their understanding of the study and their willingness to participate by providing signed consent.

The purpose of the study, along with various testing procedures and a training program, was explained to the subjects in detail. A total of 36 symptomatic young adults were selected and allocated into 2 groups: Group A (n = 18) experimental group and Group B (n 18) control group. Two outcome measures, which are CVA (Craniovertebral angle) and NDI scale (Neck Disability Index), were taken. Subjects with a Baseline NDI score of less than 15 points, CRANIOVERTEBRALANGLE (CVA) less than 50°, were randomly (Simple randomisation method) were assigned to the experimental group and control group using a lottery method.

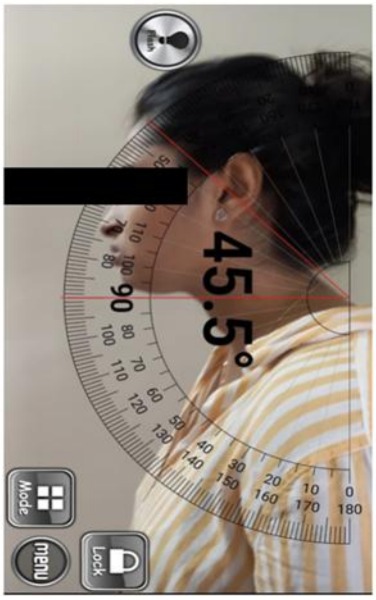
INCLUSION CRITERIA: Symptomatic young adults, aged 18 years to 25 years, both male and female, included having a Baseline NDI score of less than 15 points, CRANIOVERTEBRAL ANGLE (CVA) less than 50°. Subjects who are willing to participate.

EXCLUSION CRITERIA: Age level below 18 and above 25 years were excluded, Subjects with any medical limitation to participate in physical training program, Subjects with any kind of trauma like Whiplash injury or Cervical fractures, Subjects with any severe surgical or neurological disorders who were unable to perform the detailed movements required, and those who have been treated for trauma or pain in the cervical spine area for the last 6 months, Participants with skin allergies, fragile or healing skin, malignant sites, cellulitis or infected areas or open wounds around neck region, History of chronic pain in cervical area, Involvement in regular or professional sports activities, Subjects who are not willing to participate.

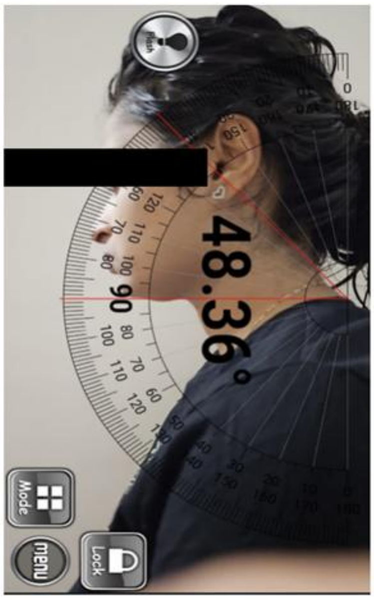
OUTCOME MEASURES:

1. CRANIOVERTEBRAL ANGLE [28,70]

Objective: To accurately measure the degree of FHP, photogrammetry was used to measure the CVA on a sagittal plane. The previous studies have suggested the photogrammetric method as a sensitive and reliable method for postural assessment. Smartphone mobile application - ON Protractor is a reliable tool to measure the craniovertebral angle. The CVA measurement is defined as the angle between a horizontal line through the spinous process of the C7 vertebra and a line from the spinous process of the C7 vertebra through the ear tragus.



PRE CVA



POST CVA

Method of use: To accurately measure the degree of forward head posture, photogrammetry was used to measure the craniovertebral angle on a sagittal plane. The subjects were asked to stand barefoot. The android smartphone was mounted 1.5 m away from the subjects for taking photographs of the participants. To maintain the same distance between the android smartphone and the subjects, a spot on the ground was marked for the subjects to stand on, and the spot was taped onto the floor. The camera's height was set at the level of the seventh cervical vertebra for each participant. The privacy and comfort of the participants were guaranteed. Skin markers were placed on the ear tragus and spinous process of the seventh cervical vertebra. The photos were taken from the subject's left-hand side, upon which the CV angle was calculated using the ON protractor application. Three pictures will be taken from a lateral view to obtain CVA. The mean average of angles extracted from three photos will be considered as the CVA measure. Normal Craniovertebral angle is 49.9 degrees. The greater the measured (CVA) value, the more ideal the alignment of the head and the neck; whereas the smaller the angle, the more serious the degree of FHP. RELIABILITY: 0.947 - 0.992 and VALIDITY: 0.99.

