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Correlation of Hamstring Tightness and Cervical Spine Dysfunction in Sedentary Lifestyle Individuals

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Abstract
Background:
A sedentary lifestyle has grown more common in the modern world as a result of increased screen time, decreased physical exercise, and extended sitting. This lifestyle leads to muscular imbalances and postural dysfunctions. One such common issue is hamstring tightness, which can alter pelvic positioning and overall spinal alignment. Simultaneously, cervical spine dysfunctions such as forward head posture, reduced cervical mobility, and neck pain are also widely observed in sedentary individuals. Emerging evidence suggests that muscular tightness in the posterior chain, especially the hamstrings, may influence posture and biomechanical stress throughout the spine, including the cervical region. Therefore, understanding the correlation between hamstring flexibility and cervical spine dysfunction is essential for physiotherapists with the goal of creating successful intervention plans for sedentary individuals.
*This study included thirty participants. Participants were selected based on inclusion and exclusion criteria, representing individuals with a sedentary lifestyle. After institutional protocol and ethical committee approval, vide their letter no. KVV/ IEC/01/2025 dated January 23, 2025. This comparative study was performed in a sedentary lifestyle individual of Krishna Vishwa Vidyapeeth. The study's main objective was to determine the Correlation of Hamstring tightness and cervical spine dysfunction in sedentary lifestyle individuals The results indicate a strong positive correlation between hamstring tightness, measured using the Active Knee Extension (AKE) test, and various cervical spine movements. The correlation coefficient (r) for cervical flexion was found to be **0.95023**, demonstrating a very strong relationship. Similarly, cervical extension showed a strong correlation with an r-value of **0.8022754**, and right side flexion had a correlation of **0.7865076**. Among all movements, left side flexion exhibited the **strongest correlation** with an r-value of **0.9859801**. Right and left cervical rotations also showed strong correlations, with r-values of **0.9335783** and **0.9233729** respectively. Every correlation was significant from a statistical view with a **p-value < 0.001**, indicating that the observed associations are highly unlikely to be due to chance. These findings support a significant relationship between hamstring flexibility and cervical spine mobility in individuals with a sedentary lifestyle.*
Conclusion The study found a positive correlation between hamstring tightness and reduced cervical spine mobility in sedentary individuals. As hamstring flexibility decreased, cervical range of motion also reduced, especially in flexion and side flexion movements. This supports the concept of myofascial chain influence from lower to upper body. Assessing and addressing hamstring tightness may be important in managing cervical dysfunction
Keywords: Active knee Extension test (AKE), Cervical Range of Motion, Cervical Spine Dysfunction, Sedentary lifestyle.

INTRODUCTION

The modern sedentary lifestyle has become a major health concern in today's society, with prolonged periods of sitting and insufficient physical activity contributing to a range of musculoskeletal disorders. Among these issues, hamstring tightness and cervical spine dysfunction are two commonly reported conditions that impact individuals who engage in minimal physical activity. Both of these conditions may seem unrelated at first glance, but emerging research suggests that they may be interconnected, particularly in individuals leading sedentary lives.[1]
The hamstring muscles are composed of three muscles: semimembranosus, semitendinosus, and biceps femoris. The hamstrings are two-jointed muscles in the posterior thigh that cross the hip and knee joints, allowing for hip extension and knee flexion. However, studies have shown that there is a high prevalence of 68% among college students who have a hamstring score of 300 to 450 on the AKET test, People aged 18 to 25 are regarded to have moderate tightness. Extended periods of sitting during work can cause tightness in the hamstrings for 90% of the population, and 85.75% of office workers who work for 6- 8 hours a day experience hamstring tightness. Over time, hamstring flexibility tends to decrease noticeably.[2]
The flexion of upper limb increases movement of same side erector spinae, gluteal region till hamstring and muscles of foot. The SBL eases effective force transmission between the extremities and trunk due to its anatomical integration. Furthermore, it facilitates movements of upper limbs in cooperation with the trunk and lower limbs during diverse functional tasks such as walking, sit to stand, and so on. The

