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A Study: Correlation Between Proprioception of Neck Joint with Forward Head Posture Among College Students.

[1]ANJALI, [2]VIDHI SINGH, [3]ANURAG SEHRAWAT, [4]HIMANSHI SHARMA

[1]MPT ORTHO STUDENT (4TH SEMESTER) - DEPARTMENT OF PHYSIOTHERAPY, [2]ASSISTANT PROFESSOR , DEPARTMENT OF PHYSIOTHERAPY, [3]MPT ORTHO STUDENT ,DEPARTMENT OF PHYSIOTHERAPY, [4]MPT NEURO

SANSKRITI UNIVERSITY, MATHURA

Abstract

Background : This study investigates the correlation between neck joint sense and forward head posture among college students. Forward head posture, characterized by an anterior shift of the head relative to the shoulders, has become increasingly prevalent due to the widespread use of electronic devices. The purpose of this research is to explore whether a relationship exists between the joint sense of the neck and the occurrence of forward head posture.

Method : The study sample consisted of 40 college students, aged between 18 and 25 years. Neck joint sense was assessed using a standardized method, such as a joint position sense test, while forward head posture was measured using established clinical evaluation techniques. Statistical analysis was conducted to determine the correlation between neck joint sense and forward head posture.

Result : This chapter deals with the results of the study. 25 subjects were included in the study for the correlation between forward head posture with Neck joint proprioception.The subject's demographic characteristics are presented in Table 1, there were no significant differences in characteristics in terms of Age, weight, height, and BMI.NOTE: JPE for right rotation is not significant with p => 0.05. JPE for left rotation is significant with p =< 0.05.

Conclusion : Possible mechanisms for the correlation between forward head posture and altered neck joint proprioception include changes in muscle activation patterns, increased muscle tension, and sensory adaptation. Forward head posture can lead to muscular imbalances and altered muscle recruitment patterns, which may affect the sensory feedback from the neck joints and compromise proprioceptive accuracy.However, more research is needed to establish a clear and consistent understanding of the relationship between forward head posture and neck joint proprioception. Longitudinal studies, with larger sample sizes and standardized measurement techniques, would provide valuable insights into the causality and temporal aspects of this relationship.In conclusion, while there is some evidence suggesting a correlation between forward head posture and altered neck joint proprioception, further research is required to fully understand the nature and underlying mechanisms of this relationship.

Fundings: There is no funding related to this study

Keywords : JPE, FHP, CVA, R.R, L.R, HRT, UTHSCSA, HRA

1.1 SUBJECT CHARACTERISTICS TABLE

1.2 Descriptive Statistics

1.3 Correlations

1.INTRODUCTION :

Nowadays people are becoming more dependent on technology to carry out even the simplesttask of every day. Same as if we see in the education system technology is becoming a ubiquitous part of learning and students become reliant on it day by day.

In spite of several benefits of technology has been seen in the education system there are manyadverse effects on health these one is that people frequently face a postural alteration which impacts many other problems related to their health. much research had been conducted beforeto see the impact of posture on balance due to the use of smartphones, desktops, and other technology sources.

Forward head posture (FHP) is a common musculoskeletal condition characterized by the protrusion of the head in relation to the shoulders. It is prevalent among college students, primarily due to prolonged periods of sitting and increased usage of electronic devices such aslaptops, tablets, and smartphones. FHP can have adverse effects on the musculoskeletal system,leading to various health issues, including neck discomfort, pain, and reduced neck joint sense.Neck joint sense refers to the proprioceptive ability of the neck, which allows individuals to perceive and control the position of their head and neck in space. It plays a crucial role in maintaining proper posture, balance, and coordination during daily activities. However, the relationship between neck joint sense and forward head posture in college students remains a subject of interest and requires further investigation.

Biomechanics of FHP:

Forward head posture, also known as anterior head carriage or "text neck," refers to a conditionin which the head protrudes forward from its normal alignment with the spine. This posture isbecoming increasingly common due to the widespread use of electronic devices and prolongedperiods of sitting. While forward head posture can have various causes, including muscular

imbalances and structural abnormalities, the biomechanics of this condition primarily involvethe muscles, joints, and alignment of the neck and upper back.

