The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 2, 2025

SPINAL POSTURAL ADAPTATIONS IN MOTORCYCLE RIDERS AND THERAPEUTIC INSIGHTS FROM MYOFASCIAL RELEASE

Dr. M. Hassan Waseem PT[*1], Dr. Kinza Nayyer PT[2], Dr. Quratulain PT[3], Dr. Zara Abbasi PT[4], Dr. Shifa Abbasi PT[5], Dr. Muhammad Abdullah Javed[6]

[*1]*Assistant Professor of Physiotherapy Iqra University, North Campus, Karachi*
[2]*Physical Therapist Karachi physiotherapy and chiropractor center (KPCC)*
[3]*Teaching Assistant in the Department of Physiology*
[4]*Vice Principal Simrah Institute of Medical & Health Sciences*
[5]*Physiotherapist, IPRS Liaquat University of Medical & Health Sciences*
[6]*Physical Therapist Alkhidmat hopsital*

[*1]hassan.waseem@iqra.edu.pk, [2]kinzaadeed@gmail.com, [3]quratulainb971@gmail.com, [4]zaraabbasi83@gmail.com, [5]shifa.abbasi21@gmail.com, [6]drmabdullahjavedpt@gmail.com

DOI: https://doi.org/10.5281/zenodo.17659193

Keywords
myofascial release, spinal deformities, motorcycle riders, postural alterations, manual therapy

Article History
Received: 11 Dec 2024
Accepted: 21 Jan 2025
Published: 04 Feb 2025

Corresponding Author: *
Dr. M. Hassan Waseem PT

Abstract

Background: *Extended motorcycle riding requires maintaining forward-flexed postures that significantly elevate compressive forces across spinal segments, predominantly impacting cervical and lumbar vertebrae. This prolonged positioning amplifies erector spinae muscle recruitment and promotes fatigue within lumbopelvic stabilizing musculature, specifically the lumbar multifidus and internal oblique, consequently predisposing riders to postural abnormalities, including thoracic kyphosis, scoliosis, and pelvic misalignment.*

Purpose: *This investigation evaluated spinal alignment alterations attributable to chronic motorcycle riding and examined myofascial release (MFR) as a viable therapeutic modality for addressing associated postural deformities.*

Methods: *This cross-sectional investigation enrolled 30 male motorcycle riders (age range 25-40 years) from Dow University Hospital, Karachi, Pakistan. Participants underwent a comprehensive postural evaluation utilizing a validated self-report questionnaire, scoliometer quantification, and postural grid photographic analysis. Measurements encompassed cervical, thoracic, and lumbar curvatures, pelvic tilt angles, and shoulder girdle alignment. Statistical examination employed SPSS version 16.0, with one-way ANOVA determining relationships between riding duration, pain intensity, and postural deviations.*

Results: *Substantial cervical lordotic deviations manifested in 73% of study participants, with forward cranial translation evident through postural grid assessment. Thoracic kyphotic measurements revealed abnormal values in 65% of subjects. Pain experienced during motorcycle operation demonstrated statistically significant correlation with cervical spine modifications ($p=0.032$). Riding duration exhibited no significant influence on lifestyle-associated postural alterations ($p>0.05$).*

Conclusions: *Chronic motorcycle riding demonstrates significant association with spinal postural abnormalities, predominantly affecting cervical and thoracic*

anatomical regions. These findings substantiate the necessity for postural awareness interventions and identify myofascial release as a therapeutically promising approach for addressing biomechanical alterations within this population.

INTRODUCTION

Motorcycle utilization has experienced substantial escalation across Asian urban centers, functioning as the predominant transportation modality for middle-income populations driven by economic viability and traffic congestion mitigation. In Pakistan's metropolitan regions, approximately 60-70% of daily commuters depend upon two-wheeled vehicles for transit. Contrasting automobile operators who benefit from lumbar support systems and ergonomic seating configurations, motorcycle riders sustain prolonged flexed postures devoid of adequate spinal stabilization, thereby predisposing them to musculoskeletal complications.

