International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 16; Issue: 6; June 2026
Website: www.ijhsr.org
ISSN: 2249-9571

Original Research Article

Effect of Kinesiology Taping and Active Stretching Among College Students with Rounded Shoulder and Its Impact on Craniovertebral Angle - A Comparative Study

Ashraf.Y[1], Aswin Siva Kumar[2], Jeseema Begum.A[3], Sangeetha.M[3], Shanthini.P[3]

[1]PSG College of Physiotherapy, [2]Department of Physical Medicine & Rehabilitation - PSG Institute of Medical Sciences and Research, [3]Independent Researcher Coimbatore, India.

Corresponding Author: Aswin Siva Kumar

DOI: https://doi.org/10.52403/ijhsr.20260632

ABSTRACT

Background: Rounded Shoulder Posture (RSP), characterized by anterior acromial displacement and scapular protraction, is a common postural deviation among college students, largely attributed to sedentary habits and prolonged digital device use. This condition alters scapulothoracic kinematics, increases cervical loading, and contributes to musculoskeletal discomfort. Although Kinesio Taping (KT) and Active Stretching (AS) have been used individually to correct postural imbalances, limited evidence compares their combined effects.
Objective: To compare the effectiveness of Kinesio Taping combined with Active Stretching (KT + AS) versus Active Stretching (AS) on Pain intensity (NPRS - Numerical Pain Rating Scale), Craniovertebral Angle (CVA), and Forward Shoulder Angle (FSA) among college students with RSP.
Methods: A parallel-group randomized controlled trial included 70 college students (19–25 years) with rounded shoulder posture (FSA ≥ 52°). Participants were randomly assigned to the KT + AS or AS group and received 12 sessions over four weeks. Pain intensity (NPRS) and postural parameters (CVA and FSA) were assessed, with CVA and FSA measured using Kinovea photogrammetric analysis (version 0.8.15). Data were analyzed using paired and independent t-tests and Pearson's correlation. Statistical significance was set at $p < 0.05$.
Results: Seventy participants (mean age: 20.84 ± 0.95 years) completed the study. Significant within-group improvements were observed in NPRS, CVA and FSA following the intervention in both groups ($p < 0.001$). In the KT+AS group, FSA decreased from 55.68 ± 1.87° to 50.68 ± 3.26°, CVA increased from 50.92 ± 2.90° to 54.06 ± 4.51°, and NPRS scores decreased from 3.54 ± 1.19 to 2.84 ± 1.35. Similarly, in the AS group, FSA decreased from 51.40 ± 2.08° to 47.12 ± 3.31°, CVA increased from 51.86 ± 3.30° to 54.72 ± 4.62°, and NPRS scores decreased from 3.28 ± 1.47 to 2.62 ± 1.47. Between-group analysis revealed a significant difference in FSA change scores favoring the KT+AS group ($p < 0.05$), while no significant between-group differences were observed for CVA or NPRS.
Conclusion: Both interventions effectively improved posture and reduced pain in college students with RSP. The addition of KT enhanced shoulder alignment, highlighting the

importance of individualized, anthropometric-based rehabilitation strategies for postural correction.

Keywords: Rounded Shoulder Posture; Kinesio Taping; Active Stretching; Craniovertebral Angle; Forward Shoulder Angle; College Students

INTRODUCTION

Posture refers to the alignment of the body's segments relative to one another and to gravity, maintained through coordinated muscle activity to minimize stress on supporting structures and optimize balance and function.[1] According to Kendall, in an ideal lateral posture, the plumb line should pass slightly anterior to the lateral malleolus, slightly anterior to the midline of the knee joint, through the greater trochanter, midway through the trunk and lumbar vertebrae, through the acromion process of the shoulder joint, and finally through the lobe of the ear-indicating optimal alignment with minimal strain .[2] Deviations from this ideal alignment, termed abnormal postures, increase mechanical stress on the musculoskeletal system, leading to muscle imbalances, movement inefficiencies, joint degeneration, fatigue, pain, and reduced functional performance and quality of life.[2-4] Common postural deviations include rounded shoulders, forward head posture, increased thoracic kyphosis, increased lumbar lordosis, anterior pelvic tilt, swayback posture, and flat-back posture.[5,6] Rounded Shoulder Posture (RSP) is characterized by anterior displacement of the acromion relative to a vertical reference line, accompanied by scapular protraction and humeral internal rotation, and is often associated with altered length - tension relationships of the shoulder girdle muscles. Typically, this deviation results from muscular imbalances -tightness of the pectoralis major and minor, weakness of the middle and lower trapezius and rhomboids, and compensatory tightness in the upper trapezius, levator scapulae, and latissimus dorsi. [2,7] With increasingly sedentary lifestyles, prolonged screen time, and poor postural habits, RSP has become a prevalent concern among young adults, particularly college students. Studies report prevalence rates of 73–78% among individuals aged 18–25 years, underscoring this population's vulnerability.[8] Despite its high prevalence, limited research has specifically addressed RSP in college students, highlighting the need for targeted, effective intervention strategies.

