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COMPARISON OF SCAPULAR POSITION IN SMARTPHONE-ADDICTED SUBJECTS AND AGE-MATCHED NON-ADDICTED INDIVIDUALS (18–25 YEARS)

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ABSTRACT

Background: Scapular dyskinesis (SD) has been reported in up to 60 % of healthy adults and is exacerbated by postural habits linked to extensive smartphone use.

Aim: To compare static scapular position between smartphone-addicted undergraduate physiotherapy students and age-matched non-addicted peers.

Methods: Eighty participants (mean 21.3 ± 2.0 years) were screened with the Smartphone Addiction Scale–Short Version. Forty addicts (Group A, score ≥ 31) and forty controls (Group B, < 31) underwent Kibler's Lateral Scapular Slide Test (LSST) in three arm postures (0°, 45°, 90°). Mean bilateral distances from the inferior scapular angle to corresponding thoracic spinous processes were recorded; an asymmetry ≥ 1.5 cm indicated dyskinesis. Between-group comparisons employed unpaired *t*-tests ($\alpha = 0.05$).

Results: Significant differences were confined to the 90° posture (right: 10.55 ± 1.96 cm vs 9.40 ± 1.07 cm, $p = 0.027$; left: 10.70 ± 1.51 cm vs 9.75 ± 1.06 cm, $p = 0.012$). No differences emerged at 0° or 45°.

Conclusion: Smartphone addiction is associated with scapular mal-alignment during functional arm elevation, highlighting the need for early ergonomic and exercise interventions in young adults.

Keywords: scapula, dyskinesia, smart phone addiction, lateral scapular slide test, scapular position

INTRODUCTION

Scapular dyskinesis (SD) is an umbrella term describing visible alterations in static position or dynamic motion of the scapula relative to the thoracic cage, typically arising from errors in muscle activation or coordination **[1]**. Although frequently recognised in sports-medicine clinics, its pathomechanics remain incompletely understood. Nodehi Moghadam *et al*. estimate that as many as 60 % of probably "healthy" adults exhibit some degree of SD, emphasising the condition's subclinical prevalence [1]. The scapula—an irregular flat bone with three angles, three borders, three processes and two surfaces—forms the keystone of the shoulder girdle, providing extensive attachment for seventeen muscles that collectively allow six fundamental motions: elevation, depression, protraction, retraction and upward or downward rotation **[2]**. Any disturbance in this delicate force-couple network can propagate abnormal loading across the glenohumeral, acromioclavicular and cervical motion segments, predisposing to pain, instability and impaired upper-limb function.

Postural adaptations are a well-recognised extrinsic driver of SD. Janda's upper-crossed syndrome (UCS) exemplifies this: tonic tightening of the upper trapezius, levator scapulae and pectoralis group coincides with inhibition of the deep cervical flexors, serratus anterior, rhomboids and lower trapezius, producing forward head posture (FHP), protracted shoulders and winging scapulae **[3]**. Modern technology usage patterns—particularly the ubiquitous smartphone—appear to reinforce the UCS template in adolescents and young adults. Smartphone addiction, a behavioural dependence characterised by compulsive overuse and measurable with the Smartphone Addiction Scale, now affects a substantial proportion of university students worldwide **[4]**.

Biomechanical observations indicate that typical smartphone handling (device held below eye level with elbows flexed and the neck flexed 30–45°) shifts the head's centre of gravity anteriorly, reducing lower-cervical lordosis and eliciting compensatory thoracic kyphosis **[5]**. Chronic exposure to this posture increases cervical extensor demand, shortens pectoralis minor and lengthens scapular stabilisers, thereby lowering the cranio-vertebral angle, diminishing the scapular index and fostering SD [6, 7]. Gohar *et al*. demonstrated significantly reduced chest expansion and scapular index in heavy smartphone users, whereas Kataria reported altered scapular positioning in students with "text-neck" syndrome [8]. Nevertheless, available studies are largely descriptive, cross-sectional and heterogeneous in their assessment tools, leaving uncertainty about whether objectively defined "addicted" users differ from non-addicted peers of the same age.

Kibler's Lateral Scapular Slide Test (LSST) offers a simple, reliable bedside metric to detect static scapular asymmetry across three arm postures. Sciascia and Kibler recently reaffirmed its clinical relevance when interpreted alongside functional elevation tests [9]. Building on these insights, the present comparative study investigates whether physiotherapy under-graduates who meet addiction criteria on the Smartphone Addiction Scale display greater LSST deviation than matched non-addicted classmates. Clarifying this relationship could support early ergonomic interventions to prevent the cascade from postural habit to symptomatic SD.

MATERIALS AND METHODS

Study design & setting: Comparative cross-sectional study conducted at Ahmedabad Physiotherapy College over six months (January–June 2025).

Population & sampling: Eighty undergraduate students (18–25 years) recruited by convenience sampling.