2. NECK DISABILITY INDEX [71,72]

The NDI is adapted from the Oswestry Low Back Pain Disability Questionnaire. NDI is a self-assessment tool developed to evaluate the ability of patients with neck pain to perform daily activities. The tool consists of 10 items related to pain intensity, lifting, concentration, reading, headache, self-management, driving, working, sleeping, and leisure activities. The score for each item is 0–5, and the total score is recorded by adding the scores of all the items. INTERPRETATION: 0 – 4 points (0-8%) (NO DISABILITY), 5 – 14 points (10-28%) (MILD DISABILITY), 15 – 24 points (30-48%) (MODERATE DISABILITY), 25 – 34 points (50-64%) (SEVERE DISABILITY), 35 – 50 points (70-100%) (COMPLETE DISABILITY). The lower the total score, the less the performance of daily activities is affected. The higher the score, the greater the limitations are to daily activities. The test-retest reliability was very high, with ICC=0.96 (Shaheen et al., 2013). RELIABILITY: 0.93 - 0.97 and VALIDITY: 0.89

TREATMENT PROTOCOLS - Subjects were divided into two groups:

Group A: Experimental group: SCAPULAR STABILIZATION EXERCISES [12 sessions of exercises for 20 minutes, 4 days/week for a total of 3 weeks] + KINESIO TAPING [Kinesiotaping application: After every 48 hours, reapplication of the tape was performed for 3 weeks]

Group B: Control group: SCAPULAR STABILIZATION EXERCISES [12 sessions of exercises for 20 minutes, 4 days/week for a total of 3 weeks]

		REPETATIONS	**STRECH HOLD**
WARM UP	NECK MOVEMENTS	5	
	SHOULDER SHRUGS	10	
	TRAPEZIUS SELF STRECHING	3	1ST WEEK - 20Secs 2nd WEEK - 30Secs 3rd WEEK - 45Secs [EACH SIDE]
	PECTORALIS MINOR SELF-STRETCHING	3	1ST WEEK - 20Secs 2nd WEEK - 30Secs 3rd WEEK - 45Secs [EACH SIDE]
COOL DOWN	CAT STRETCH	3	1ST WEEK - 20Secs 2nd WEEK - 30Secs 3rd WEEK - 45Secs [EACH SIDE]
	STERNOCLEIDOMASTOID SELF STRETCHING	3	1ST WEEK - 20Secs 2nd WEEK - 30Secs 3rd WEEK - 45Secs [EACH SIDE]
	LEVATOR SCAPULAE SELF STRECHING	3	1ST WEEK - 20Secs 2nd WEEK - 30Secs 3rd WEEK - 45Secs [EACH SIDE]

WARM UP PROTOCOL

1. **Neck Movements**
2. **Shoulder Shrugs:** Stand erect and arms at your side, elevate the shoulders as high as possible and hold them for 2-3 seconds, then slowly lower your shoulders to the original position.
3. **Trapezius self-stretching:** Sitting erect, For right side of trapezius stretch lower your left ear towards your left shoulder, To prevent the lifting of the right shoulder the right hand is placed behind your back or hold the chair behind, Now using your left hand gently press your head and hold it for few seconds, Then slowly release the stretch and get back to original position and repeat the same manner to the right side.
4. **Pectoralis minor self-stretching:** Stand at the corner of the wall or at the doorstep. Shoulders are abducted to 90 degrees and the elbow to 90 degrees. Now, place the forearm on each side of the door step. Slowly lean forward or shift your weight forward. Hold it for a few seconds. Then slowly release the stretch and get back to the original position.

SCAPULAR STABILIZATION EXERCISES

1. **Chin Tuck Exercises:** (longus colli, longus capitis), Sit in a chair with your feet flat on the floor, relax your shoulders. Look straight ahead, and move your chin towards your chest. Don't tilt your head up or down, or bend your neck forward. Hold for 5 seconds. Then relax.
2. **TYI Exercises:** (middle trapezius, lower trapezius, serratus anterior), Subject lying on their stomach/ prone lying while fully extending their elbows and fingers, positioning their scapulae, and attempting to hold these positions throughout the exercise. Align your head

with your thoracic spine. Mimic the shapes of T, Y, and I with the arms while holding each position for 5 seconds.

3. **Quadruped arm press**
4. **Scapulothoracic strengthening exercise:** Standing position

[A] CONTRACTING BOTH SHOULDERS: Scapulothoracic (rhomboid, middle and lower trapezius) strengthening exercise while attaching your arms to the body with elbows flexed, convergence to contract both shoulders

