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Resistant Vibration Stimulus and Backward Walking for Improving the Craniovertebral Angle in A Patient with Forward Head Posture: A Case Report

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ABSTRACT

BACKGROUND: Dysfunctional postures are commonly seen in the current generation especially aged 10-30 mainly due to over usage of smartphones and computers in a faulty posture. Forward Head posture is a routinely seen type of head posture which is characterized by reduction in the CV angle (Craniovertebral Angle) and a tilting of the head forward beyond its usual alignment. Resistant vibration stimulus creates vibration that enhances proprioceptive feedback and strengthens large muscle groups. Backward walking exercises have an impact on posture, specifically from the waist to the cervical spine and enhance muscle activation as well as strength in various leg muscles, thereby influencing the deep core muscles.

OBJECTIVE: To evaluate the effectiveness of Resistant Vibration Stimulus and Backward Walking on Craniovertebral angle in a patient with Forward Head Posture.

METHODOLOGY: A 23 year old male with forward head posture was assessed for CV angle by Head Posture Spinal Curvature instrument. Resistant vibration stimulus exercises with a Flex bar and Backward walking Exercise on a treadmill was given for 4 sessions per week for 25 mins for 5 weeks. Following the interventions after 5 weeks, the effect of the intervention was assessed and values studied.

RESULT: There was an increase of CV angle by 5 degrees after the treatment compared to its pre test value. Both Resistant Vibration Stimulus and Backward Walking showed improvement in the CV angle after 5 weeks.

CONCLUSION: Resistant Vibration Stimulus and Backward Walking was found to be effective in improving Craniovertebral Angle in a patient with forward head posture.

KEYWORDS: Backward Walking, Craniovertebral angle, Flexi bar, Forward head Posture

INTRODUCTION

The relationship between the various body segments (head, neck, trunk, upper and lower limbs) in an upright position is referred to as the human body's posture. Maintaining a good posture protects the body's supporting structures from harm and the formation of deformities, enabling muscles to work more effectively for improved movement and endurance. The cervical spine provides stability and mobility for

the head and neck. Of these, 50% is attributed to the cervical rotation and 50% to the flexion and extension of the neck, respectively, in the upper cervical spine (C0–C2). [1]

The modern lifestyle exposes people to dysfunctional postures, as people use mobile phones, computers for a longer duration and also adopt a faulty posture while performing these activities. The forward head posture (FHP) is one of the commonly recognized types of poor head postures in the sagittal plane.[1] This posture has become more common as a result of the quick spread of the internet and IT devices, especially among people in the 10 to 30 age range who use smartphones.[16] The FHP is characterized by the flexion of the lower cervical vertebrae and the increased extensions of the upper cervical vertebrae.[1] The pectoralis major, pectoralis minor, upper trapezius, levator scapulae and rhomboids fibers shorten, and there is a weakening of the deep neck flexors and scapular retractors. Cervical position sense is reduced as a result of muscle shortening. Proprioceptive afferent input originating from neck muscles is crucial for postural control. Forward head posture can impair neck muscles' ability to perceive proprioception and lead to postural issues. Neck pain and decreased productivity are common symptoms of forward head posture. [2]

The head weighs between 10 and 12 pounds when standing up straight, which is normal given the neck muscles. However, as the neck moves forward, the head's weight is also increased, which puts strain on the muscles and causes pain. So even with slight head movement, the head weighs six times more than the normal.[21] FHP symptoms also includes chronic pain in the neck, shoulders, upper ,middle and lower back, fatigue, reduced range of motion, clenching of teeth, temporomandibular joint dysfunction, arthritis , headaches, myofascial pain syndrome, pinching of nerves, reduction in height, numbness or tingling in arms and hands, muscle spasms, tightness of neck and chest muscles, asthma, poor athletic perfomance , facial pain, disc degeneration, facial pain and sleep apnea.[16] Failure to treat FHP may result in disc compression or herniation, degeneration of the spine, early onset arthritis, and total damage to the nerves or muscles.[21]

The commonly used research measure for diagnosing FHP is by calculating the craniovertebral angle. Craniovertebral angle is the angle formed at the intersection of a line drawn from the tragus of the ear through the spinous process of C7 and a horizontal line through C7 .[16] The smaller CV angle shows greater forward head posture.[15] A CVA less than 48°–50°is defined as FHP.[21]In patients with FHP, CVA is a factor that greatly influences pain. The cervical vertebrae flex forward as a result of the lower CVA, which, if sustained for an extended period of time, puts more strain on the surrounding connective tissues and the extensor muscles. According to studies, FHP participants with lower CVA had more reduced cervical range of motion (ROM). A lower CVA angle limits joint movements and increases pressure between the facet joints, as well as muscular modifications in the head and neck region. As a result of this, there is decrease in the cervical range of motion of flexion and extension along with pain. [20]