amount of force created by the cells of SBL is quite sufficient to influence the movement of musculoskeletal structures throughout the human body. Although the presence of myofibroblasts signifies a believable explanation for stiffness changes in tissues, it most likely is not the single cause. A systematic review found strong evidence for the presence of myofascial chains across the spine, which include the plantar fascia, gastrocnemius, hamstrings, and erector spinae. As a result, evidence of a superficial backline relationship with hamstring tightness can be presented alongside neck pain.[2]

The Sedentary Lifestyle and Musculoskeletal Health

A sedentary lifestyle, characterized by prolonged periods of physical inactivity, particularly sitting, has been linked to numerous health problems, including cardiovascular diseases, obesity, diabetes, and musculoskeletal dysfunction [3]. The musculoskeletal system, which includes muscles, bones, joints, tendons, and ligaments, can be severely affected by prolonged inactivity. One area that is especially prone to dysfunction due to sedentary behavior is the musculoskeletal system of the lower body and neck region. Specifically, hamstring tightness and cervical spine dysfunction are two prevalent conditions in sedentary individuals [3].

Hamstring Tightness: Etiology and Impact

The hamstrings, a group of muscles in the rear of the leg, are necessary for the movement like walking, running, and bending. Prolonged sitting leads to the shortening and tightening of these muscles, resulting in a condition commonly referred to as "hamstring tightness." Tight hamstrings not only limit mobility and however, this can lead to stiffness and discomfort in the lower back and hip regions. In the context of a sedentary lifestyle, muscle atrophy, altered postural alignment, and reduced joint mobility are key contributors to hamstring tightness [4].

Hamstring tightness has been associated with a variety of clinical conditions, including lower back pain, pelvic dysfunction, and altered gait mechanics [4]. The mechanism of hamstring tightness involves both muscle shortening and impaired neuromuscular function, which results in restricted movement and compensatory patterns in other areas of the body.

Cervical Spine Dysfunction: Etiology and Impact

Cervical spine dysfunction, encompassing conditions like neck pain, stiffness, and postural abnormalities, is another common complaint among individuals with a sedentary lifestyle. Prolonged sitting, especially with poor posture, places significant strain on the cervical spine and its supporting structures. This strain can lead to misalignment, muscle imbalances, and ultimately dysfunction in the cervical region [5]. In sedentary individuals, especially those who spend long hours working at a computer or looking down at mobile devices, cervical spine dysfunction is prevalent.

The cervical spine, composed of seven vertebrae in the neck, is responsible for supporting the head and facilitating a range of motions, such as rotation, extension, and flexion. However, the static postures commonly adopted during prolonged sitting, particularly forward head posture (FHP) and rounded shoulders, place undue stress on the cervical spine. Over time, this leads to muscle imbalances, reduced mobility, and pain [6].

The Interrelationship Between Hamstring Tightness and Cervical Spine Dysfunction

The static sitting posture, which is a result of daily living conditions, causes many musculoskeletal problems, especially cervical problems, and facial chain defects.

In particular, the hamstrings, as the structures on the superficial fascial back line are strongly influenced by this static sitting posture. The hamstring muscle group is situated on the superficial back line and conveys the stress created by the muscles that cover the posterior of the human body. The hamstrings, gastrocnemius, Sacro tuberous ligament, thoracolumbar fascia, erector spinae (including iliocostalis), and galea aponeurotica are all components of this fascial line. The tension created in these muscles is conveyed along the myofascial tensegrity network via this fascia line. Tension that develops in these muscles is conveyed through the myofascial tensegrity network via this fascial line. Loss of flexibility in the hamstring muscle can lead to loss of flexibility in many muscles related to the superficial fascial back line.