Here are some key biomechanical aspects of forward head posture:

Cervical spine alignment: The normal alignment of the cervical spine (neck) should maintain a gentle inward curve known as lordosis. With forward head posture, this curvature becomes exaggerated, causing the head to shift forward in relation to the shoulders. This misalignment can lead to increased stress on the cervical vertebrae, discs, and surrounding soft tissues.

Muscle imbalances: Forward head posture often results from muscular neck and upper back imbalances. The deep cervical flexor muscles at the front of the neck, responsible for maintaining proper posture, can become weak and overstretched. Meanwhile, the muscles at the back of the neck and upper back, including the suboccipital muscles and upper trapezius, can become tight and overactive. These imbalances can further exacerbate the forward head position.

Increased load on muscles and ligaments: As the head moves forward, the weight of the head increases, placing additional strain on the muscles, ligaments, and other soft tissues supportingthe neck and upper back. This increased load can lead to muscle fatigue, discomfort, and pain.Alterations in biomechanics of adjacent areas: Forward head posture can affect the biomechanics of other areas of the body. The altered alignment of the cervical spine can impactthe positioning of the shoulders and upper back, potentially leading to rounded shoulders, thoracic kyphosis (increased forward curvature of the upper back), and altered scapular(shoulder blade) movement.

Impact on breathing and jaw position: Forward head posture can also affect breathing patternsand jaw alignment. The protrusion of the head can restrict the space in the throat and chest, potentially leading to shallow breathing or other respiratory issues. Additionally, the

misalignment of the jaw caused by forward head posture can contribute to temporomandibularjoint (TMJ) dysfunction and associated symptoms.
Neurological effects: Prolonged forward head posture can affect the nervous system. The compression of nerves in the neck and upper back can result in nerve impingement, leading tosymptoms such as pain, numbness, tingling, and weakness in the arms, hands, and fingers.
It's important to note that forward head posture can have various contributing factors, includingpoor posture habits, sedentary lifestyle, weak or imbalanced muscles, and structural abnormalities. Addressing these factors through corrective exercises, postural awareness,ergonomic adjustments, and, in some cases, professional intervention can help improvebiomechanics and alleviate the symptoms associated with forward head posture. Consulting with a healthcare professional, such as a physical therapist or chiropractor, can provide personalized guidance and treatment options based on individual circumstances.

Biomechanics of neck joint proprioception:
Neck joint proprioception refers to the body's ability to sense the position and movement of theneck joints. Proprioception plays a crucial role in maintaining postural stability, coordinating head movements, and providing sensory feedback to the central nervous system. The biomechanics of neck joint proprioception involves various anatomical and physiological factors. Here are some key aspects:
Ligaments and Joint Capsules: Ligaments and joint capsules surround the neck joints, providing stability and proprioceptive feedback. These structures contain mechanoreceptors called proprioceptors, which are sensitive to mechanical deformation and provide sensory information about joint position, movement, and tension.
Muscle Spindles: Muscles in the neck, such as the deep neck flexors and extensors, contain specialized sensory organs called muscle spindles. Muscle spindles are stretch receptors that
detect changes in muscle length and rate of stretch. They provide feedback on musclecontraction, muscle length, and movement to the brain.
Joint Receptors: The neck joints, including the atlantooccipital joint (between the base of the skull and the first cervical vertebra) and the cervical facet joints (between adjacent cervical vertebrae), have specialized receptors within their joint capsules. These receptors are sensitiveto changes in joint position, movement, and pressure, contributing to neck joint proprioception.Mechanoreceptors in Cervical Discs: The intervertebral discs between cervical vertebrae contain mechanoreceptors, which respond to compression, tension, and shear forces. These receptors provide information about the mechanical status of the discs and contribute to overall neck proprioception.
Neural Pathways: Proprioceptive information from the neck joints is transmitted through sensory nerve fibers to the central nervous system. The signals travel via the cervical spinal nerves, dorsal root ganglia, and ascending pathways in the spinal cord to reach the brain. The brain integrates and processes this information to generate motor commands and coordinate neck movements.
Sensorimotor Integration: Proprioceptive information from the neck joints is integrated with visual and vestibular inputs to maintain postural control and coordinate head and eye movements. This integration occurs in brain regions such as the cerebellum and vestibular nuclei, which contribute to balance, coordination, and spatial orientation.
Motor Output: Once the brain processes proprioceptive information, it generates motor commands that activate the appropriate muscles for neck movement and stabilization. These commands are transmitted through descending pathways in the spinal cord to the neck muscles,allowing precise control and coordination of head and neck movements.
Understanding the biomechanics of neck joint proprioception is essential for assessing and rehabilitating neck-related conditions, such as neck pain, whiplash injuries, and cervical spine
disorders. Therapeutic interventions, such as exercises and manual therapies, can target these proprioceptive mechanisms to improve neuromuscular control, postural stability, and functional outcomes.
Understanding the correlation between neck joint sense and forward head posture in college students is essential for developing effective preventive and therapeutic strategies to address the musculoskeletal issues