The consequences of RSP extend beyond musculoskeletal discomfort, significantly affecting functional performance and quality of life. Individuals with RSP frequently demonstrate altered scapulohumeral rhythm, reduced shoulder range of motion, increased cervical spine loading, and glenohumeral joint compression, which may contribute to impingement syndromes, chronic pain, and postural instability. Furthermore, RSP can restrict thoracic expansion, impair respiratory efficiency, and induce muscular fatigue in the neck, shoulders, and upper back - negatively impacting daily activities and academic productivity. If left uncorrected, persistent RSP increases the risk of thoracic outlet syndrome, cervical radiculopathy, and rotator cuff pathology. [9-20] Therefore, implementing effective corrective interventions is essential to prevent long-term musculoskeletal complications.

Several approaches have been proposed to manage RSP, including postural education, ergonomic modification, manual therapy, strengthening exercises, stretching, and external supports. Among these, Kinesio Taping (KT) and Active Stretching (AS) have received increasing attention. KT is a non-invasive technique designed to enhance proprioception, facilitate scapular positioning, and promote postural realignment. The application of elastic adhesive tape provides sensory input that supports muscle activation and delivers tactile cues to maintain proper alignment.[21,22] By promoting scapular retraction and reducing strain on overactive anterior musculature, KT may improve postural awareness and shoulder alignment during daily activities.

Active stretching, by contrast, involves the voluntary contraction of antagonist muscles to lengthen tight musculature, particularly targeting the pectoralis major and minor, upper trapezius, levator scapulae, latissimus dorsi, and anterior deltoid. Regular stretching has been shown to restore optimal muscle length, improve scapular kinematics, and enhance overall posture.[23] While stretching alone can reduce muscle tightness and improve flexibility, KT may provide additional postural reinforcement through continuous external feedback, potentially augmenting the effects of stretching interventions.

Despite the documented benefits of KT and AS when applied independently, few studies have examined their combined effectiveness in correcting RSP - particularly within student populations, where practical and time-efficient interventions are desirable. Most existing research evaluates these techniques separately, and their potential synergistic effects on postural alignment and pain remain underexplored. Addressing this gap, the present study aims to compare the effectiveness of KT combined with AS (KT + AS) versus Active Stretching (AS) in improving pain intensity, craniovertebral angle (CVA), and forward shoulder angle (FSA) among college students with RSP.

To evaluate these effects, three outcome measures were selected: the Numeric Pain Rating Scale (NPRS) for quantifying pain intensity; the Craniovertebral Angle (CVA) for assessing forward head posture; and the Forward Shoulder Angle (FSA) for measuring shoulder alignment. Together, these parameters provide objective, quantitative data on postural correction and discomfort, facilitating a comprehensive assessment of the intervention's effectiveness.

The findings of this study are expected to contribute to the development of cost-effective, non-invasive postural correction strategies and to offer practical, evidence-based solutions for preventing and managing postural dysfunction among college students.