While hamstring tightness and cervical spine dysfunction may seem like isolated conditions, recent evidence suggests a potential link between the two, particularly in individuals with a sedentary lifestyle. Both conditions are believed to share common pathophysiological mechanisms, such as muscle imbalances, altered biomechanics, and poor postural alignment [7]. When the body adopts compensatory movement patterns due to one dysfunction, it can lead to the development of other musculoskeletal issues in different regions of the body.

For instance, a person with tight hamstrings may adopt an altered posture to compensate for the

restriction in movement, which could affect the alignment of the pelvis and spine. This compensatory pattern may, in turn, impact the cervical spine, leading to dysfunction and pain in the neck area [8]. Furthermore, the neural connections between the lower body and the cervical spine, as well as the shared muscle groups, might contribute to the transmission of pain and discomfort across the body.
One key factor that may contribute to both conditions is the central nervous system's role in coordinating movement and muscle function. Chronic pain and tightness in one area of the body may alter neural control of movement in other regions, leading to compensatory adjustments and further dysfunction [9]. Additionally, the relationship between the pelvis and spine has been well documented, with dysfunctional movement patterns in the lower body affecting the alignment of the upper body, including the cervical spine [10].
Mechanisms Linking the Two Conditions
The link between hamstring tightness and cervical spine dysfunction can be understood through several biomechanical and neuromuscular pathways:
1. Postural Compensation: Prolonged sitting and sedentary behavior can lead to postural alterations, such as forward head posture (FHP) and increased lumbar lordosis, both of which contribute to musculoskeletal strain and dysfunction. Tight hamstrings can further exacerbate these postural issues, placing additional stress on the cervical spine [2].
2. Neuromuscular Dysfunction: Both the hamstrings and the cervical spine are controlled by complex neuromuscular pathways. Dysfunction in one area can influence the motor control of other areas, resulting in abnormal movement patterns and muscle tightness [4].
3. Shared Neural Pathways: Research has shown that the lower extremities and cervical spine are interconnected through neural pathways. Tightness or discomfort in one area of the body may lead to pain referral patterns or altered muscle activation in other regions [8].
4. Reduced Mobility and Flexibility: Both hamstring tightness and cervical spine dysfunction are characterized by reduced mobility and flexibility. Over time, the body's range of motion is compromised, leading to increased pain, discomfort, and a further reduction in functional capacity [4].

Participants
Thirty sedentary lifestyle individuals were chosen for this research. In accordance with the inclusion criteria, aged 18–40 years. No history of musculoskeletal, neurological, or systemic disorders. No prior surgery or injury affecting the lower limbs, cervical spine, or balance

Procedure
This study finds the correlation of hamstring tightness and cervical spine dysfunction in sedentary lifestyle individuals, this study was done with the help of Data collection sheet. Certification and permission were taken from authorities, protocol committee, and ethical committee. Patients was selected according to inclusion and exclusion criteria. Data collection sheet including demographic data such as Name, Age, Gender, AKE test, Cervical spine Range of motion. Master chart was formed with collected data then with the help of statistician result statistic are formed.

Ethical approval and participation consent
The ethical approval for undertaking the proposed study has been obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad, Maharashtra, India, vide their letter no. KVV/ IEC/01/2025 dated January 23, 2025. Written informed consent was obtained from all participants, who were assured of confidentiality and their right to withdraw at any time.

Outcome measures
- Hamstring Tightness: To quantify hamstring flexibility

Measured using the Active Knee Extension (AKE) test.
Procedure: -
a. Patient lies supine with hip flexed at 90°.
b. The tested leg is stabilized, and the patient actively extends the knee.
c. A goniometer measures the knee angle between the thigh and the lower leg.

- Cervical Spine Range of Motion:

To assess neck mobility across four movements: flexion, extension, lateral flexion, and rotation.

Measured using a goniometer
Procedure: -
a. Patient sits upright with shoulders relaxed.
b. Goniometer aligned to anatomical landmarks:
i. Flexion/Extension: Axis at ear (external auditory meatus).
ii. Lateral Flexion: Axis at C7 vertebra.
iii. Rotation: Axis at the top of the head
c. Patient performs each movement; angles are recorded.