The human musculoskeletal architecture is biomechanically optimized for dynamic locomotion and vertical posture maintenance rather than sustained static positioning. Prolonged sitting, particularly in motorcycle riding configurations, imposes considerable mechanical stress upon spinal structures. Research demonstrates that seated positions elevate intradiscal pressure by approximately 40% relative to standing postures, with anterior flexion further augmenting this pressure by an additional 16%. The aerodynamic riding posture characteristic of motorcyclists—featuring anterior pelvic inclination and lumbar flexion transitioning from physiological lordosis toward kyphosis—compounds these mechanical stressors. Lumbopelvic stabilizing musculature, particularly lumbar multifidus and internal oblique, executes crucial functions in counterbalancing compressive forces upon vertebral bodies while maintaining spinal stability. During extended sitting periods, these muscles experience elevated fatigue levels, diminishing their dynamic stabilization capacity. Additionally, posterior pelvic rotation and lumbar lordosis reduction characteristic of motorcycle riding posture generate increased erector spinae muscle activation, modified load distribution across intervertebral discs, and heightened stress concentration on posterior spinal structures.

Common spinal deformities associated with prolonged motorcycle riding include thoracic kyphosis (excessive posterior curvature of the upper back), scoliosis (lateral spinal curvature), reduced lumbar lordosis, and forward head posture. These alterations can manifest as cervical dysfunction, impaired cardiopulmonary function, chronic low back pain, neurological deficits, and decreased functional capacity. Myofascial release (MFR) is a manual therapy technique involving sustained low-load, long-duration mechanical forces applied to the myofascial complex to restore optimal tissue length, decrease pain, and improve function. MFR operates on the principle that fascial restrictions in one body region create compensatory stress patterns throughout the interconnected fascial network. Evidence suggests that MFR effectively reduces pain and improves physical function in patients with chronic low back pain by addressing fascial restrictions.

Despite growing evidence supporting MFR for various musculoskeletal conditions, limited research has specifically investigated its application for spinal deformities associated with prolonged motorcycle riding. This study aimed to evaluate spinal alignment alterations in chronic motorcycle riders and explore the therapeutic potential of myofascial release for addressing these postural abnormalities.

METHODS & MATERIALS:

Study Design and Setting:

This cross-sectional observational study was conducted at the Department of Physiotherapy, in different Hospitals, Karachi, Pakistan, spanning 12 months from January to December 2016.

Participant Selection:

A convenience sample comprising 30 male motorcycle riders was recruited from the physiotherapy outpatient department and university community. Sample size determination utilized feasibility considerations and preliminary power calculations assuming medium effect magnitude (Cohen's d=0.5) with 80% statistical power at α=0.05.

Inclusion criteria:

1. Male participants within the 25-40-year age range
2. Regular motorcycle operators (minimum 2 hours daily operation for ≥6 months)
3. Capacity to comprehend and complete the assessment questionnaire
4. Voluntary participation consent

Exclusion criteria:

1. Diagnosed systemic disorders (rheumatoid arthritis, ankylosing spondylitis)
2. Confirmed osteoporosis via bone mineral density testing
3. Previous spinal surgery or vertebral fracture history
4. Acute traumatic injuries within the preceding 3 months
5. Neurological conditions affecting postural control or muscle function

Outcome Measures and Assessment Tools:

1. Self-Designed Questionnaire: A structured instrument collected demographic information, riding behaviors, pain characteristics, and medical history.
2. Scoliometer Measurements: Spinal curvatures were quantified utilizing a scoliometer (precision ±1 degree) measuring cervical curvature (C1-C7), thoracic curvature (T1-T12), thoracic deviation (lateral curvature), lumbosacral angle (L1-S1), and bilateral shoulder shift. Measurements were performed in relaxed standing position, repeated thrice, and averaged.
3. Postural Grid Analysis: Participants positioned before calibrated postural grid for photographic documentation in four standardized views (anterior, posterior, right lateral, left lateral) evaluating forward head posture, shoulder protraction, thoracic kyphosis, lumbar lordosis, and pelvic alignment.