MATERIALS & METHODS

Study Design and Participant Allocation

A Parallel-group randomized controlled trial was implemented to examine the comparative effectiveness of Kinesio Taping (KT) combined with Active Stretching (AS) versus Active Stretching in the correction of Rounded Shoulder Posture (RSP) among college students. The study was conducted at PSG College of Physiotherapy and PSG College of Nursing, Coimbatore, India, between January and July 2019. Ethical approval for the study was obtained from the Institutional Human Ethics Committee (IHEC), PSG Institute of Medical Sciences and Research (PSG IMS&R), Coimbatore, Tamil Nadu, India (Approval Number - PSG/IHEC/2019/Appr/FB/004). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrolment. A total of 334 college students were screened for eligibility. Based on predefined inclusion and exclusion criteria, 70 participants presenting with RSP were deemed eligible and enrolled. Inclusion criteria were: (1) age 19–25 years; (2) RSP confirmed via plumb line assessment and Forward Shoulder Angle (FSA ≥ 52°) determined by Kinovea photogrammetric analysis (version 0.8.15); (3) Body Mass Index (BMI) between 18.5 and 29.9 kg/m²; and (4) shoulder or upper back pain ≥ 3/10 on the Numeric Pain Rating Scale (NPRS) at baseline. Exclusion criteria were: (1) unresolved upper extremity injury or surgery within the preceding six months; (2) current participation in shoulder or cervical spine rehabilitation; (3) structural scoliosis or excessive thoracic kyphosis; (4)

neurological, autoimmune, or systemic musculoskeletal disorders; (5) use of postural corrective devices (e.g., braces, taping) within the previous three months; and (6) ongoing use of analgesics or muscle relaxants.

70 participants were randomly assigned in a 1:1 ratio to one of two intervention groups using a simple randomization (lottery) method: Group A - KT + AS group and Group B - AS alone group, ensuring equal allocation (figure 1). Sample size was calculated using G*Power 3.1.9.4, with an effect size = 0.74, α = 0.05, and power = 0.95, accounting for a 10% attrition rate. Blinding was not implemented.

During the intervention period, three participants from the KT + AS group and one participant from the AS group discontinued due to various reasons. All randomized participants were included in the analysis following the intention-to-treat (ITT) principle, with missing post-intervention data handled using the Baseline Observation Carried Forward (BOCF) method.

