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Evaluation of Deep Neck Flexors Endurance in Subjects with Non - Specific Neck Pain Versus Normal Subjects of Student Population by Using Sphygmomanometer: An Observational Study

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Abstract: ***Aim: This study was designed to observe the strength and endurance capacity of Deep Cervical Flexors in subjects with and without neck pain. Method: Group A consisted of 30 subjects with neck pain and Group B consisted of 30 subjects without neck pain. Pressure biofeedback unit was used to assess the strength and endurance of the cervical flexors. Strength of the cervical flexors was measured as the maximum pressure at which the patient was able to hold steady for 10 seconds; and muscle endurance capacity was measured by the number of times the subject was able to hold up to 10 - seconds at the maximum pressure. Results: The study concluded that the maximal Deep neck cervical flexor strength of overweight adults is stronger than normal and underweight adults. The difference is maintained in all age groups. Strength and endurance of deep cervical flexors are reduced in neck pain. During the measurement of endurance capacity the subjects had to do more number of repetitions so they were not able to hold at the final pressure till the end of the test. Conclusion: The results of this study demonstrated that subjects with neck pain and without neck pain both shows good strength but the subjects with neck pain had a poor endurance capacity when compared to subjects without neck pain.***

Keywords: Deep neck flexors, neck pain, endurance, strength, sphygmomanometer, pressure biofeedback unit, cervical flexors, musculoskeletal disorder, posture, biomechanics, cervical pain, forward head posture, muscle activation, physiotherapy, observational study, cranio cervical flexion, segmental control, cervical flexion and cervical extension.

1. Introduction

Neck pain is a common musculoskeletal disorder. Most episodes of neck pain are of unknown origin and are usually referred to as non - specific or idiopathic neck pain [1, 2] Occasionally neck pain may be related to a severe pathology such as nerve compression, a prolapsed intervertebral disc, or a fracture[1].

Neck pain is a major source of disability and a common global problem. Neck pain is the most common condition with a prevalence rate of 41 - 44% of the world population. In India, around 30% to 50% of adults experience neck pain at some point.

Neck pain is about 12% for the adult female population and 9% for the adult male population. Approximately 45% of the working population will have one attack of stiff neck.

Bad posture of a stiff neck concerning the chest is one of the most common causes of chronic neck pain. Most adults (18 - 50) are particularly affected due to long hours of desk work, poor posture, and stress. The rise of technology use has led to an increase in neck pain among younger adults, primarily due to poor posture and excessive screen time[2].

The physiology of the neck involves a complex interplay of structures that provide support, movement, and protection. The cervical spine comprises seven vertebrae, with C1 (atlas) supporting the skull and allowing nodding, and C2 (axis) facilitating head rotation. Intervertebral discs act as shock absorbers and enable flexibility, while facet joints between the vertebrae allow controlled movement and stability[3.] Muscles such as the sternocleidomastoid, trapezius, and scalene support and move the neck, while ligaments like the anterior and posterior longitudinal ligaments reinforce stability and limit excessive motion. The spinal cord, housed within the cervical vertebrae, transmits nerve signals through cervical nerve roots that innervate the neck, shoulders, arms, and hands. Additionally, the vertebral arteries supply blood to the brain and spinal cord, highlighting the neck's integral role in both movement and neural function[4, 5, 6, 7.]

Mechanical stability of the cervical spine is provided by the deep neck flexors including the rectus capitis anterior, rectus capitis lateralis, longus capitis longus colli, sternocleidomastoid, and some degree of scalene muscles[8]. These muscles have small moment arms, perform a tonic activity, and are responsible for providing postural and segmental control for the neck. The deep neck flexors like

any other muscles are subjected to regular internal and external pressures attributable to activities of daily living resulting in decreased strength and altered pattern of activation which could cause neck pain[3].

Neck problems can have adverse psychological, and physical functions. The Forward Head Posture is accepted as an internal factor that can cause dysfunction in neck and shoulder pain. The posture dysfunction extends the upper cervical vertebrae and flexes the lower cervical vertebrae and head[9, 10]. The disclosure of this static load on the non - contractile in the actions and biomechanics, and this increase in stress leads to musculoskeletal dysfunction or pain[3].

The pathomechanics of neck pain involves a range of disruptions in the cervical spine's normal function and structure. Muscle strain from poor posture or sudden movements can lead to pain and stiffness, while intervertebral disc issues such as herniation or degeneration may cause nerve root compression, resulting in radiculopathy with symptoms like pain or weakness radiating into the arm. Facet joint dysfunction, often due to degeneration or injury, contributes to localized pain and restricted movement. Ligament strain from trauma or chronic stress can cause instability, and postural stress from prolonged poor posture exacerbates mechanical strain on the cervical spine[4, 5, 8]. Additionally, acute injuries, such as whiplash, can damage soft tissues, leading to inflammation and further discomfort. These factors interact to create a complex pain experience that requires a comprehensive approach for effective diagnosis and treatment.

A Sphygmomanometer, traditionally used for measuring blood pressure, can be adapted to evaluate deep neck flexor endurance by using the cuff to provide resistance against the head. During the test, the cuff is placed around the forehead or back of the head and inflated to a specific pressure, creating resistance as the participant holds their head in a flexed position. The duration the individual can maintain this position is recorded, offering a quantifiable measure of neck muscle endurance. This approach provides a controlled and objective way to assess and track improvements in neck strength and endurance, which is particularly useful in rehabilitation and research settings. However, comfort and consistent protocol application are important to ensure accurate and reliable results[8, 9].

The need of the study was to assess the strength and endurance of cervical flexors in subjects with and without neck pain by using a method that is quick and easy to administer in clinical settings. This method can be used as a part of assessment in day - to - day practice as it provides feedback and helps us to set treatment goals.