Statistical analysis
The program Instat was used to do statistical analysis on the recorded data. Each outcome measure's mean and standard deviation were determined. A master chart and a variety of graphs with specified frequencies were created using Microsoft Excel. The data were compared using the paired t test.

RESULTS
The results indicate a strong positive correlation between hamstring tightness, measured using the Active Knee Extension (AKE) test, and various cervical spine movements. The correlation coefficient (r) for cervical flexion was found to be **0.95023**, demonstrating a very strong relationship. Similarly, cervical extension showed a strong correlation with an r-value of **0.8022754**, and right side flexion had a correlation of **0.7865076**. Among all movements, left side flexion exhibited the **strongest correlation** with an r-value of **0.9859801**. Right and left cervical rotations also showed strong correlations, with r-values of **0.9335783** and **0.9233729** respectively. All correlations were statistically significant with a **p-value < 0.001**, indicating that the observed associations are highly unlikely to be due to chance. These findings support a significant relationship between hamstring flexibility and cervical spine mobility in individuals with a sedentary lifestyle

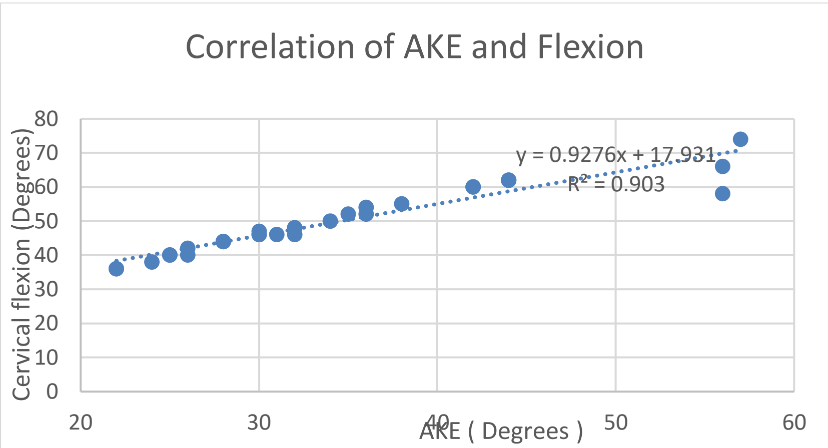

Figure No. 01: Correlation of AKE and Flexion

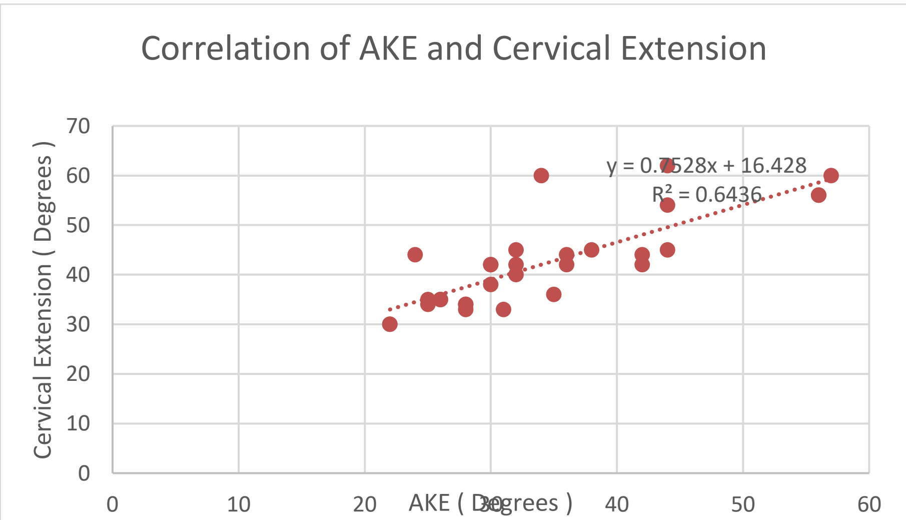

Figure No. 02: Correlation of AKE and Extension