associated with FHP. This study aims to explore the potential correlation between neck joint sense and forward head posture among college students.

By conducting a comprehensive investigation, including assessments of neck joint sense and forward head posture, this study seeks to contribute to the existing body of knowledge regarding musculoskeletal health in the college student population. The findings of thisresearch may have implications for the development of interventions, exercises, and ergonomic recommendations to improve neck joint sense and prevent or alleviate forward head posture incollege students.

Overall, this study aims to bridge the gap in our understanding of the relationship between neckjoint sense and forward head posture in college students. By shedding light on this correlation,it is hoped that healthcare professionals, educators, and students themselves can implement effective strategies to promote musculoskeletal health and well-being within the collegeenvironment.

2.METHODOLGY :

This chapter deals with the methodology implemented to conduct the study. This section provides information on the type of study design, sampling, technique, and procedures fordata collection.

Size of sample

The total number of subjects was 30 selected for the study on the basis of inclusion andexclusion criteria.

Source of the subjects

The subjects were selected from the rehabilitation center of Jamia Hamdard after signing theinformed consent according to the following criteria.

Method of selecting subjects

The subjects were selected only if they met the following sets of inclusion and exclusion criteria

Inclusion criteria

- Both male and female
- Age between 18-25
- Smartphone users
- Computer users

Exclusion criteria

- Traumatic neck injuries, inflammatory joint disease, and other musculoskeletaldisorders
- No history of any recent trauma and surgeries
- Neurological disorders
- Malnutrient and overweight
- Any communication problem

Method of sampling

- sample of convenience

Study design

- correlation study

Instruments/types of equipment

1. For proprioception measurement

- Laser attached with lightweight headboard
- One chair
- One marker
- Blindfold
- Inch tape
- One Target sheet
- Performance recording sheet

2. For C V A angle measurement

- Marker
- Goniometer
- UTHSCSA software version 3.0

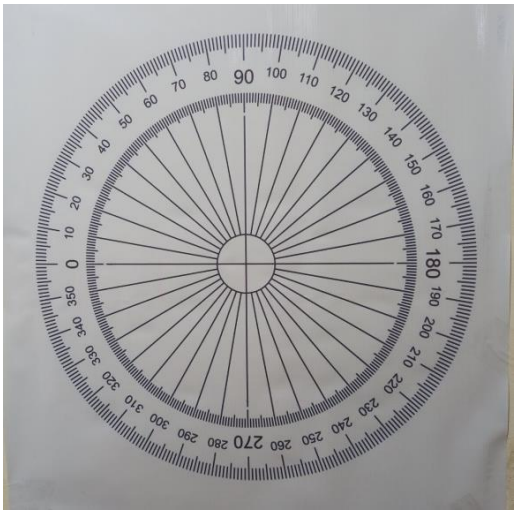

Fig1 - Wall fitted cervical relocation chart

Fig 2- Laser pointer pen

Fig 3- velcro strap, a marker & an inchtape

Fig 4- scale, protractor & a micropore

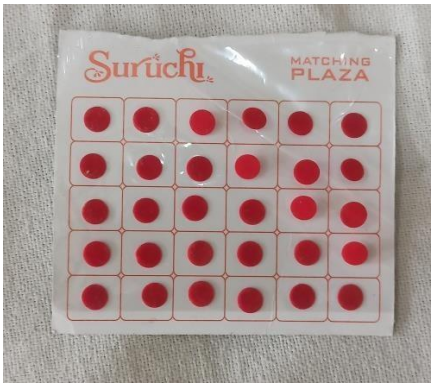

Fig 5- Marker (Bindi placed at tragus of the ear)

