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Original Research Article

Comparison of Scapular Muscle Endurance and Craniovertebral Angle in Motorbike Riders with and Without Neck Pain: A Pilot Study

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ABSTRACT

Background: Motorbike drivers are frequently exposed to sustained postures, road vibrations, and repetitive upper limb movements, making them prone to musculoskeletal issues, particularly in the cervical and scapular regions. Scapular muscle endurance and craniovertebral angle (CVA) are crucial parameters related to postural control and neck function. Alterations in these factors may contribute to or result from neck dysfunction.

Context and purpose of study: To compare scapular muscle endurance and craniovertebral angle in motorbike drivers with neck pain and those without neck pain.

Results: The unpaired t-test revealed a statistically significant difference in mean scapular muscle endurance between the neck pain group (15.92kg) and the non-neck pain group (20kg), with a p-value of 0.008. Similarly, the craniovertebral angle was markedly reduced in those with neck pain (mean = 43.17°) compared to those without (mean = 49.25°), with a highly significant difference.

Conclusion: Participants with neck pain have significantly lower scapular muscle endurance and a smaller craniovertebral angle (CVA) than those without neck pain.

KEY WORDS: Cervical spine Angle, Forward Head Posture, Cervical Pain, Scapulothoracic Muscle Endurance.

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INTRODUCTION

Motorbike riding plays a crucial role in daily activities such as transportation, mobility, economic functions, and sports. Despite its benefits, motorbike use is linked with significant physical risks due to exposure to environmental factors like noise, vibration, and poor road conditions. Prolonged and repetitive riding can lead to driving-related Musculoskeletal disorders (DMSD), commonlyaffecting the spine, lower back, shoulders, and neck. Poor posture, constant vibration, and lack of adequate support during riding contribute to muscle fatigue, spinal injuries, and pain, especially in the lower back and neck regions [1]. The study show that bike riders are exposed to prolonged static posture causing significant angular deviations at all joints of the body, which in turn causes unwanted pain [2].

These issues are compounded by socioeconomic factors and stress, which are the major

contributors to accidents and physical discomfort among riders in developing countries. Compared to car drivers, motorbike riders are more vulnerable to postural strain due to lack of back support and prolonged seated positions. Studies highlight a high incidence of neck and shoulder pain in this population, linked to abnormal joint angles, poor pressure distribution, and muscular overuse. Over time, such physical stress can lead to deterioration in muscles, ligaments, and joints, making motorbike riders a high-risk group for chronic DMSD [3].

Forward head posture (FHP) refers to a condition in which the position of the head shifts forward in relation to the shoulder or lower spine rather than being in an optimal position. In transportation, the ergonomic design of vehicles, particularly bikes, can play a pivotal role in the onset and progression of FHP, given the extended hours that riders spend in static positions. Specifically, bike riders are susceptible to FHP due to the nature of their seated posture, extended driving periods, and potential stress from traffic and road conditions. However, despite being at risk, bike riders maintain a more dynamic posture, consistently adjusting their body alignment with the changing terrain and speed. Thus, physical demands and postural dynamics differ considerably [4].

The scapular muscles play a crucial role in maintaining shoulder stability, upper body posture, and efficient arm function. In motorbike riders, these muscles are subjected to continuous biomechanical stress due to the nature of their riding postures, which often involve prolonged static positions with forward head positioning and rounded shoulders, resulting in muscular imbalances around the scapula. Key stabilizing muscles such as serratus anterior, trapezius, and rhomboids are either overused or weakened due to the repetitive and sustained nature of driving tasks like steering, gear shifting, and braking. Over time, this leads to scapular dyskinesia, abnormal movement or positioning of the scapula, which compromises shoulder mechanics and increases strain on the neck and upper back. Research has shown that drivers with scapular dysfunction commonly experience neck and shoulder pain and demonstrate reduced grip strength and endurance, indicating a breakdown in the kinetic chain that connects core stability to hand function [5].

Such dysfunction not only affects comfort and performance but also raises the risk of developing chronic musculoskeletal disorders. Therefore, assessing scapular muscle function and incorporating stabilization exercises into rehabilitation and ergonomic interventions is crucial for preventing and managing driving-related musculoskeletal issues [6].

Forward head posture is a significant contributor to neck pain in drivers, not only by altering muscle activation patterns but also by reducing joint mobility and sensorimotor control. As the head moves forward, the load on the cervical spine increases significantly. For every inch the head moves forward, the effective weight of the head on the neck muscles increases, leading to muscle fatigue, tension, and joint compression [7].