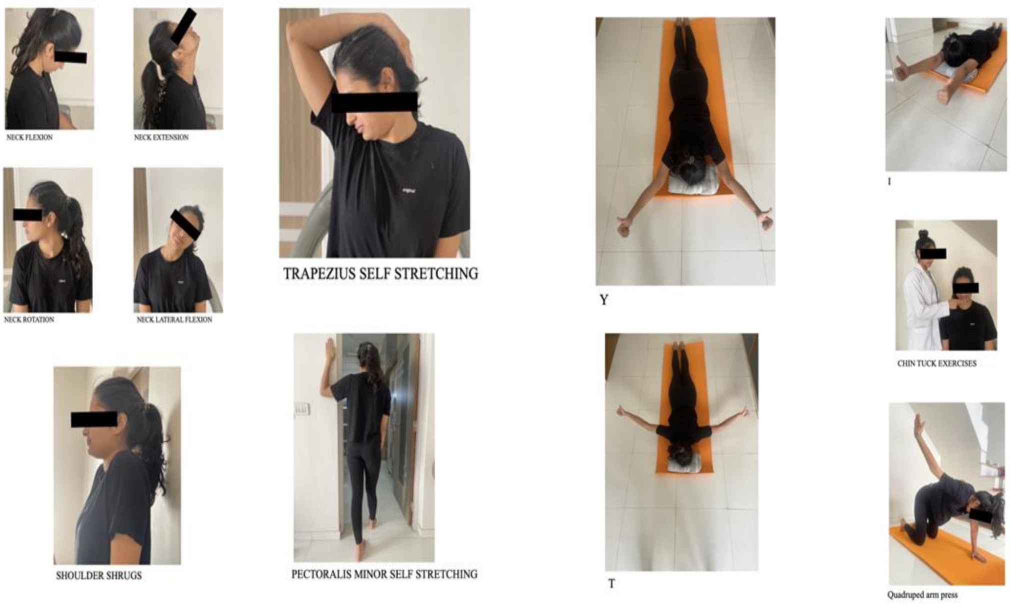
[B] W SHAPE AND V SHAPE: Scapulothoracic (rhomboid, middle and lower trapezius) strengthening exercise while attaching your arms to the body with elbows flexed, convergence to contract both shoulders and hold both shoulders as W shape and stretch both arms as V shape.

5. Serratus anterior punches: Stand like you're about to punch someone. Pivot to the right, and extend your left hand directly in front of you. Try to extend your arm as far out as it will go. Then pivot back to your left, bringing your left hand toward your chest and extending your right hand in front of you.

DOSAGE FOR SSE: 1ST WEEK: 2 SETS, 6 REPETITIONS, 2ND WEEK: 2 SETS, 8 REPETITIONS, 3RD WEEK: 3 SETS, 8 REPETITIONS.

COOL DOWN PROTOCOL

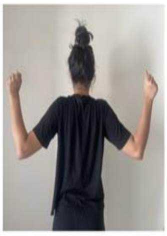
1. **CAT STRETCH:** (latissimus dorsi, middle and lower trapezius, serratus anterior). Begin sitting on your heels and knees on the floor mat. Now, bring your head slowly down to the floor. Gently stretch your arms to the front, under your forehead, or by your side. Breathe slowly while maintaining this posture, and to release yourself from this posture, exhale slowly and sit back, gently straightening your spine.
2. **STERNOCLEIDOMASTOID SELF-STRETCHING:** To stretch the sternocleidomastoid muscle, the subject was instructed to look back behind their shoulder and lift their head up toward the ceiling while the opposite hand was placed on the forehead and pulled in the direction to elongate the muscle.
3. **LEVATOR SCAPULAE SELF-STRETCHING:** The levator scapula was stretched by having one hand grasp the opposite side of the head and pulling the chin towards the direction of the armpit. At the same time, the opposite arm was lifted up along the wall so that the shoulder blade could be turned upward in order to elongate the muscle as much as possible.



Serratus anterior punches

CAT STRETCH

V SHAPE



W SHAPE

STERNOCLEIDOMASTOID SELF STRETCHING

LEVATOR SCAPULAE SELF STRETCHING

KINESIOTAPING

SKIN PREPARATION: A Small test patch of Kinesio Tape for 24 hours prior to undertaking a full application. Ensuring the skin is clean, free from any oils or creams, and dry. Clip or shave any dense or matted hair.

1. STRENGTH TAPING FOR RHOMBOID MAJOR [73]

Client position: The client is seated with the upper limb horizontally adducted and the arm held by the opposite arm; the scapula is protracted by reaching further forward.

Measurement of tape: Measure a length of tape from T2 to the inferior border of the scapula whilst it is protracted. This can be left as an I-strip to address specific fibres to allow for more tissue coverage.

Tape application: I-strip application, apply the starting anchor on the spine at the level of T2 with zero tension. With the tissue in a lengthened position, apply the tape towards the inferior angle of the scapula with 25–35% tension. Complete the taping by applying the anchor onto the scapula with zero tension. Rub the tape to activate the glue.

2. LENGTH TAPING FOR UPPER TRAPEZIUS [73]

Client position: The client is seated in neutral lordosis with the neck flexed forward and laterally flexed to the contralateral side and rotated to the ipsilateral side so as to obtain maximal tissue stretch over the area.

Measurement of tape: Measure a length of tape from under the hairline to the acromion. The tape can be left as an I-strip taping for the middle trapezius, and also allows for a better angle as the tape travels up towards the occiput.