Fig 6- Marker (pins placed at C7 with the help of micropore)

PROCEDURE

Patients who were assessed and fulfilled with inclusion and exclusion criteria will be asked tosign the informed consent.

- Explanation of the procedure to the subject.
- Subject position: Sitting on a chair with an arm supported for proprioception measurement and standing for CVA angle measurement.

Trial: subject was given a trial to get accustomed to the procedure.

Measurement: proprioception measurement by the head repositioning accuracy test and the CVA angle by a horizontal line joining passes through C7 to the tragus of the ear and using UTHSCSA scale version 3.0
Average: The mean of three readings was taken.

Measurements Proprioception measurement
Head repositioning accuracy: the laser method was applied to measure cervical joint position error. Roren et. Al 2009 -results show this method has demonstrated good test-retest reliabilityand has been shown to have an excellent correlation with an ultrasound technique for the measurement of JPE.

Procedure

One cervical spine movement (right rotation) was assessed using the HRA test. A laser was attached to a lightweight headband on the participant's head. The laser was projected at a targetsheet that hung on a wall that is 90 cm in front of the participant. Participants were seated on achair with arm and back support and their head in a natural straight position. Their feet were placed supported on the floor with knee and hip 90 degrees. participants were asked to maintainthis position throughout the full test. They were asked to focus on the Target sheet and mark that point as a starting point or Target point and asked the subject to memorize that point. The cervical spine movement taken in a procedure was demonstrated to the participant. The subjectperformed three trials for the movement to become familiar with the test. participants were thenasked to keep their eyes closed throughout the full test and perform the movements in a slow, controlled manner. The eyes of the subjects were covered with eye folds to make sure that theparticipants could not observe the laser pointer and then try to adjust their position. The participants were asked. The participants were asked to move to half the reported normal range of motion (right rotation=40 degrees) to avoid any potential end-range pain or stretch provocation. This range of movement was measured by the use of a Goniometer. They were
then instructed to return slowly to their starting position and indicate verbally when reached there. The difference between the starting and relocation position was recorded. The movementwas performed 3 times and averaged. All participants were given the same instructions and no feedback was given about their performance. Ten seconds of rest time was allowed between attempts of the same movement. The outcomes are measured in centimetre.

Fig 7- Measurement of the mark point

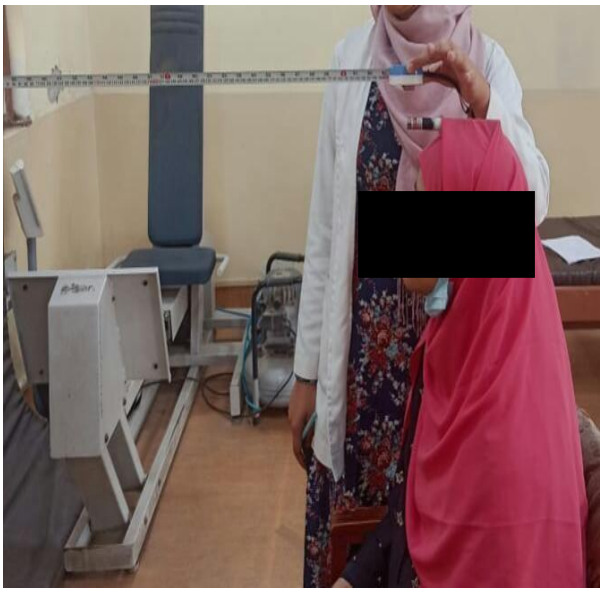

Fig 8- Distance measure from the target

Measurement of CVA angle

The craniovertebral angle is identified as the intersection of a horizontal line passing through the C7 spinous process and a line joining the midpoint of the tragus of the ear to the skin overlying the C7 spinous process [1].