Statistical Analysis:

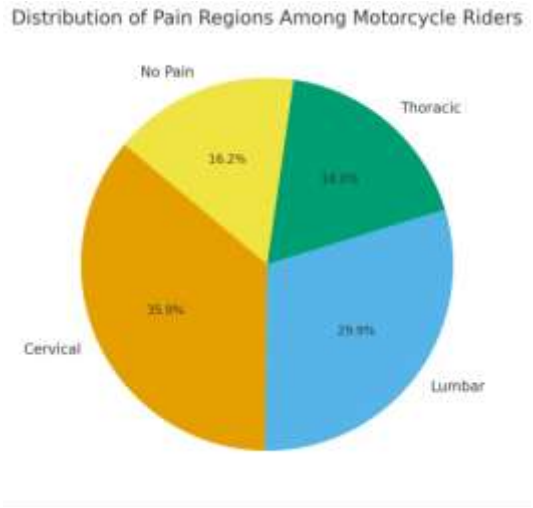
Data underwent analysis utilizing SPSS version 16.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics encompassed means, standard deviations, frequencies, and percentages. One-way analysis of variance (ANOVA) examined associations between independent variables (lifestyle factors, pain during riding) and dependent variables (spinal curvature measurements). Statistical significance threshold established at $p<0.05$ for all analyses.

RESULTS:

Participant Characteristics:

The investigation enrolled 30 male motorcycle riders exhibiting a mean age of 31.4±4.2 years (range 25-40 years). Average daily motorcycle riding duration measured 3.8±1.6 hours, with participants utilizing motorcycles as primary transportation for 7.2±3.5 years. Twenty-two participants (73.3%) reported experiencing pain during or following riding, with the cervical region most commonly affected (n=18, 60%), followed by the lumbar region (n=15, 50%) and the thoracic region (n=9, 30%).

Figure 1: Distribution of pain regions among motorcycle riders (n=30). Cervical pain was the most frequently reported, followed by lumbar and thoracic regions.

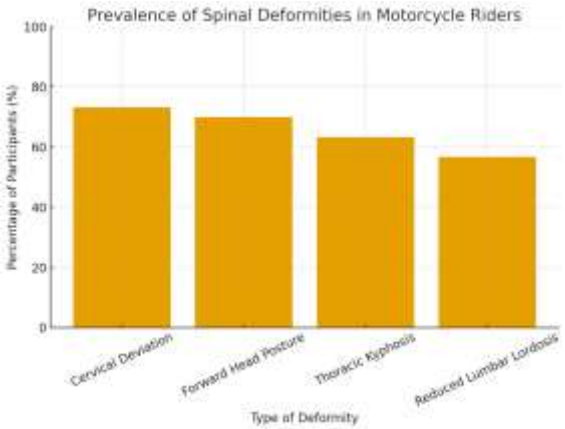


Spinal Curvature Measurements:

Scoliometer measurements revealed substantial deviations in cervical curvature from normative values in 22 participants (73.3%), with mean cervical curvature measuring 4.8±0.9 cm. Postural grid analysis identified forward head posture in 21 participants (70%), characterized by anterior cranial translation relative to vertical axis.

Thoracic curvature measurements demonstrated mean value 6.4±1.1 cm, with 19 participants (63.3%) exhibiting increased thoracic kyphosis beyond normal ranges. Thoracic deviation (lateral curvature) averaged 8.5±3.3 degrees. The mean lumbosacral angle measured 5.2±0.8 cm, with postural assessment revealing reduced lumbar lordosis in 17 participants (56.7%). Bilateral shoulder shift measurements showed mean deviation 6.7±2.5 degrees.

Figure 2: Prevalence of spinal deformities observed in motorcycle riders, with cervical deviations and forward head posture being the most common findings.

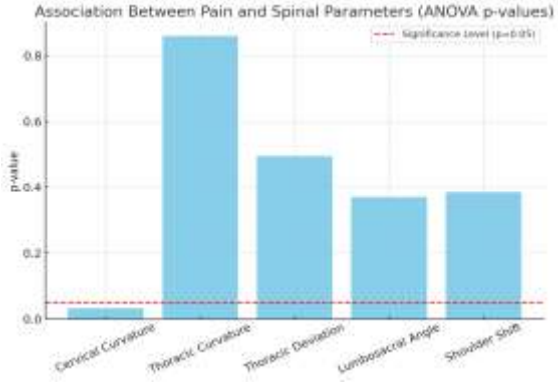


Association Between Pain and Spinal Deformities:

One-way ANOVA analysis demonstrated statistically significant association between pain experienced during riding and cervical curvature alterations ($F=5.072$, $p=0.032$). Participants

reporting pain during riding exhibited greater cervical lordotic deviations and forward head posture compared to asymptomatic riders.