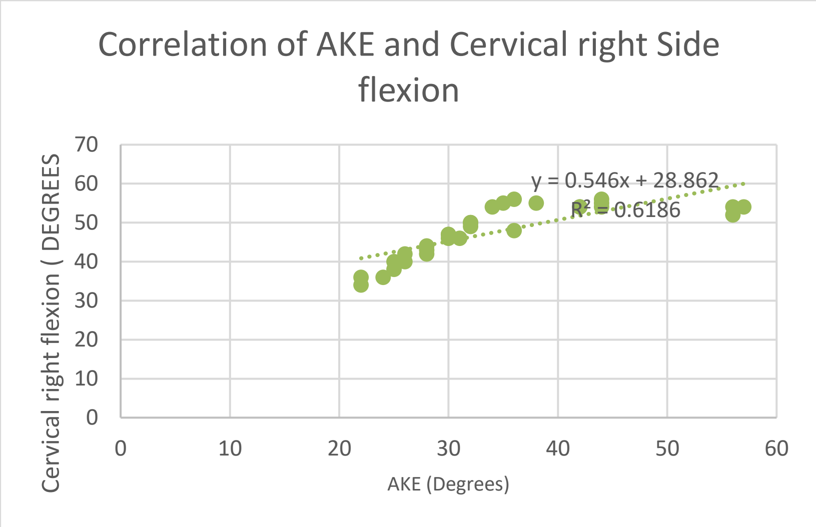

Figure No. 03: Correlation of AKE and Right side Flexion

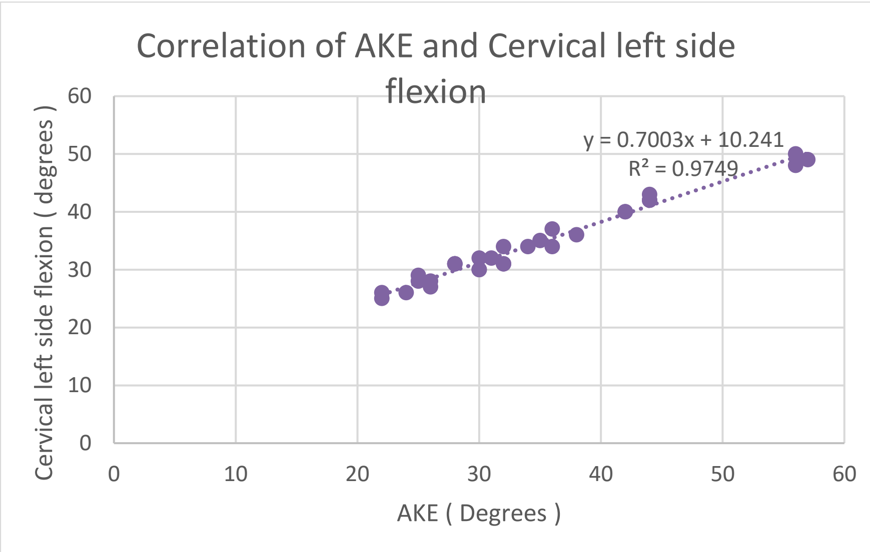

Figure No. 04: Correlation of AKE and Left side Flexion

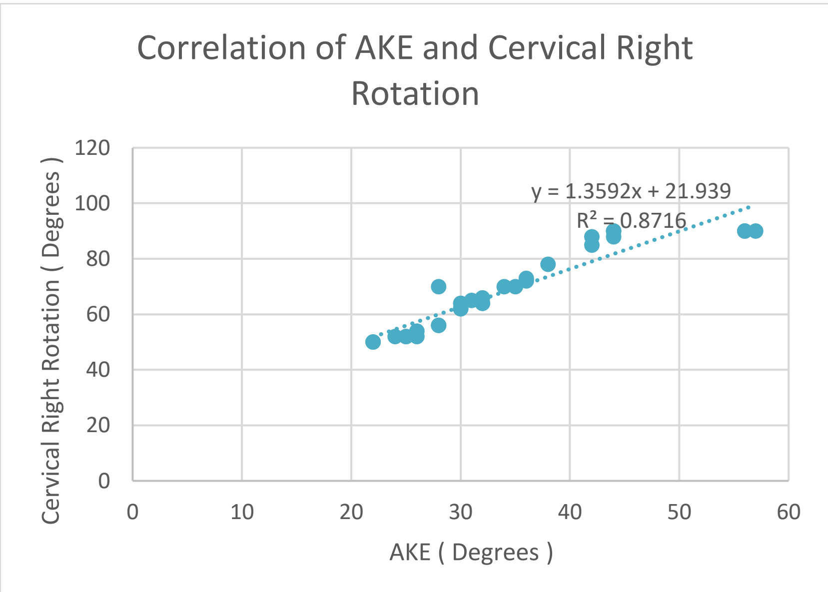

Figure No. 05: Correlation of AKE and Right rotation

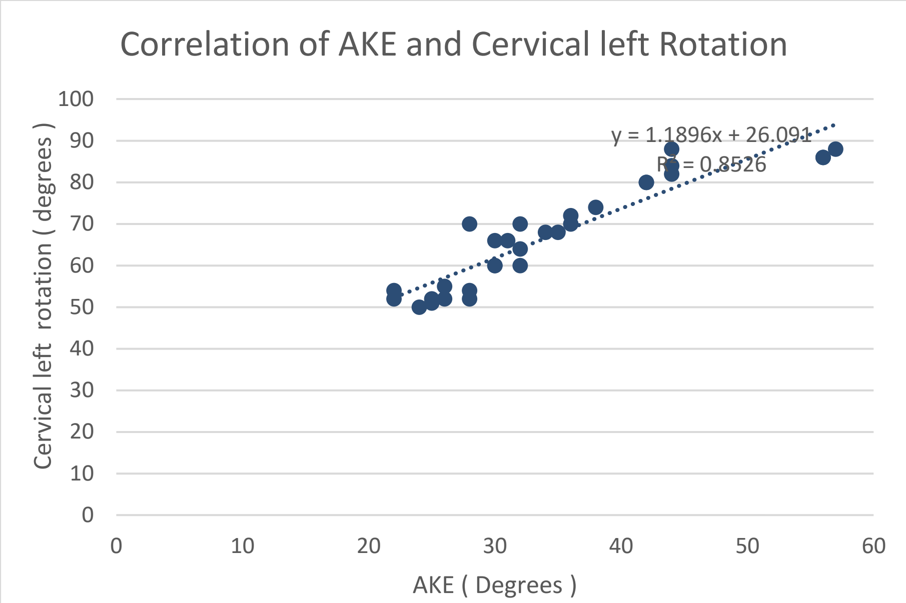

Figure No. 06: Correlation of AKE and Left Rotation

Cervical Movement	Correlation with AKE (r)	p-value	Strength of Correlation
Cervical Flexion	0.95023	< 0.001	Strong
Cervical Extension	0.8022754	< 0.001	Strong
Right Side Flexion	0.7865076	< 0.001	Strong
Left Side Flexion	0.9859801	< 0.001	Strong
Right Rotation	0.9335783	< 0.001	Strong
Left Rotation	0.9233729	< 0.001	Strong