Resistant vibration exercise produces hyper gravity through the manipulation of vibration frequency and high levels of amplitude acceleration, resulting in the repetitive engagement of muscles through concentric and eccentric contractions . This state stimulates the muscle spindle and activates proprioceptor and Golgi tendon organ, and excitability input information by vibration. The use of resistant vibration exercise is beneficial in enhancing proprioceptive awareness through the activation of the intrafusal fibers in the shoulder joint and increasing sensitivity in the serratus anterior muscle, which in turn leads to improved muscle engagement and stability of the shoulder joint. Additionally, this type of exercise aids in refining proprioceptive awareness by stimulating the joint capsule and ligaments surrounding the shoulder joint. The simultaneous contraction and activation of dynamic stabilizing muscles during vibration exercise result in heightened mobilization of alpha motor neurons, thereby improving neuromuscular control,

strengthening major muscle groups, and enhancing proprioceptive feedback, ultimately benefiting muscle activity. [3]

Backward walking exercise is an intervention that involves a total of 15 minutes of treadmill walking, with the first 5 minutes at a speed of 1.0 km/h for warm-up, followed by 10 minutes at a speed of 1.5 km/h for backward walking. Backward walking exercises affect posture from the waist to the cervical spine by increasing muscle activation and strength in many leg muscles, impacting the deep core muscles, and compensating for the weight shift during the gait cycle. Additionally, emphasizing proper posture during backward walking stimulates muscles around the spine and pelvic region, integrating sensory input, while the contraction of deep spinal muscles maintains posture.[16]

A forward head posture is seen in people who frequently slump because they spend a lot of time at their desks, play video games, or use their smartphones. The widespread adoption of this posture has increased in tandem with the sharp rise in smartphone and computer usage. Consequently, there is less cervical region mobility. Long-term maintenance of this forward head position puts more compressive strain on the cervical spine's tissues, which can eventually result in skeletal and muscular problems. Resistant vibration stimulus exercise using a Flexi bar and Backward walking may have a positive impact on reducing the forward head posture. Hence, this study aimed to examine the effect of resistant vibration stimulus and backward walking on a patient with forward head posture with reduced CVA angle within a time limit of 5 weeks.

MATERIALS AND METHODS

A 23year old male was selected from a Physiotherapy college in Mangalore and underwent an assessment for suitability for undergoing the exercise program. The subject had 44 degrees in Craniovertebral angle and had no history of cervical fracture, cervical surgery, herniated disc and spinal issues. Materials used for assessment included a Head Posture Spinal curvature instrument.

The Head Posture Spinal Curvature Instrument was used to evaluate the pre-test for Craniovertebral angle. Resistant vibration stimulus exercises using a Flexi bar and Backward walking Exercises on a treadmill were administered for 5 weeks,4 sessions a week, for a duration of twenty-five minutes each. Over the course of five weeks, the subject attended the sessions for both interventions four days a week. The improvement of the Craniovertebral angle was the main goal of the exercises. The same instrument used for the Pre-test was used to evaluate the impact of the exercise program 5 weeks following the intervention.

OUTCOME MEASURES

CRANIOVERTEBRAL ANGLE

The craniovertebral angle was assessed by using a Head Posture Spinal Curvature Instrument,a specialized form of goniometer. Subject was asked to stand in a comfortable position and perform the neck flexion and extension exercises for 3 times to improve abnormal muscle condition. Then the subject was instructed to place the head and neck in a normal position, and the forward head posture was measured. The examiner stands on the subject's left side, with the stationary arm perpendicular to the ground. The axis of the goniometer is parallel to the spinous process of C7, and the moveable arm is on the anterior ear cartilage (Tragus). The craniovertebral (CV) angle was measured as the angle formed by the moveable arm and the horizontal line going through C7. It has good inter-rater reliability (ICC = 0.76; CI = 0.65–0.84) as well as intra-rater reliability (ICC= 0.87; CI = 0.82–0.91).[22]

INTERVENTIONS

Table No.1 : Flexi bar Treatment Regimen

Exercise	Dosage and Time
Exercise (1) : In a standing position, the subject is instructed to seize the middle of the pole with both hands and flex the shoulder joint to 180 in an overhead position and is asked to perform an oscillation exercise in the sagittal plane. Figure (A)	3 Sets for 3 minutes with each Set for 1 minute. 4 sessions per week for 5 weeks. Rest time: 5 minutes
Exercise (2) : In a standing position, the subject is instructed to seize the middle of the pole with both hands and flex the shoulder joint to 90° and is asked to perform oscillation exercise in the transverse plane. Figure (B)	3 Sets for 3 minutes with each Set for 1 minute. 4 sessions per week for 5 weeks. Rest time: 5 minutes
Exercise (3): In a standing position, the subject is instructed to seize the middle of the pole with both hands, with both of the arms behind the back and is asked to perform oscillation exercise in the sagittal plane. Figure (C)	3 Sets for 3 minutes with each Set for 1 minute. 4 sessions per week for 5 weeks. Rest time: 5 minutes

For the first 3 weeks, the first two exercises were performed in upward and downward movement to emphasize more on the flexibility of the muscles.

For the last two weeks the subjects were asked to sustain the vibration in each of the two certain positions to emphasize more on the strength of the muscles.

(A)

(B)

 (C)

Figure (1) : Flexi Bar Training -Patient is performing oscillation exercises in different planes.