The scapular muscles play a crucial role in maintaining proper neck posture and function, and their dysfunction is strongly associated with neck pain, particularly in individuals with a forward head posture or chronic cervical issues. Key scapular muscles involved include the upper, middle, and lower trapezius, serratus anterior, rhomboids, and levator scapulae. Among these, the upper trapezius and levator scapulae are often overactive and tight in individuals with neck pain, contributing to increased cervical spine loading and muscular fatigue. In contrast, the lower trapezius, middle trapezius, and serratus anterior are commonly found to be weak or underactive, leading to poor scapular stability and altered movement patterns. This imbalance can cause scapular dyskinesis, which places additional strain on the cervical musculature to compensate for the lack of scapular control [8].

Overall, addressing scapular muscle imbalances and improving their endurance is a key component in the physiotherapy management of neck pain. Individuals with idiopathic neck pain demonstrate altered electromyographic (EMG) activity patterns in key scapular stabilizing muscles, particularly the upper trapezius,

lower trapezius, and serratus anterior. These changes are often characterized by increased activation of the upper trapezius and reduced activation or delayed recruitment of the lower trapezius and serratus anterior during various functional tasks. This abnormal muscle activity suggests the presence of scapular dyskinesis, which may contribute to or result from neck pain by disrupting normal scapulocervical rhythm and increasing cervical muscle load [9].

Motorbike riders are exposed to prolonged static postures, vibration, and repetitive loading of the cervical and shoulder regions due to long hours of riding, often in poor ergonomic positions. These factors contribute to postural deviations such as FHP, which is reflected by a reduced CVA and is commonly associated with neck pain. Additionally, scapular muscle dysfunction, particularly reduced endurance of stabilizing muscles like the lower trapezius and serratus anterior, can lead to poor postural control, scapular dyskinesis, and increased cervical strain. While neck pain is prevalent among motorbike drivers, there is a lack of research investigating the relationship between scapular muscle endurance and cervical posture (measured via CVA) in this population [10,11].

Understanding this relationship is crucial for identifying biomechanical contributors to neck pain and for designing effective preventive and rehabilitative strategies tailored to motorbike drivers. Therefore, this study is necessary to determine whether deficits in scapular muscle endurance and changes in craniovertebral angle are significantly associated with neck pain in motorbike drivers, thereby highlighting potential targets for physiotherapeutic intervention.

METHODS

The Present study was conducted as a cross-sectional study with 24 participants who ride a motor vehicle from the AJ Institute of Medical Science and Research Centre. Among them, 12 participants had neck pain, and 12 did not. We employed a non-probability sampling design, selecting participants based on convenience. The allocation of participants was done randomly using the envelope method. Data collection lasted for 4 months.

Procedure: Approval of the study was obtained from the Institutional Ethics Committee. Patients were included according to the specified inclusion and exclusion criteria. Inclusion criteria include 24 Motorbike riders under the aged 21-30 years with or without neck pain, Individual whose primary mode of transportation is motor bike (2-wheeler), Individual using Motor bike with gear and having a driving experience of 2-3 years, the participants who drive at least 1-2 hours per day and bikes with a lower rider seat and raised pillion seat are included.

Participants with any deformity, neurological disorders, recent RTA/trauma, congenital abnormalities, cervical spine surgeries, and conditions that impair sensation or movement in the cervical region were excluded.

Twelve participants with neck pain and twelve without neck pain who drive a motorbike and meet the inclusion criteria were selected to assess scapular muscle endurance using a push-pull dynamometer. Participants were asked to stand facing the wall with their shoulders and elbows in a 90 ° flexion position. There was no contact between the participant's arm and the wall. While both scapulae were in neutral position, an appropriately sized stick was placed between the elbows, and a dynamometer was placed between their hands. The participants were asked to perform a shoulder external rotation until the dynamometer read 1 kg of load capacity, and then they were asked to maintain this position. When the participants could not keep the resistance, dropped the stick, could not support the 90° houlder flexion, or reported unbearable pain, the test was terminated, and the time of hold is recorded in seconds. Serratus anterior and trapezius muscle endurance was measured by the scapular muscle endurance (SME) test, and the results were recorded.