Figure 3: Association between pain and spinal parameters based on ANOVA results. Only cervical curvature showed a statistically significant relationship ($p < 0.05$).



No significant associations were identified between pain during riding and thoracic curvature ($p=0.860$), thoracic deviation ($p=0.495$), lumbosacral angle ($p=0.371$), or shoulder shift ($p=0.386$).

Effect of Lifestyle Factors:

Analysis of lifestyle variables (occupational demands, physical activity levels, ergonomic awareness) revealed no statistically significant effects on measured spinal parameters: cervical curve ($p=0.478$), thoracic curve ($p=0.511$), thoracic deviation ($p=0.721$), lumbosacral angle ($p=0.727$), and shoulder shift ($p=0.307$).

DISCUSSION:

This cross-sectional investigation establishes that chronic motorcycle riding demonstrates significant association with spinal postural alterations, predominantly affecting cervical and thoracic anatomical regions. The elevated prevalence of cervical lordotic deviations (73.3%) and thoracic hyperkyphosis (63.3%) observed within this cohort substantially exceeds anticipated rates in general populations, which typically range 20-30% for postural abnormalities in comparable age groups.

The significant correlation between riding-associated pain and cervical spine alterations ($p=0.032$) underscores the clinical relevance of these postural modifications. Forward head posture, identified in 70% of participants, creates biomechanical disadvantages by displacing the center of gravity anterior to cervical spine, necessitating increased posterior cervical muscle activation and elevating compressive forces on cervical facet joints. Postural adaptations observed in motorcycle riders reflect sustained biomechanical demands of riding position. The transition from physiological lumbar lordosis toward lumbar kyphosis during riding, combined with anterior pelvic inclination, modifies normal load distribution across intervertebral discs. Investigations utilizing pressure-sensitive measurements have documented intradiscal pressure increases of 40-100% during forward flexion postures compared to neutral standing.

The theoretical framework supporting MFR for motorcycle riding-related spinal deformities encompasses several interconnected mechanisms. Sustained riding postures create adaptive shortening of anterior myofascial chains (pectoralis major, anterior cervical musculature, hip flexors) while lengthening and weakening posterior chains (rhomboids, middle/lower trapezius, erector spinae). MFR techniques address these imbalances by applying sustained mechanical forces inducing viscoelastic deformation of fascia, promoting collagen fiber reorganization and restoring optimal tissue

extensibility. For motorcycle riders, MFR protocols should target key regions: (1) cervical spine to address forward head posture and upper crossed syndrome, (2) thoracic spine to reduce hyperkyphotic positioning and improve rib cage mobility, (3) lumbar spine and lumbopelvic region to restore lordotic curvature and activate local stabilizers, and (4) hip flexor complex to address anterior pelvic tilt.

Healthcare providers should: (1) implement screening programs to identify at-risk individuals through postural assessments and pain questionnaires, (2) provide postural education emphasizing awareness of riding posture, (3) recommend ergonomic modifications such as adjustable handlebars, (4) integrate MFR techniques into comprehensive treatment protocols for symptomatic riders, and (5) prescribe corrective exercises targeting weakened posterior chain muscles.

Study Limitations:

Several limitations warrant consideration. The cross-sectional design precludes causal inferences regarding temporal relationships between motorcycle riding and spinal deformities. The convenience sampling method and relatively limited sample size (n=30) restrict generalizability. The study population consisted exclusively of male participants aged 25-40 years from a single urban center. The investigation did not implement or evaluate actual MFR interventions, limiting conclusions to theoretical considerations. Randomized controlled trials are needed to empirically test MFR efficacy.