Table No. 01

DISCUSSION

The current study examined the relationship between hamstring tightness and cervical spine dysfunction in individuals leading sedentary lifestyles. In recent years, sedentary behavior—characterized by extended periods of sitting with minimal physical activity—has been increasingly linked to musculoskeletal imbalances. These imbalances, particularly in the posterior muscle chain, often lead to dysfunctions in both the lower and upper body. Tightness in the hamstring muscles, coupled with compromised cervical mobility, reflects a possible biomechanical linkage within the kinetic chain. This connection may be explained through myofascial pathways, such as the superficial back line, which forms a continuous fascial network from the plantar fascia to the suboccipital region, facilitating force transmission and postural interdependence [11]. The results obtained via the Active Knee Extension (AKE) test reaffirm the critical role of hamstring flexibility in athletic and clinical cohorts. In our study, participants consistently exhibited AKE angles indicative of moderate tightness, aligning with commonly accepted thresholds (AKE > 20°) used to diagnose restricted hamstrings [18]. This reinforces the AKE test's sensitivity in detecting clinically meaningful changes in muscle length. Neto et al. documented excellent intrarater reliability for AKE (ICC 0.87–0.94), paired with low SEM (2.6–2.9°) and MDC (7–8°), highlighting the test's robustness for monitoring interventions that target hamstring extensibility [18]. Moreover, interrater reproducibility is similarly strong; Stenneberg et al. reported ICC values up to 0.99 with consistent agreement within 10° across diverse raters [19]. Precision can be further optimized through strict stabilization of the pelvis and thigh during measurement, thereby reducing compensatory movements and maintaining validity. Given these psychometric strengths, the AKE test stands as a practical and powerful tool for both baseline assessment and repeated measures in clinical and sports settings.

Previous literature has indicated similar intersegmental relationships across the musculoskeletal system. Studies have highlighted that tight hamstrings can influence pelvic tilt and lumbar spine alignment, subsequently altering cervical spine posture and function [12]. Moreover, chronic postural adaptations like forward head posture and thoracic kyphosis—commonly seen in individuals with prolonged sitting habits—are often associated with both decreased hamstring extensibility and cervical dysfunction [13].

The kinetic chain theory supports these findings, suggesting that dysfunction in one region can affect distant joints. Evidence also points to the benefits of improving hamstring flexibility through stretching, which has been shown to reduce spinal discomfort and enhance mobility in both the lumbar and cervical areas [14,15].

The assessment of cervical spine range of motion using universal goniometry demonstrated excellent reliability across all movement planes—flexion, extension, lateral flexion, and rotation. Gardhel Costa Araujo et al. reported test–retest ICCs ≥ 0.986, SEMs ≤ 1.89%, and MDCs ≤ 5.23%, with inter-rater ICCs ≥ 0.947 in chronic neck pain patients, affirming goniometry's precision [20]. Importantly, high concurrent validity was also observed when comparing goniometer readings to those obtained via fleximetry and digital inclinometry (Spearman's rho ≥ 0.993), supporting the interchangeability of these assessment tools [20]. Furthermore, smartphone-based clinometer applications have shown moderate to excellent agreement (ICC 0.87–0.96) in measuring cervical ROM, offering accessible and cost-effective alternatives in resource-limited settings [20]. Evidence from a recent BMC study also confirmed the reliability of both analogue and digital tools for cervical range evaluation in chronic neck pain populations (ICC ≥ 0.986; SEM < 2%; MDC < 6%) [20]. Taken together, these findings validate cervical ROM goniometry as a consistent, reliable, and valid outcome measure, aiding therapists in both diagnosis and treatment monitoring—even without access to specialized digital equipment.

CONCLUSION

The study found a positive correlation between hamstring tightness and reduced cervical spine mobility in sedentary individuals. As hamstring flexibility decreased, cervical range of motion also reduced, especially in flexion and side flexion movements. This supports the concept of myofascial chain influence from lower to upper body. Assessing and addressing hamstring tightness may be important in managing cervical dysfunction

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Ethical Committee

The ethical approval for undertaking the proposed study has been obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad, Maharashtra, India, vide their letter no. KVV/ IEC/01/2025 dated January 23, 2025.

Conflicts of Interest :

We claim that there is no conflicts of interest in the content of this study.

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