Tape application: Apply the anchor over the acromioclavicular joint with zero tension. With the tissue in a lengthened position, apply the tape with 15–25% tension. Complete the taping by applying the anchor under the occiput with zero tension. Rub the tape to activate the glue.

KINESIOTAPING FOR RHOMBOID MAJOR

KINESIOTAPING FOR UPPER TRAPEZIUS

RESULT

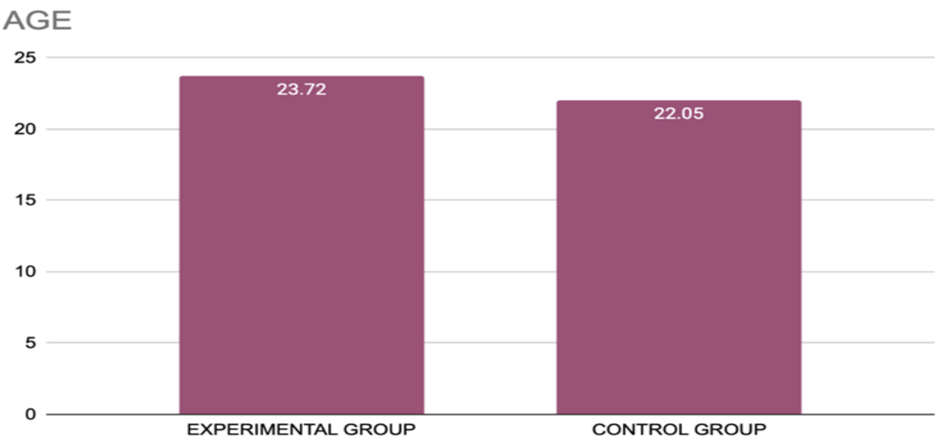
In this study, a total of 36 subjects participated, with 18 in the experimental group who received SCAPULAR STABILIZATION EXERCISES AND KINESIOTAPING and 18 in the control group who received SCAPULAR STABILIZATION EXERCISES. Pre and post-data were collected before and after 3 weeks. STATISTICAL ANALYSIS was conducted using the software Statistical Package for Social Science (SPSS) version 23 for Windows. Initially, the normality of the data distribution in both groups was assessed using the SHAPIRO-WILK TEST, which indicated that the data were not normally distributed. Therefore, non-parametric tests were chosen for the analysis. Mean and standard deviation were calculated for the numeric data. Within the Experimental and Control groups, pre and post-data were analysed using the WILCOXON SIGNED RANK TEST. Additionally, a comparison of the mean differences between the two groups was conducted using the MANN-WHITNEY U TEST. Significance was defined as $p < 0.05$, and a 95% confidence interval was used to determine the significance of the results.

DEMOGRAPHIC DATA

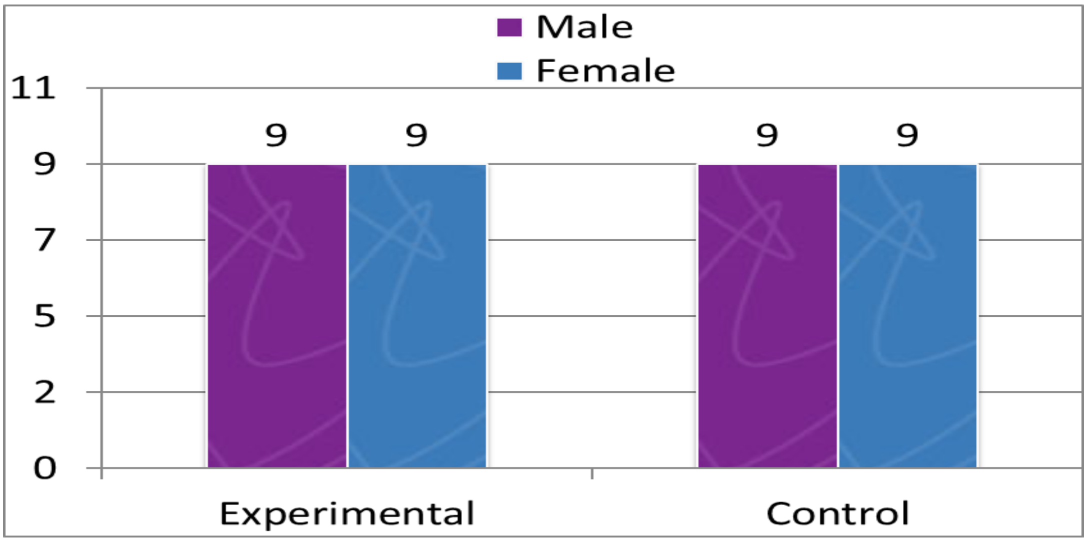
TABLE 1: AGE DISTRIBUTION IN BOTH GROUPS AND GENDER DISTRIBUTION IN BOTH GROUPS

GROUP	MEAN ± SD (years)
EXPERIMENTAL	23.72 ± 0.75
CONTROL	22.06 ± 2.05

GENDER	EXPERIMENTAL	CONTROL
MALE	9	9
FEMALE	9	9



THE MEAN AND STANDARD DEVIATION IN THE EXPERIMENTAL GROUP IS 23.72 ± 0.75 AND IN THE CONTROL, GROUP IS 22.06 ± 2.01.