Measurement of craniovertebral angle, (CVA) is one of the common methods in assessing headposture.

The craniovertebral angle is also referred to as the cervical angle and forward head angle.[2] Measuring Craniovertebral angle is measured by taking 2 lateral photographs of the subject ina relaxed seated position without back support. The spinous process of C7 and the tragus of theear are marked with a body marker. A horizontal line is drawn passing through C7 making aright angle with the vertical. Then, the angle between the line connecting the C7 spinousprocess with the tragus of the ear and the horizontal line is measured using e.g., Goniometer.

Fig-9- forward head

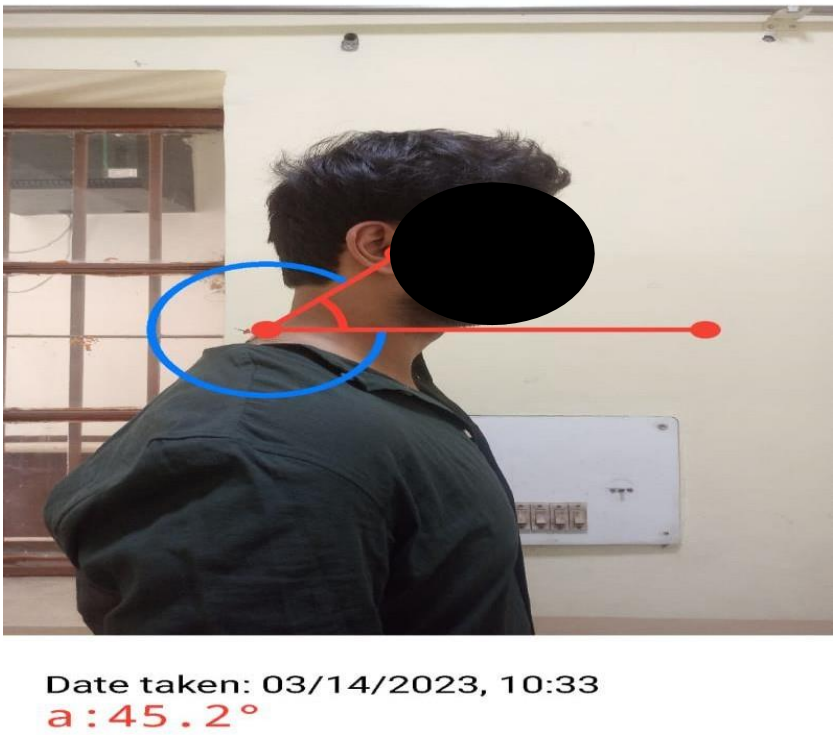

Fig 10-forward head

3.RESULT

This chapter deals with the results of the study. 25 subjects were included in the study for thecorrelation between forward head posture with Neck joint proprioception.

The subject's demographic characteristics are presented in Table 1, there were no significantdifferences in characteristics in terms of Age, weight, height, and BMI.

TABLE 1.1

SUBJECT CHARACTERISTICS TABLE

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	24	20	26	22.42	1.472
Height	24	1.50	1.85	1.6373	.10636
weight	24	45.00	90.00	61.1583	13.21764
BMI	24	16.10	27.20	22.5167	3.17814