This study aimed to measure and compare the strength and endurance capacity of deep cervical flexor muscles in subjects with and without neck pain by using the pressure biofeedback unit.

2. Materials and Methods

Materials

1) Hard plinth
2) Sphygmomanometer
3) Stopwatch
4) Consent form
5) Couch

Methods

- Study design: Observational study
- Study duration is of 4months from march 1st 2024 to July 31st 2024
- The sample size is 30 members of the student population.
- The study consisted of 2 groups i. e. group A subjects with non - specific neck pain and group B subjects without neck pain.50 subjects were enrolled for the study from the outpatient college of Physiotherapy, svims Tirupati with 15 subjects in each group. Subjects were randomly selected from the neck pain population and the asymptomatic population.
- The sampling method is purposive sampling.

Every alternate subject was further divided into 2 groups respectively. The age group of subjects was 18 - 30 years. Before testing subjects were screened for eligibility criteria and informed consent was obtained from them.

Inclusion Criteria:

Only female subjects with and without neck pain between the age group of 18 - 30 years and who were willing to participate in the study were taken.

Exclusion Criteria

The subjects with a history of trauma or surgery to the cervical spine, neurological deficit, cervical myelopathy, or psychological problems and subjects who had participated in any form of specific strengthening of the neck and upper extremities musculature in the past 6 months were excluded.

3. Procedure

Familiarization was done with the subjects by demonstrating the technique. Demonstration was done by making the subject lie down in a supine position on the plinth. The procedure was held at the college of Physiotherapy, svims, Tirupati. The subject was made to lie down in a supine position on a hard plinth. A pressure biofeedback unit was placed under the suboccipital region and the pressure cuff was inflated to a pressure of 20 mmHg to fill the space of the cervical lordosis. The subject was asked to perform a gentle head - nodding action of craniocervical flexion (indicating yes). Maximum pressure increase above the baseline up to 10 mmHg was achieved and held for 10 seconds defining it as the strength of deep cervical flexors. The final pressure was the one at which the subject was able to hold steady. For assessing endurance, the final pressure that was achieved was multiplied by the number of repetitions performed by the subject successfully with 10 10 - second hold at that pressure. A rest period of 10 seconds was allowed between the holds. Trick movements were avoided. Subjects were advised to discontinue the test if pain was experienced.

- Consent form
- Hard plinth
- Pressure biofeedback unit (Chattanooga)
- Stopwatch
- Pen

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4. Discussion

The current study was to get the normative significance for measuring Deep neck flexors muscle strength using a Pressure Biofeedback Unit and sphygmomanometer in young adults within age group between 18 and 30 years.50 healthy young adults were recruited in the study and the normative value of deep neck flexor muscle strength was measured using a pressure biofeedback unit and sphygmomanometer. Subjects in the neck pain group had difficulty achieving higher pressure levels on the pressure biofeedback unit than compared to the normal population. Normal populations can flex under higher pressures.

The limitations of the study were only the female population participated in the study. For males and people suffering from dizziness, severe hypertension, recent neck injuries, vertigo, spinal instability, and neurological conditions like cervical myelopathy or radiculopathy in those conditions it is appropriate to conduct a test.

Statistical Analysis

A total of 30 subjects were participated. Mean value for both groups age given in the table below (table 1).

Table 1: Ranks

	Group	N	Mean Rank	Sum of Ranks
1. Strength	1	15	8.23	123.5
	2	15	22.77	341.5
	Total	30		
2. Flexion	1	15	13.9	208.5
	2	15	17.1	256.5
	Total	30		
3. Extension	1	15	9.8	147
	2	15	21.2	318
	Total	30		
4. Rotation Right	1	15	9.03	135.5
	2	15	21.97	329.5
	Total	30		
5. Rotation Left	1	15	16.4	246
	2	15	14.6	219
	Total	30		
6. Lateral Flexion Right	1	15	14	210
	2	15	17	255
	Total	30		
7. Lateral Flexion Left	1	15	14.17	212.5
	2	15	16.83	252.5
	Total	30		

Table 2

Strength	Frequency	Percentage
1.42mmhg	3	10.00%
2.44mmhg	6	20.20%
3.46mmhg	4	13.30%
4.48mmhg	8	26.70%
5.50mmhg	3	10.00%
6.52mmhg	3	10.00%
7.54mmhg	1	3.30%
8.56mmhg	1	3.30%
Total	30	100.00%

The maximal deep neck cervical flexor strength of overweight adults and normal persons is higher than that of underweight adults [f=4] with non - specific neck discomfort, according to frequency values [f=6, 13]. In every age category, the disparity persists seen in table 2

The correlation coefficient value between BMI and strength is 0.288, and the significance p - value is 0.002. This test's significance is shown by the p - value. As indicated in Table 3, a p value of less than 0.05 indicates the presence of a statistically significant link between two variables.

Table 3

		Age	BMI	Strength
1. Age	Correlation coefficient	1.000	- .171	.164
	P value	.	.367	.388
	N	30	30	30
2. BMI	Correlation coefficient	- .171	1.000	.288
	P value	.367	.	.002
	N	30	30	30
3. Strength	Correlation coefficient	.164	.288	1.000
	P value	.388	.123	.
	N	30	30	30

SPEARMANS Rho correlations, table 3

Neck pain reduces the strength and endurance of the deep cervical flexors. During the measurement of endurance capacity, the individuals had to perform additional repetitions, therefore they were unable to maintain the final pressure until the completion of the test.

5. Results

This study found that overweight adults have higher maximal deep neck cervical flexor strength than normal and underweight adults. The maximum deep neck cervical flexor strength for flexion is acquired from the neutral position of the neck.

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