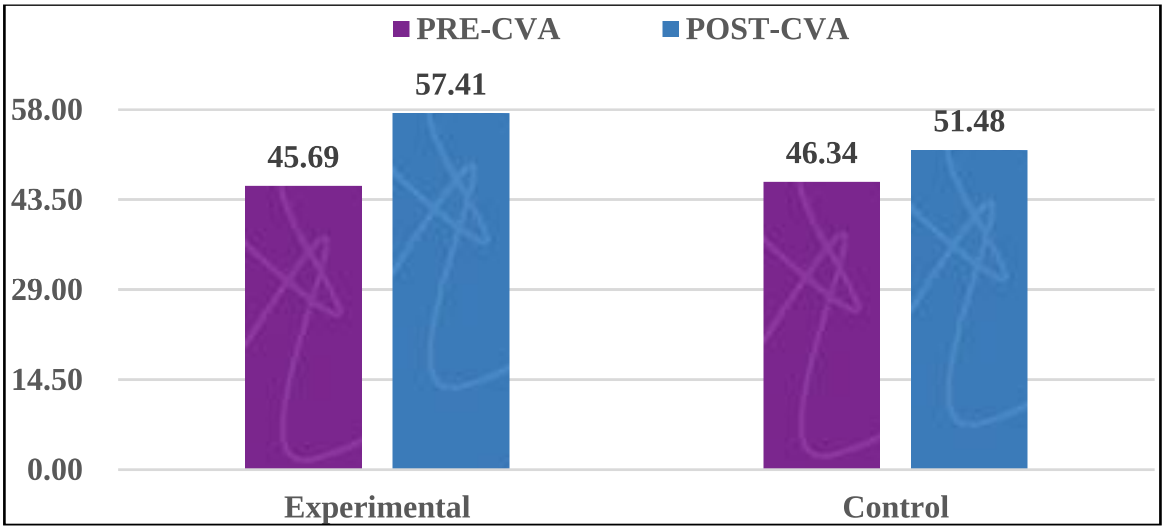
THERE ARE 9 MALES AND 9 FEMALES IN EACH GROUP.

WITHIN GROUP ANALYSIS - WILCOXON SIGNED RANK TEST

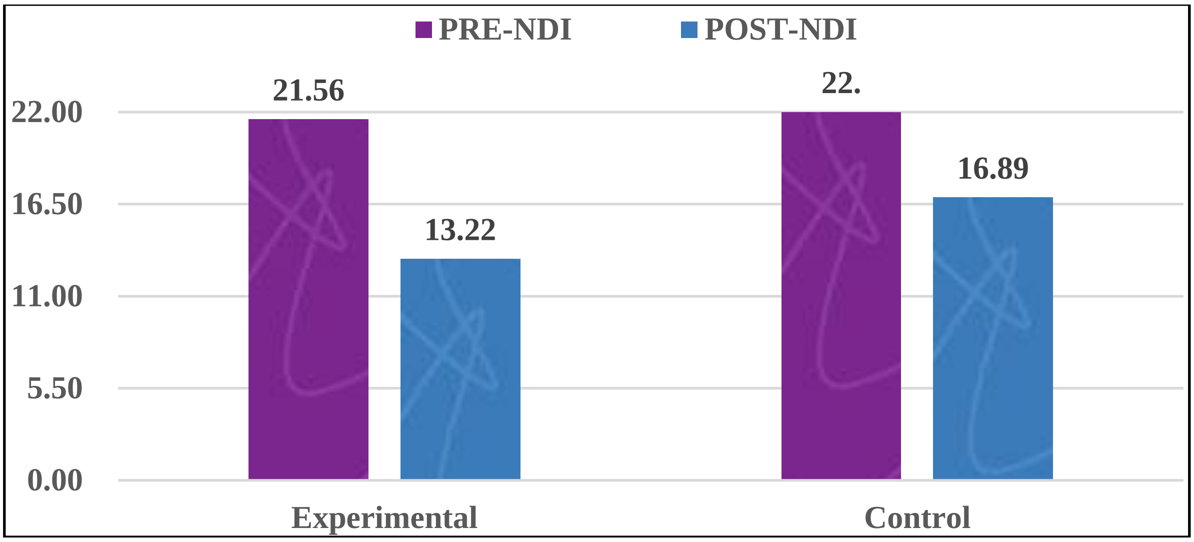
TABLE 2: MEAN AND STANDARD DEVIATION VALUES OF CRANIOVERTEBRAL ANGLE IN BOTH THE GROUPS AND MEAN AND STANDARD DEVIATION VALUES OF NECK DISABILITY INDEX SCALE IN BOTH THE GROUPS.