Inclusion criteria:

- Both gender.
- Age group of 18-25 years.
- Undergraduate physiotherapy students.
- Smartphone addiction scale score more than 31

Exclusion criteria:

- Forward head posture for non-addicted population
- No recent surgeries
- Myelopathies
- Radiculopathies

Assessment tools: Smartphone Addiction Scale–Short Version (Hindi) and Kibler's LSST.

LSST protocol: Distances from the inferior scapular angle to the nearest thoracic spinous process were measured bilaterally in three positions: P1 (arms relaxed 0°), P2 (hands on hips 45° abduction/internal rotation) and P3 (90° abduction/internal rotation). Three trials per posture were averaged; asymmetry ≥ 1.5 cm indicated SD [15].

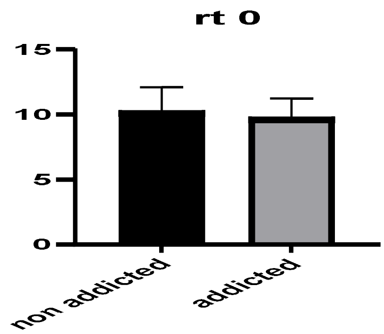
Statistical analysis: Data entered in MS-Excel 14; normality checked with Shapiro–Wilk. Unpaired *t*-tests compared group means (GraphPad Prism 8.4.3), significance $p \leq 0.05$.

RESULTS

Mean demographics were comparable between groups. Significant differences were confined to P3: right scapula ($p = 0.027$) and left scapula ($p = 0.012$). No between-group differences surfaced at P1 or P2 (all $p > 0.38$). LSST asymmetry ≥ 1.5 cm was observed in 15/40 (37.5 %) addicts versus 5/40 (12.5 %) controls.

Table 1: Comparison of scapular position between group A and group B at 00 of right side using Unpaired t-test.

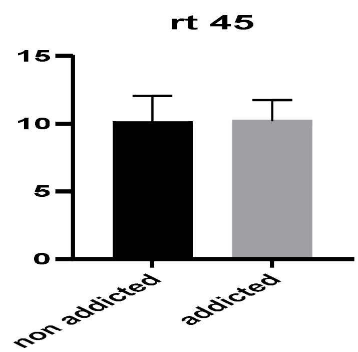
SCAPULAR POSITION	GROUP A	GROUP B
MEAN	10.18	9.7000
SD	1.935	1.542
SEM	-0.4750 ± 0.5533	-0.4750 ± 0.5533
95% CI	-1.595 to 0.6451	
P VALUE	0.3960	
SIGNIFICANTLY DIFFERENT	No	



Inference: There is a significance difference of scapular position between group A and group B at 0^0 of right side.

Table 2: Comparison of scapular position between group A and group B at 45^0 of right side using Unpaired t-test

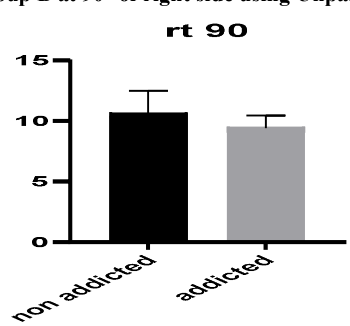
SCAPULAR POSITION	GROUP A	GROUP B
MEAN	10.05	10.18
SD	2.006	1.567
SEM	0.1250 ± 0.5691	0.1250 ± 0.5691
95% CI	-1.027 to 1.277	-1.027 to 1.277
P VALUE	0.8273	
SIGNIFICANTLY DIFFERENT	No	



Inference: There is a significance difference of scapular position between group A and group B at 45^0 of right side.

Table 3: Comparison of scapular position between group A and group B at 90^0 of right side using Unpaired t-test

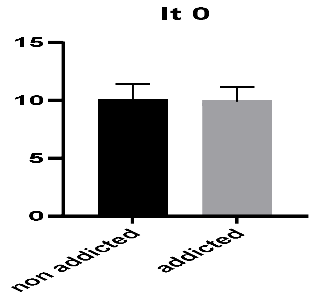
SCAPULAR POSITION	GROUP A	GROUP B
MEAN	10.55	9.400
SD	1.959	1.071
SEM	-1.150 ± 0.4993	-1.150 ± 0.4993
95% CI	-2.161 to -0.1391	-2.161 to -0.1391
P VALUE	0.0268	
SIGNIFICANTLY DIFFERENT	Yes	



Inference: There is a significance difference of scapular position at between group A and group B at 90^0 of right side.

Table 4: Comparison of scapular position between group A and group B at 0 ^{0} of left side using Unpaired t-test

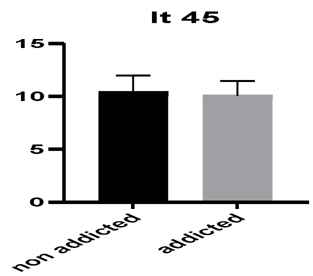
SCAPULAR POSITION	GROUP A	GROUP B
MEAN	10.00	9.875
SD	1.423	1.276
SEM	-0.1250 ± 0.4275	-0.1250 ± 0.4275
95% CI	-0.9904 ± 0.7404	-0.9904 ± 0.7404
P VALUE	0.7716	
SIGNIFICANTLY DIFFERENT	No	



Inference: There is a significance difference of scapular position between group A and group B at 0^0 of left side.