Note- Values are presented as mean ± standard deviation

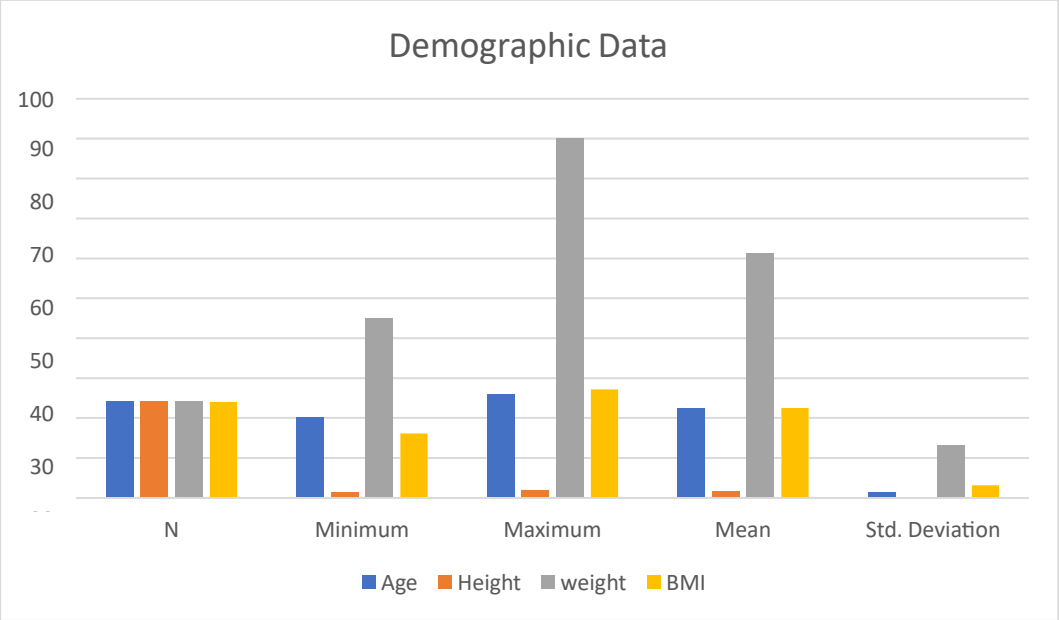

Fig 11- a graph showing mean value of age, height, weight and BMI

TABLE-1.2

Descriptive Statistics			
	Mean	Std. Deviation	N
CVA	45.3083	2.96969	24
JPE R. R	9.6250	8.55576	24
JPE L. R	8.5083	6.11533	24

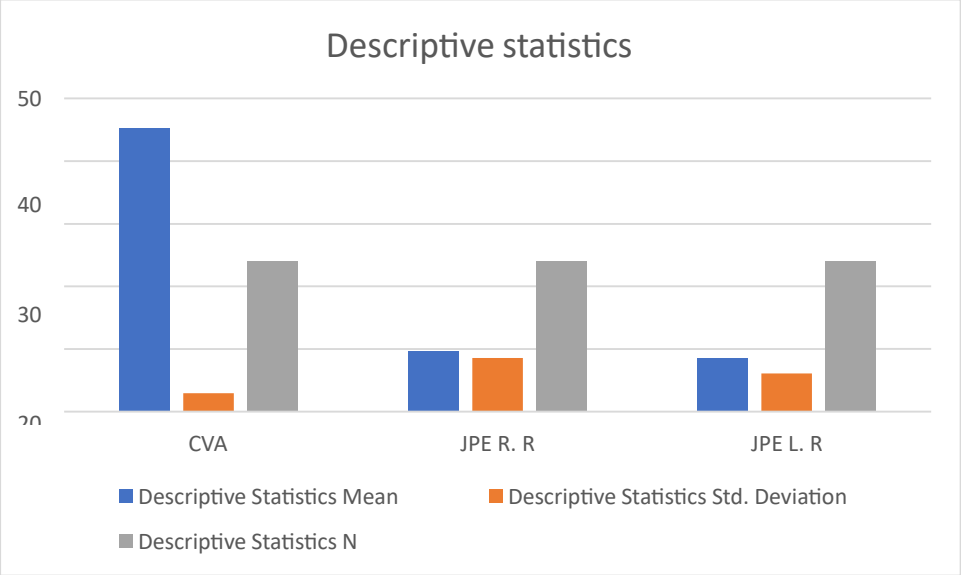

Fig 12 – Descriptive statistics

TABLE-1.3

Correlations

		CVA	JPE R. R	JPE L. R
CVA	Pearson Correlation	1	-.031	.561**
	Sig. (2-tailed)		.885	.004
	N	24	24	24
JPE R. R	Pearson Correlation	-.031	1	.306
	Sig. (2-tailed)	.885		.145
	N	24	24	24
JPE L. R	Pearson Correlation	.561**	.306	1
	Sig. (2-tailed)	.004	.145	
	N	24	24	24