The craniovertebral angle is measured using Kinovea software to assess the head position. Participants' photographs are taken, and CVA

is measured by marking 2 points: the first marker was placed at C7, and the second one in the tragus of the ear. The angle formed by both red markers is recorded [12].

This application was designed to automatically measure the craniovertebral angle using computer-assisted vision and two red markers. If the angle obtained is less than 48 degrees, then it is considered as FHP.

RESULTS

Statistical analysis of the data was performed using SPSS20.0(IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). T-test. Descriptive statistics were presented using mean and Standard deviation. Comparison of numerical variables between the groups was done using an unpaired t-test. A p-value <0.05 is considered statistically significant.

Table 1: comparison of scapular muscle endurance (Kg) and craniovertebral angle (degrees).

	With neck pain		Without neck pain		t value	P value
	mean	Std. deviation	mean	Std. deviation		
Scapular muscle Endurance	15.92	2.58	20	4.11	4.92	0.008
Craniovertebral angle	43.17	2.44	49.25	3.52	2.92	0.0000641

DISCUSSION

The findings of this pilot study reveal a significant association between neck pain and both reduced scapular muscle endurance and craniovertebral angle (CVA) in motorbike drivers. The lower mean scapular muscle endurance in individuals with neck pain (15.92 kg) compared to those without (20 kg) suggests that neck pain may be linked to impaired scapular muscle function. Weak scapular stabilizers can alter shoulder and neck mechanics, leading to increased stress on cervical structures and contributing to pain. This has been highlighted in a study conducted by Karaaðaç A et.al, which explains that individuals with nonspecific chronic neck pain exhibit significantly lower scapulothoracic muscle strength and endurance compared to healthy individuals [8].

Furthermore, the significantly smaller craniovertebral angle in the neck pain group (43.17° vs. 49.25°) indicates a more pronounced forward head posture (FHP), which is commonly associated with prolonged static positions, such as those maintained during motorbike riding. FHP shifts the head's centre of gravity anteriorly, increasing the load on cervical musculature and potentially leading to musculoskeletal discomfort and dysfunction. Aafreen et al. conducted a study that underscores the fact that bike drivers experiencing neck pain exhibit significantly compromised neck health metrics—including reduced craniovertebral angle (reflecting forward head posture), diminished cervical range of motion, and lower proprioceptive acuity—compared to their pain-free peers [5].

These results support the hypothesis that both poor postural alignment and reduced scapular muscle endurance contribute to neck pain among motorbike riders. The strong statistical significance of the findings underscores the importance of early identification and intervention. Strengthening scapular muscles and correcting posture could be effective strategies in managing and preventing neck pain in this population [13].

The recommended prolonged-riding guidelines and education to raise awareness among non-occupational riders suggest that motorbike drivers should adopt ergonomic practices—such as regular posture checks, planned rest stops, and awareness of fatigue signs—to reduce the risk of MSDs, even during routine rides [14,15].

CONCLUSION

The results of the comparison indicate that individuals with neck pain have significantly lower scapular muscle endurance and a smaller craniovertebral angle (CVA) than those without neck pain. These findings suggest that reduced scapular muscle endurance and forward head posture (indicated by a decreased CVA) are associated with neck pain, highlighting the importance of targeting scapular and postural correction in rehabilitation programs.

ABBREVIATIONS

CVA: Craniovertebral Angle
DMSD: Driving Related Musculoskeletal Disorder
FHP: Forward Head Posture
SME: Scapular Muscle Endurance

Conflicts of interest: None

REFERENCES

[1]. Tony BJ, Alphin MS, Krishnan GS. Analysis of upper body ergonomic parameters on commuter motorbike users. Journal of Transport & Health. 2020 Mar 1;16:100828. https://doi.org/10.1016/j.jth.2020.100828

[2]. Deepan V, Subramanian M, Dineshkumar C. Motorcycle rider fatigue analyze: results of an online survey. International Journal of Mechanical and Production Engineering Research and Development. 2018 Mar.