Table 5: Comparison of scapular position between group A and group B at 45^0 of left side using Unpaired t-test

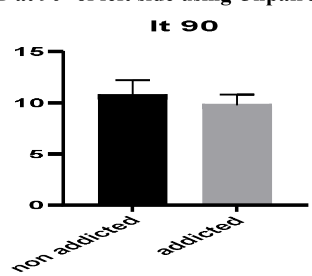
SCAPULAR POSITION	GROUP A	GROUP B
MEAN	10.37	10.03
SD	1.608	1.437
SEM	-0.3400 ± 0.4822	-0.3400 ± 0.4822
95% CI	-1.316 to 0.6362	-1.316 to 0.6362
P VALUE	0.4851	
SIGNIFICANTLY DIFFERENT	No	



Inference: There is a significance difference of scapular position in smartphone between group A and group B at 45^0 of left side.

Table 6: Comparison of scapular position between group A and group B at 90^0 of left side using Unpaired t-test

SCAPULAR POSITION	GROUP A	GROUP B
MEAN	10.70	9.750
SD	1.508	1.058
SEM	-0.9500 ± 0.4118	-0.9500 ± 0.4118
95% CI	-1.784 to -0.1163	-1.784 to -0.1163
P VALUE	-1.784 to -0.1163	
SINIFICANTLY DIFFERENT	Yes	



Inference: There is a significance difference of scapular position between group A and group B at 90^0 of left side.

DISCUSSION

This comparative study sought to determine whether objectively defined smartphone addiction is associated with altered static scapular alignment in young adults. The LSST revealed significant group differences exclusively at 90° shoulder abduction, wherein addicted users displayed mean deviations that exceeded Kibler's 1.5 cm threshold in 37.5 % of cases. These findings suggest that excessive device use exerts its deleterious effect most clearly when the scapular upward-rotator force couple is stressed by functional elevation.

Our results mirror the broader pattern of cervical and shoulder dysfunction reported in contemporary literature. Alshahrani *et al*. documented reduced deep-neck flexor endurance and diminished hand-grip strength among high-frequency smartphone users, highlighting how prolonged digital engagement compromises proximal stability **[10]**. In a similar vein, Salvi and Battin linked higher Mobile Phone Addiction Scale scores with lower cranio-vertebral angles and reduced scapular indices **[11]**. The biomechanical underpinning is well explained by Neumann's muscular imbalance model: FHP increases the moment arm of the head about the cervical spine up to six-fold, driving overactivity of the upper trapezius and levator scapulae while inhibiting the middle trapezius and serratus anterior **[12]**. Electromyographic studies by Ludewig and colleagues corroborate that these length-tension shifts alter upward-rotation timing and reduce the subacromial clearance during arm elevation, thereby predisposing individuals to impingement and tendinopathy **[13, 14]**.

Contrasting evidence exists: Dubey *et al*. observed no static LSST difference despite extended smartphone usage **[6]**. Their cohort, however, recorded shorter daily screen times and lacked an addiction criterion, suggesting that the intensity and compulsivity of use—not mere duration—may be critical thresholds for clinically meaningful dyskinesis. Our data reinforce this distinction, showing significant positional changes only in the addicted group.

From a clinical standpoint, early recognition of scapular mal-alignment is essential because it frequently precedes overt pain or rotator-cuff pathology. Interventions combining ergonomic education, scheduled "tech breaks," pectoralis minor stretching and serratus anterior plus lower-trapezius strengthening have shown promise in reducing discomfort and restoring kinematics **[3, 4, 15]**. Embedding such preventive strategies within university wellness programmes could curtail the burgeoning musculoskeletal burden in digital-native populations.

Limitations include the cross-sectional design, convenience sampling from a single campus, and reliance on static assessment; future work employing three-dimensional motion analysis, larger multi-centre cohorts and longitudinal tracking would better elucidate causality and temporal progression. Confounding variables such as backpack weight, computer usage and overall physical activity were not quantified and should be controlled in subsequent research.

Notwithstanding these constraints, the present study contributes to the growing evidence that behavioural addiction to smartphones—rather than usage time alone—is associated with measurable alterations in scapular alignment during functional arm elevation. Early ergonomic counselling and targeted exercise prescription may therefore be prudent preventative measures for heavy smartphone users.

CONCLUSION

Scapular position at rest (0°) and hands-on-hips (45°) did not differ between groups; however, smartphone-addicted students demonstrated significant dyskinesis at 90° abduction. These findings underscore the importance of monitoring scapular mechanics in habitual smartphone users and implementing early corrective strategies.

Limitations: Static assessment only; dynamic kinematics and additional postural factors warrant investigation.

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