**. Correlation is significant at the 0.01 level (2-tailed).

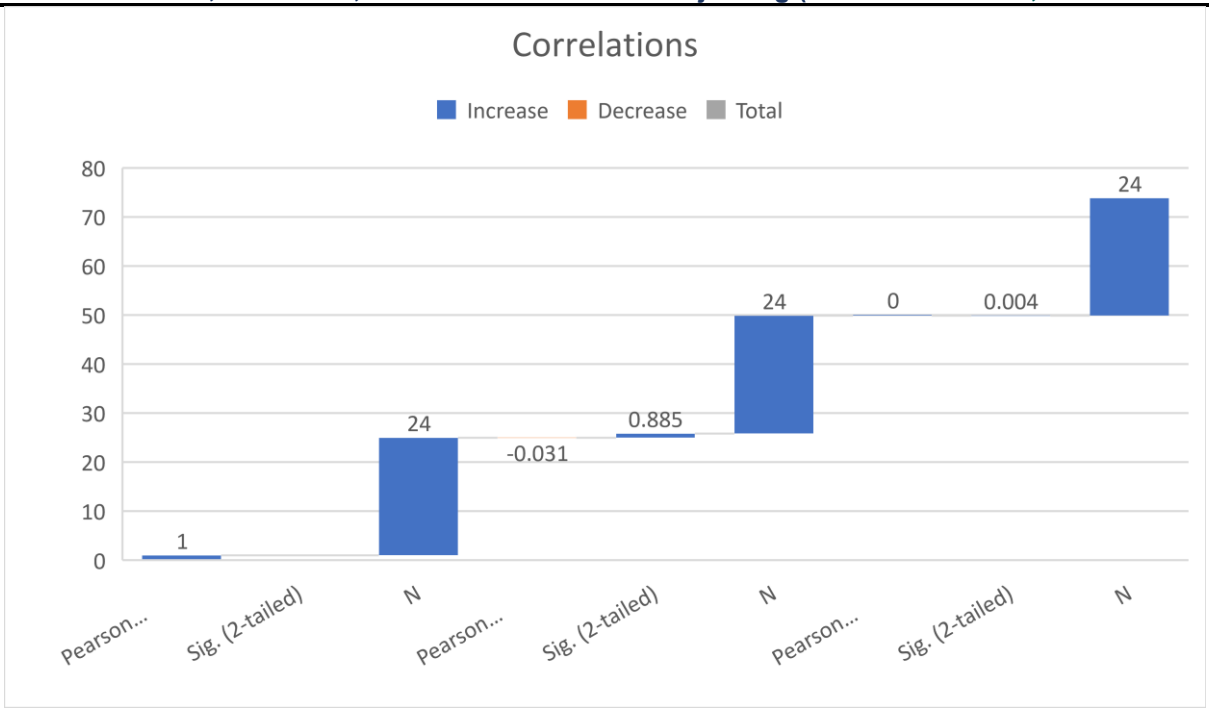

Fig 13- graph showing co relation between CVA angle and neck proprioception.

NOTE: JPE for right rotation is not significant with p => 0.05.

JPE for left rotation is significant with p =< 0.05.

4.DISCUSSION:

Discussion on the correlation between forward head posture and neck joint proprioception. Forward head posture (FHP) refers to the position of the head being pushed forward in relationto the shoulders, resulting in an increased curvature of the upper spine. Neck jointproprioception, on the other hand, refers to the ability to sense the position and movement ofthe neck joints through sensory feedback.

There is a correlation between forward head posture and neck joint proprioception, and research has explored this relationship. Here are some key points to consider in the discussion:**Altered Sensory Input:** Forward head posture can lead to changes in the sensory input received by the neck joints. The altered position of the head can affect the alignment of the neck vertebrae and put a strain on the ligaments, muscles, and joints. This can disrupt the normal sensory feedback loop from the neck joints to the brain, potentially affecting neck joint proprioception.