GROUPS	MEAN ± SD		P-Value
EXPERIMENTAL	PRE-CVA	45.69 ± 1.71	<0.001
	POST-CVA	57.41 ± 4.53	
CONTROL	PRE-CVA	46.34 ± 1.89	<0.001
	POST-CVA	51.48 ± 2.47	

GROUPS	MEAN ± SD		P-Value
EXPERIMENTAL	PRE - NDI	21.56 ± 4.20	<0.001
	POST - NDI	13.22 ± 4.40	
CONTROL	PRE - NDI	22.00 ± 2.91	<0.001
	POST - NDI	16.89 ± 2.76	



A SIGNIFICANT DIFFERENCE WAS OBSERVED WHEN COMPARING THE PRE AND POST-MEAN VALUES OF THE CRANIOVERTEBRAL ANGLE IN BOTH GROUPS.



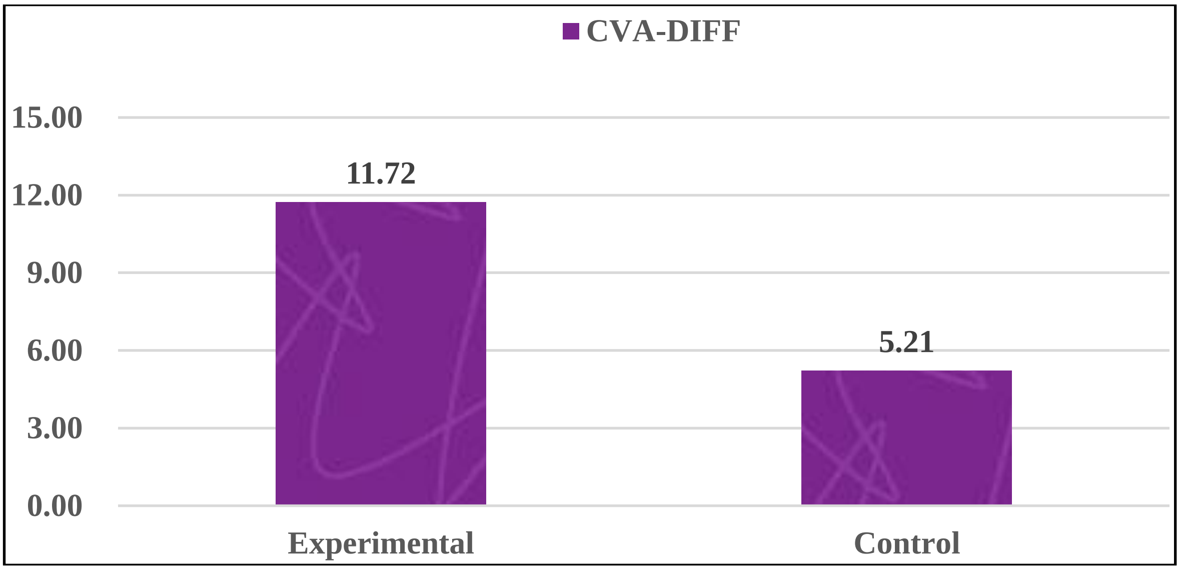
A SIGNIFICANT DIFFERENCE WAS OBSERVED WHEN COMPARING THE PRE AND POST-MEAN VALUES OF THE NECK DISABILITY INDEX SCALE IN BOTH GROUPS.

BETWEEN GROUP ANALYSIS - MANN WHITNEY U TEST

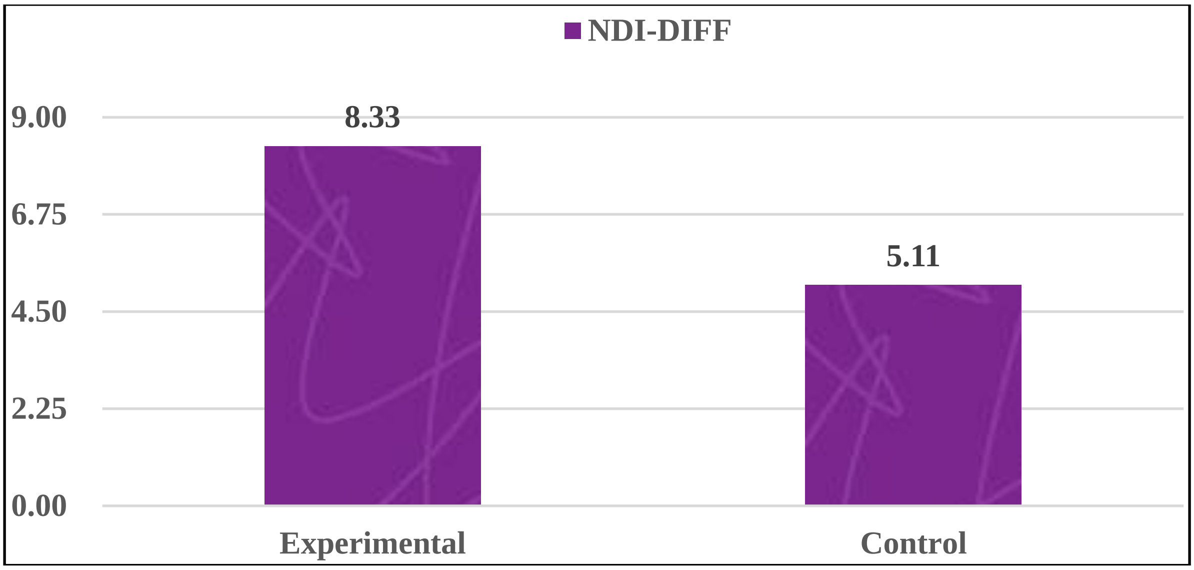
TABLE 3: MEAN DIFFERENCE OF CRANIOVERTEBRAL ANGLE BETWEEN THE GROUPS AND MEAN DIFFERENCE OF NECK DISABILITY INDEX SCALE BETWEEN THE GROUPS.