2. Backward walking on treadmill

Subject was asked to perform a total of 15 minutes of treadmill walking, with the first 5 minutes at a speed of 1.0 km/h for warm-up, followed by backward walking for 10 minutes at a speed of 1.5 km/h for 5 weeks with 3 sessions per week. Participant was instructed to maintain a straight posture with slight chin retraction and abdominal engagement. Additionally, a bar was placed in the middle of the treadmill to maintain appropriate stride width and distance. Participant was provided with sufficient practice before the experiment. A 3-minute rest period was given after the exercise to minimize discomfort or dizziness

Figure (2) : Patient is performing backward walking in a Treadmill.

RESULT

When comparing the pre- and post-treatment data, it is clear that the patient's CV angle improved from an initial 44 ° to its current value of 49 ° over the course of 5 weeks. The patient showed improvement in the CV angle after receiving 5 weeks of Resistant Vibration Stimulus using a Flexi Bar and Backward Walking on a treadmill.

DISCUSSION

This study was performed to evaluate the effectiveness of resistant vibration stimulus and backward walking on improving the craniovertebral angle in a patient with forward head posture. Forward head posture is seen in people who assume a flexed and slouched posture when conducting some long-term tasks, such as using smartphones, laptops, and sitting at desks, exhibit a forward head position. Longer periods of maintaining forward head posture result in muscular and skeletal diseases.[1] Decreased range of motion, headaches, asthma, facial pain and sleep apnea are also few of the symptoms that are caused due to forward head posture.[10] It can cause serious complications such as disc compression, spinal degeneration, onset of early arthritis, nerve or muscle damage if left untreated.[22]

By creating a high acceleration of amplitude and vibration frequency, resistance vibration stimulus training with a Flexi bar produces hyper gravity and repeatedly causes concentric and eccentric contractions in the muscles. Through the activation of the shoulder joint's ligaments and joint capsule, it enhances proprioception. Exercises involving resistance vibration stimuli enhances nervous muscle adjustment capacity, strengthens big muscles, and enhance proprioceptor feedback—all of which have a good effect on muscular activity.[2] Backward walking exercises influences posture from the waist to the neck by boosting muscle engagement and strength in various leg muscles, engaging the deep core muscles, and counterbalancing the weight transfer during walking.[16]

In this present study, it was found that 5 weeks of Flexi bar Exercises (Resistant Vibration stimulus) shows improvement in the Craniovertebral angle in a patient with Forward Head posture. This was supported by Nourhan Ahmed Gamal Eldin Sarhan et.al (2021) where they evaluated the effectiveness of body blade exercises on craniovertebral angle and pain in individuals with forward head posture. They concluded that resistant vibration stimulus exercises improved CV angle in patients with forward head posture.[2]Another study was done by Eun- Kyung Kim et.al (2016) proved that there was an increase in the CV angle after the application of resistant vibration stimulus.[3]

In this present study, it was also found that 5 weeks of Backward walking exercise on a treadmill showed improvement in the CV angle in a patient with Forward Head Posture. A similar study was done by Han Kyu Park et.al (2020) which concluded thatbackward walking exercises were effective in improving CV angle in patients with forward head posture[16]. Another study was done by Han Kyu Park et.al (2021) which reported that backward walking exercises showed an increase in CV angle and had a positive effect on forward head posture[17].

Head Posture Spinal Curvature Instrument was used to measure the Craniovertebral angle in this study. Same instrument was used by Reza Rajabi et.al (2016) for measuring the CV angle in patients with forward head posture[15]. This was supported by AV Subarayyalu et.al (2016) where they showed a good inter-rater reliability (ICC = 0.76; CI = 0.65–0.84) as well as intra-rater reliability (ICC = 0.87; CI = 0.82–0.91) and concluded that it is a reliable and valid instrument for measuring CV angle in subjects with or without postural neck pain[22].

This study had some limitations. Firstly, the sample size is limited; it can be repeated on a larger sample size. Secondly, gait related exercise (backward walking) was given but the gait parameters were not considered as an outcome measure. Thirdly, the intervention had strengthening exercise but strength measurement was not taken as an outcome measure. Also, the study's duration was limited to 5 weeks, and it is uncertain about the long-term effects.

Previous studies on forward head posture were conducted in a variety of ways, demonstrating the effectiveness of these interventions. However, the effect of a combination of resistant vibration stimulus and backward walking for 5 weeks on forward head position has not been thoroughly studied. Further research can be undertaken with a larger sample size, longer exercise duration, and alternative outcome measures. Based on the findings of this study, both interventions were found to have a good effect on a patient with forward head posture.

CONCLUSION

The findings of this study concluded that Resistant Vibration Stimulus and Backward Walking showed better improvement in Craniovertebral Angle in patient with Forward Head Posture.

Declaration of the patient consent

The authors attest to having all the gotten all necessary patients consent. The patients has/have provided his/her/their approval on the form of his/her/their photos and clinical information to be reported on this journal. Subject aware that their initials and name will not be published, and that every attempt will be made to keep their identities hidden, but anonymity cannot be guaranteed.

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Conflict of interest

There are no conflicts of interest.

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