Muscle Imbalance: Forward head posture often accompanies muscle imbalances in the neck and upper back. The muscles at the front of the neck become elongated and weakened, while the muscles at the back become shortened and tight. These imbalances can further affect neckjoint proprioception by altering the muscle spindle activity and mechanoreceptor function.

Sensorimotor Control: Neck joint proprioception plays a crucial role in sensorimotor control,which refers to the integration of sensory information and motor responses. Studies have shownthat individuals with forward head posture may exhibit impaired sensorimotor control of the neck, including reduced accuracy and precision in neck movements. This suggests a link between FHP and compromised neck joint proprioception.

Musculoskeletal Dysfunction: Forward head posture and impaired neck joint proprioceptioncan contribute to musculoskeletal dysfunction. The altered biomechanics and reduced proprioceptive feedback can increase the risk of neck pain, headaches, and othermusculoskeletal issues in the neck and upper back region.

Rehabilitation and Treatment: Addressing forward head posture and improving neck joint proprioception are important in the rehabilitation and treatment of related conditions. Physical therapy interventions that focus on correcting posture, strengthening weak muscles, and improving proprioception can be beneficial in restoring optimal alignment and function of theneck joints.

It's worth noting that while there is evidence supporting the correlation between forward headposture and neck joint proprioception, further research is needed to establish a causal relationship and understand the underlying mechanisms more comprehensively. The interaction between posture, proprioception, and musculoskeletal health is complex, andindividual variations should also be considered. Consulting a healthcare professional, such as a physical therapist or chiropractor, can provide personalized guidance and treatment options for addressing forward head posture and related concerns.

LIMITATIONS OF THE STUDY:

1. Sample size was small
2. Time period for data collection was less.
3. Availability of Subjective for successive days was difficult.

FUTURE SCOPE OF THE STUDY:

1. Study can be done on a larger population.
2. Future studies can include other variables also.
3. The study can include different populations with different ages.
4. The study can include only one gender at a time and a comparison of both treatmentparameters n be done.

SIGNIFICANCE OF THE STUDY:

By shedding light on this correlation, it is hoped that healthcare professionals' educators, and students themselves can implement effective strategies to promote musculoskeletal health andwell-being within the college environment.

5. CONCULSION :

6. The correlation between forward head posture and neck joint proprioception has been a topic of interest in the field of musculoskeletal health. After considering the available research up until my knowledge cut-off in September 2021, it is important to note that scientific understanding may have evolved since then.
7. Based on the existing evidence, there appears to be a relationship between forward head postureand altered neck joint proprioception, although the direction and strength of this relationship are still not fully understood. Forward head posture is characterized by anterior positioning ofthe head in relation to the shoulders, often accompanied by rounding of the upper back and shoulders. This posture places increased stress on the neck and upper spine, which can affect various aspects of musculoskeletal function, including neck joint proprioception.

8. Neck joint proprioception refers to the ability to perceive the position and movement of the neck joints. It plays a crucial role in maintaining postural control, coordinating movement, andproviding stability to the neck. Several studies have suggested that individuals with forward head posture may exhibit altered neck joint proprioception compared to those with normal headposture. However, the specific nature of this relationship is still under investigation.
9. Some research studies have found that individuals with forward head posture tend to have poorer neck joint proprioception, indicating a potential negative correlation. Other studies havereported conflicting findings or found no significant correlation. It is worth noting that the design and methodology of these studies vary, and there may be other factors that contribute to the observed relationship.
10. Possible mechanisms for the correlation between forward head posture and altered neck joint proprioception include changes in muscle activation patterns, increased muscle tension, and sensory adaptation. Forward head posture can lead to muscular imbalances and altered muscle recruitment patterns, which may affect the sensory feedback from the neck joints and compromise proprioceptive accuracy.
11. However, more research is needed to establish a clear and consistent understanding of the relationship between forward head posture and neck joint proprioception. Longitudinal studies,with larger sample sizes and standardized measurement techniques, would provide valuable insights into the causality and temporal aspects of this relationship.
12. In conclusion, while there is some evidence suggesting a correlation between forward head posture and altered neck joint proprioception, further research is required to fully understand the nature and underlying mechanisms of this relationship.

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