GROUPS	MEAN ± SD		P-Value
CVA	EXPERIMENTAL	11.72 ± 4.39	<0.001
	CONTROL	5.21 ± 2.56	

GROUPS	MEAN ± SD		P-Value
NDI	EXPERIMENTAL	8.33 ± 2.93	0.002
	CONTROL	5.11 ± 3.16	



A SIGNIFICANT DIFFERENCE WAS FOUND WHEN COMPARING THE MEAN DIFFERENCE IN CRANIOVERTEBRAL ANGLE BETWEEN THE TWO GROUPS (P<0.05). ADDITIONALLY, THE EXPERIMENTAL GROUP EXHIBITED A MORE SIGNIFICANT DIFFERENCE COMPARED TO THE CONTROL GROUP.



A SIGNIFICANT DIFFERENCE WAS FOUND WHEN COMPARING THE MEAN DIFFERENCE IN NECK DISABILITY INDEX SCALE BETWEEN THE TWO GROUPS (P<0.05). ADDITIONALLY, THE EXPERIMENTAL GROUP EXHIBITED A MORE SIGNIFICANT DIFFERENCE COMPARED TO THE CONTROL GROUP.

DISCUSSION

This study was conducted to evaluate the effectiveness of scapular stabilization exercises versus kinesiotaping on craniovertebral angle among young adults with forward head posture. It was conducted among young adults across Ahmedabad city, 36 subjects between the age group of 18-25 years were selected and divided into two groups on the basis of the inclusion and exclusion criteria.

The experimental group received scapular stabilization exercises, and kinesiotaping application was applied to participants every 48 hours, and the Control group received scapular stabilization exercises. The total duration was 3 weeks of exercises for 4 days/ week, so a total of 12 sessions of exercises and a total of 9 sessions of kinesiotaping were provided. Data was gathered both before and after three weeks. The results showed significant improvement in CVA and NDI when compared with the control group.

Numerous research has looked into the incidence of FHP, one of the most prevalent postural abnormalities across various populations. According to reports, between 60 and 70 percent of students in Malaysia and India have FHP. The practice of repeatedly maintaining a bad position causes an increase in muscle length following structural weakness of the muscles.

In this study, forward head posture was measured using craniovertebral angle and NDI, which showed high significance in the experimental group ($p<0.05$). Scapular stabilization exercises, along with kinesiotaping, illustrated significant improvement in the forward head posture among young adults when given an interventional protocol for 3 weeks.

Na-Yeon Kang [74] (2021) et al. studied forward head posture in office workers aged between 20 and 60 years. The experimental group received the SSE and TEE, while the control group received simply cervical stabilisation exercises (CSE) and stretching exercises (SE). For a total of six weeks, both groups worked out three times a week for forty minutes. Result showed that the intra-group comparison, both groups showed significant differences ($p<0.05$) in CVA, forced expiratory volume at 1 sec (FEV1), Visual Analog Scale (VAS), and neck disability index at pre- and post-intervention, while only the experimental group showed a significant difference ($p<0.05$) in maximum inspiratory pressure, maximum expiratory pressure, and forced vital capacity. For inter-group comparison, a significant difference ($p<0.05$) between

FEV1 and VAS was observed. The NDI showed a significant difference in both groups in intra-group comparison (p<0.05). The study concluded that a combination of scapular stabilization and thoracic extension exercises, not directly applied to the cervical spine, has an effect on improving the posture, respiration, neck pain, and disability in office workers with FHP.