[3]. Kamala V, Yamini S, Gajanand MS, Jagadeeswaran KR. Investigating the physical ergonomic risks associated with last-mile delivery personnel riding motorcycles. International Journal of Productivity and Performance Management. 2025 Mar 21. https://doi.org/10.1108/IJPPM-08-2024-0543

[4]. Aafreen A, Khan AR, Khan A, Ahmad A, Shaphe MA, Alshehri MM, Alajam RA, Hakamy A, Alqahtani AS, Ali T, Aldhahi MI. Prevalence of Forward head posture among car and bike drivers and its relation with neck and cardiopulmonary health parameters-a cross-sectional study. Plos one. 2024 Aug 8;19(8):e0307016. https://doi.org/10.1371/journal.pone.0307016 PMid:39116115 PMCid:PMC11309429

[5]. Husen A, Mehta A, Nagulakr J. Prevalence of scapular dyskinesia among truck drivers: An observational study. International Journal of Multidi sciplinary Research and Growth Evaluation 2025;6(2):115-122.

[6]. Aafreen A, Khan AR, Khan A, Ahmad A, Shaphe MA, Alzahrani A, Alhusayni A, Alameer AH, Alajam RA. Decoding the impact of driving postures: comparing neck pain, mobility, proprioception in car and bike drivers with and without Forward Head Posture. Journal of Transport & Health. 2023 Nov 1;33:101719. https://doi.org/10.1016/j.jth.2023.101719

[7]. Castelein B, Cools A, Bostyn E, Delemarre J, Lemahieu T, Cagnie B. Analysis of scapular muscle EMG activity in patients with idiopathic neck pain: a systematic review. Journal of Electromyography and Kinesiology. 2015 Apr 1;25(2):371-86. https://doi.org/10.1016/j.jelekin.2015.01.006 PMid:25683111

[8]. Lotfian, S., Fesharaki, M.J., Shahabbaspour, Z. et al. The impact of forward head posture on neck muscle endurance and thickness in women with chronic neck pain: a cross-sectional study. BMC Musculoskelet Disord 2025;26:468. https://doi.org/10.1186/s12891-025-08705-w PMid:40361072 PMCid:PMC12070504

[9]. Karaaðaç A, Arslan SA, Keskin ED. Assessment of pain, scapulothoracic muscle strength, endurance and scapular dyskinesis in individuals with and without nonspecific chronic neck pain: A cross-sectional study. J Bodyw Mov Ther. 2023 Jul;35:261-267. https://doi.org/10.1016/j.jbmt.2023.04.008 PMid:37330779

[10]. Özdemir F, Toy Þ, Kýzýlay F, Avcý ZT, Altay Z, Çolak C. Effects of scapular stabilization exercises in patients of chronic neck pain with scapular dyskinesis: A quasi-experimental study. Turkish journal of physical medicine and rehabilitation. 2021 Mar 4;67(1):77. https://doi.org/10.5606/tftrd.2021.6775 PMid:33948547 PMCid:PMC8088807

[11]. Javdaneh N, Ambro¿y T, Barati AH, Mozafaripour E, Rydzik £. Focus on the Scapular Region in the Rehabilitation of Chronic Neck Pain Is Effective in Improving the Symptoms: A Randomized Controlled Trial. J Clin Med. 2021 Aug 8;10(16):3495. https://doi.org/10.3390/jcm10163495 PMid:34441791 PMCid:PMC8397110

[12]. Eraslan U, Gelecek N, Genc A. Effect of scapular muscle endurance on chronic shoulder pain in textile workers. J Back Musculoskelet Rehabil. 2013;26(1):25-31. https://doi.org/10.3233/BMR-2012-0346 PMid:23411645

[13]. Özyürek S, Cansu Kalkan A, Doðan E, Melike Bülbül H, Akif Kamar M, Balci A, Ömer Ýkiz A, Keskinoðlu P, Genç A. Decreased muscle strength and scapular muscle endurance associated with shoulder function after neck dissection. J Back Musculoskelet Rehabil. 2023;36(2):347-355. https://doi.org/10.3233/BMR-210270 PMid:36278334

[14]. Rashid H, Omar AR, Mahmud Z, Wan Fauzi WM. Musculoskeletal disorders (MSDs) among non-occupational motorcyclists: what are the issues?. Asian Journal of University Education (AJUE). 2020;16(4):220-9. https://doi.org/10.24191/ajue.v16i4.11959

[15]. Panumasvivat J, Surawattanasakul V, Kwangsukstith S, Mahakkanukrauh C, Kiratipaisarl W. The relationship between working conditions, vehicle factors, and work-related musculoskeletal disorders affecting job satisfaction and job stress among motorcycle food delivery riders. International Journal of Hygiene and Environmental Health. 2025 Jun 1;267:114594. https://doi.org/10.1016/j.ijheh.2025.114594 PMid:40373579

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