CONCLUSIONS:

This cross-sectional investigation establishes that chronic motorcycle riding demonstrates significant association with spinal postural abnormalities, predominantly affecting cervical and thoracic anatomical regions, with 73% of riders demonstrating cervical lordotic deviations and 63% exhibiting thoracic hyperkyphosis. Based on literature reviewed and theoretical considerations, myofascial release emerges as a promising therapeutic intervention to address fascial restrictions and muscular imbalances associated with prolonged motorcycle riding. Healthcare providers serving populations with high motorcycle usage should maintain heightened awareness of riding-associated musculoskeletal complications. Comprehensive management approaches integrating postural assessment, manual therapy techniques including MFR, corrective exercise prescription, and ergonomic education offer greatest potential for preventing and treating spinal deformities in this at-risk population.

Future research should include longitudinal studies tracking postural changes, randomized controlled trials comparing MFR to standard interventions, and investigation of preventive strategies including ergonomic modifications.

CONFLICT OF INTEREST:

The authors declare no conflicts of interest.

REFERENCES:

1. Adams MA, Hutton WC. The effect of posture on the lumbar spine. J Bone Joint Surg Br 1985;67:625-629.
2. Ajimsha MS, Al-Mudahka NR, Al-Madzhar JA. Effectiveness of myofascial release: systematic review of randomized controlled trials. J Bodyw Mov Ther 2015;19:102-112.
3. Barnes MF. The basic science of myofascial release: morphologic change in connective tissue. J Bodyw Mov Ther 1997;1:231-238.
4. Briggs AM, van Dieën JH, Wrigley TV, Greig AM, Phillips B, Lo SK, Bennell KL. Thoracic kyphosis affects spinal loads and trunk muscle force. Phys Ther 2007;87:595-607.
5. Callaghan JP, McGill SM. Low back joint loading and kinematics during standing and unsupported sitting. Ergonomics 2001;44:280-294.
6. Harrison DD, Harrison SO, Croft AC, Harrison DE, Troyanovich SJ. Sitting biomechanics part I: review of the literature. J Manipulative Physiol Ther 1999;22:594-608.

7. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain. Spine 1996;21:2640-2650.
8. Kapandji IA. The Physiology of the Joints Volume 3, The Trunk and Vertebral Column. 2nd ed. Edinburgh: Churchill Livingstone; 1974.
9. Mahmoud NF, Hassan KA, Abdelmajeed SF, Moustafa IM, Silva AG. The relationship between forward head posture and neck pain: a systematic review and meta-analysis. J Phys Ther Sci 2019;31:124-128.
10. Muyor JM, López-Miarro PA, Casimiro AJ. Spinal posture of thoracic and lumbar spine and pelvic tilt in cyclists. J Sports Sci Med 2011;10:355-361.
11. Nachemson A, Elfström G. Intravital dynamic pressure measurements in lumbar discs. Scand J Rehabil Med Suppl 1970;1:1-40.
12. O'Sullivan PB, Dankaerts W, Burnett AF, et al. Effect of different upright sitting postures on spinal-pelvic curvature and trunk muscle activation. Spine 2006;31:E707-E712.
13. Page P, Frank C, Lardner R. Assessment and Treatment of Muscle Imbalance: The Janda Approach. Champaign, IL: Human Kinetics; 2010.
14. Panjabi MM. The stabilizing system of the spine. Part I. Function, dysfunction, adaptation, and enhancement. J Spinal Disord 1992;5:383-389.
15. Schleip R. Fascial plasticity: a new neurobiological explanation. J Bodyw Mov Ther 2003;7:11-19.
16. Stecco C, Stern R, Porzionato A, et al. Hyaluronan within fascia in the etiology of myofascial pain. Surg Radiol Anat 2011;33:891-896.
17. Wilke HJ, Neef P, Caimi M, Hoogland T, Claes LE. New in vivo measurements of pressures in the intervertebral disc in daily life. Spine 1999;24:755-762.
18. Wu Z, Wang Y, Ye X, et al. Myofascial release for chronic low back pain: a systematic review and meta-analysis. Front Med 2021;8:697986.
19. Yip CHT, Chiu TTW, Poon ATK. The relationship between head posture and severity and disability of patients with neck pain. Man Ther 2008;13:148-154.