Priya, S [75] (2018) studied the efficacy of scapular stabilization exercises in patients with mechanical neck pain where 30 patients were selected and 15 patients assigned to each groups having the age group between 18-45 years where Group A received scapular stabilization exercises Group B received conventional physiotherapy for 30 minutes per session, two session per day for total duration of 3 days/4 weeks. For both groups, baseline assessments were conducted using the Neck Disability Index (NDI) and Visual Analogue Score (VAS). An experimental group's data indicates a significant improvement in their functional status (NDI) (p<0.001). The functional status went from 35.1 to 12.8 with a considerable improvement. After training with scapular stabilisation exercises, the experimental group's functional status considerably improved in comparison to the control group. When compared to the control group, the experimental group's NDI score showed a notable improvement. The control group's mean pre-test score was 39.4, while the scapular stabilisation exercises group's was 35.1. Each group's post-test mean scores were 12.8 and 25.3, respectively. The experimental group's data shows a significant difference in pain level (VAS) between 75.7 and 57.5, according to a group analysis. The groups' VAS scores do not significantly differ in terms of pain levels when compared to the control group. The study concluded that scapular stabilization exercises show statistically significant improvement in functional status compared to conventional physiotherapy, whereas there was no statistically significant difference between scapular stabilization exercises and conventional physiotherapy in pain.

Gauri R. Moghe [76] (2019) et al. had investigated the short-term effects of kinesiotaping in conjunction with conventional occupational therapy and conventional occupational therapy alone on pain management, active and passive cervical range of motion, functional ability, and postural improvement in patients with forward head posture and chronic mechanical neck pain. A Sample of 20 Subjects aged between 25-55 years was divided into two groups (N=10) in each group. Kinesio-taping Group (received kinesio-taping with conventional OT Program) and Control Group (received only conventional OT Program) for a total duration of 4 weeks. The result of the study showed there was a significant decrease in neck disability, numeric pain rating scale, and improvement in cervical ROM, and an increase in craniovertebral angle of both groups pre- to post-intervention. However, greater was seen in the kinesiotaping group. Based on the analysis, it was found that a combination of kinesiotaping with conventional exercises has significant immediate effects on reducing pain intensity and functional disability, improving cervical range of motion, and improving forward head posture. The study concludes that kinesiotaping combined with conventional therapy for 4 weeks found immediate effects in reducing pain, improving cervical range of motion, and functional ability in patients with chronic. In patients with forward head posture, mechanical neck pain and postural improvements are more beneficial than workouts alone.

Hyo Jin Yoo [77] (2018) et al. Studied the effect of taping and proprioception training on pain, neck disability, craniovertebral angle, and muscle activity in forward head posture. 37 individuals in all, both male and female, were chosen; they were all 20-something students at %N" University. Measurement of pain, NDI (neck disorder index), craniovertebral angle, and muscle activity was taken before and after the 6-week intervention period. The subjects were split into three groups: one for neck exercises

(NE, n = 12), one for neck exercises with proprioceptive training (NEPT, n = 13), and one for neck exercises with taping (NEKT, n = 12). The result of the study showed that the three groups significant decrease in VAS (p<.05). NEPT was the only intervention of all the groups that had a statistically significant effect on VAS by comparison (p<.05). NEKT and NEPT had a statistically significant decrease in NDI. NEKT and NEPT indicated a statistically significant increase in CVA within the group (p<.05). Interventions that increased CVA more effectively than NE were NEKT and NEPT (p<.05). </mark> The study concluded that both neck posture correction exercises paired with kinesiotaping or proprioceptive training are effective interventions for addressing neck disability, craniocervical angle, and muscle activity. Pain, neck disorders, craniocervical angle, and muscular activity can all be addressed more effectively with neck posture correction exercises in conjunction with kinesio taping or proprioceptive training than with the exercises alone.

The result of the present study was found to be similar to the previous studies as per statistical analysis of the present study, there was a significant difference observed when doing within the group comparison of pre and post mean and standard deviation of the craniovertebral angle in experimental group was with P value <0.001, control group with P value <0.001.

A significant difference was observed when comparing the pre and post mean values of the craniovertebral angle in both the groups There was a significant difference observed when doing within the group comparison of pre and post mean and standard deviation of the neck disability index in experimental group was with P value <0.001, control group with P value <0.001. A significant difference was observed when comparing the pre- and post-mean values of the neck disability index scale in both groups.

Between-group analysis showed a mean difference of craniovertebral angle in the experimental group, with the P value <0.001. A significant difference was found when comparing the mean difference of craniovertebral angle between the two groups (P<0.05). Additionally, the experimental group exhibited more significant difference compared to the control group. Between the group analysis the mean difference of the neck disability index scale in the experimental group with the P value 0.002. A significant difference was found when comparing the mean difference of the neck disability index scale between two groups (P<0.05). Additionally, the experimental group exhibited more significant difference compared to the control group.

CONCLUSION

The study concludes that scapular stabilization exercises combined with kinesiotaping for 3 weeks provided significant effects in improving craniovertebral angle and reducing neck disability compared with scapular stabilization exercises alone in young adults with forward head posture.

Limitations

The study did not include a long-term follow-up to assess the sustainability of the observed improvements.

Future Recommendations

- The future studies can be done with larger samples
- The future studies can be done using different outcome measures
- Future studies can be conducted using a different demographic and professions, such as IT professionals and medical professionals

Declaration by Authors

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