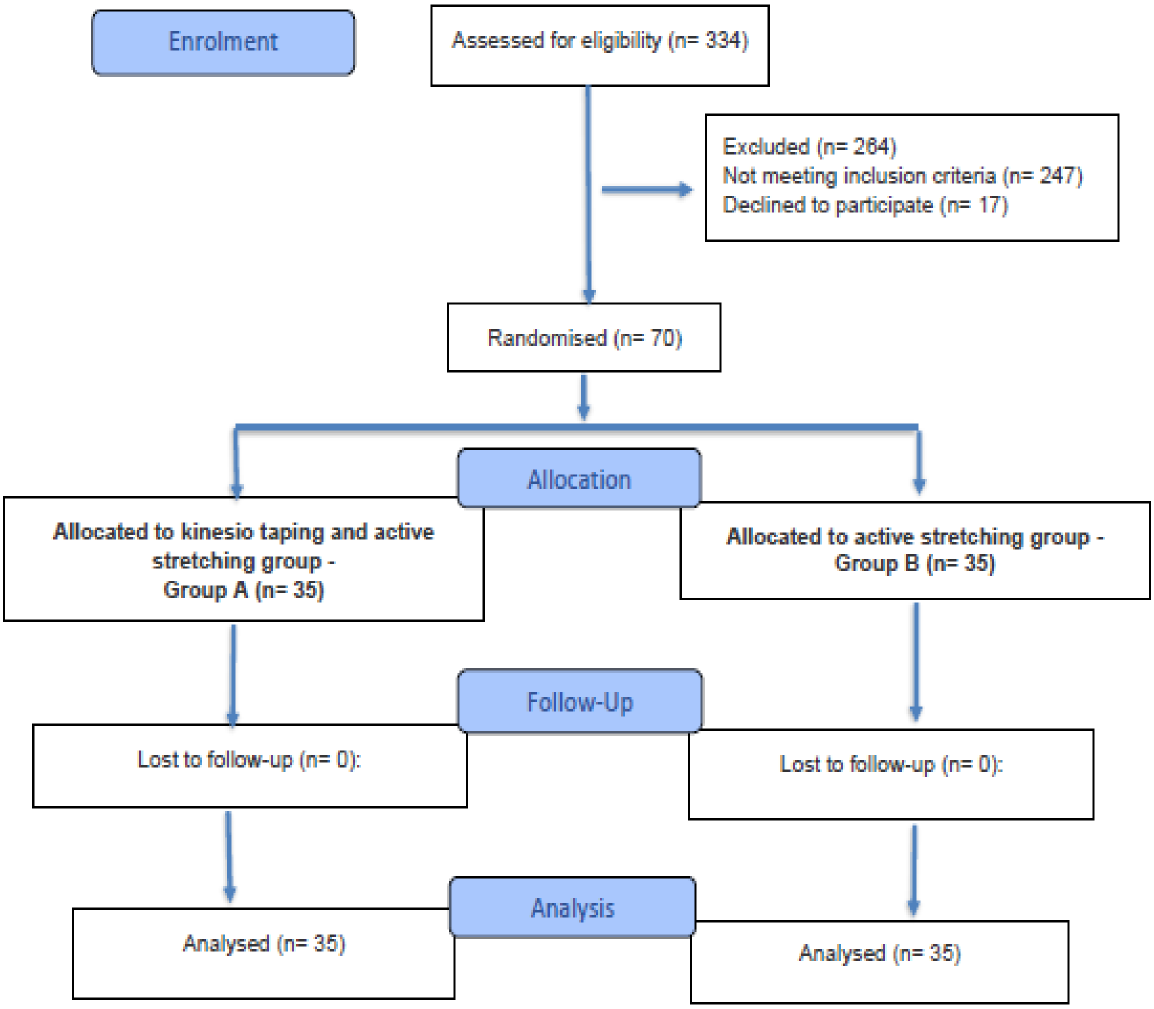

Figure 1. CONSORT Flowchart of Participant Screening, Allocation, and Analysis

Outcome Measures

Three primary outcome measures were employed: Numeric Pain Rating Scale (NPRS), Craniovertebral Angle (CVA), and Forward Shoulder Angle (FSA). These variables were selected for their established reliability, validity, and clinical relevance in postural assessment. Measurements were obtained pre-intervention and post-intervention (after four weeks, 12 sessions total).

1. Numeric Pain Rating Scale (NPRS)

The NPRS is a subjective pain assessment tool providing quantitative data on perceived pain intensity. Participants rated pain on an 11-point scale (0 = no pain, 10 = worst possible pain). The NPRS demonstrates excellent test-retest reliability (ICC = 0.95) and strong construct validity in musculoskeletal conditions, enabling quantitative evaluation of pain changes following intervention.[24]

2. Craniovertebral Angle (CVA)

CVA is an objective indicator of forward head posture, commonly associated with RSP. It is defined as the angle between a horizontal line through the spinous process of C7 and a line connecting C7 to the tragus of the ear. A smaller angle reflects greater forward head displacement. Measurements were obtained using Kinovea software (version 0.8.15), a validated digital photogrammetry tool with high intra- and inter-rater reliability (ICC = 0.88 - 0.98).[25]

3. Forward Shoulder Angle (FSA)

FSA quantifies the degree of anterior shoulder displacement, defined as the angle between a vertical line through C7 and a line connecting C7 to the acromion process. A larger FSA indicates more pronounced shoulder protraction. FSA measurements were captured using Kinovea software (version 0.8.15), demonstrating high inter-rater (ICC = 0.89) and test-retest reliability (ICC = 0.94).[22] This measure provided an objective assessment of shoulder alignment and postural correction.

Interventions

Interventions were conducted over four weeks, with three supervised sessions per week (approximately 45 minutes each) under the supervision of a licensed physiotherapist.

1. Kinesio Taping + Active Stretching Group

KT was applied to facilitate weak muscles, inhibit overactive muscles, and enhance proprioceptive feedback to promote postural awareness and scapular stability. Facilitation taping targeted the middle trapezius, lower trapezius, and rhomboids, while inhibition taping targeted the pectoralis major and minor. Y-strips were used for scapular stabilization and I-strips for pectoral inhibition, applied with 50-75% tension while participants maintained corrected posture. The tape remained in place for 3-5 days, and participants continued normal activities. [26-28]

Participants also performed a structured active stretching routine targeting tight anterior musculature, including the pectoralis major and minor, anterior deltoid, upper trapezius, levator scapulae, thoracic extensors and latissimus dorsi. Each stretch was held for 30 seconds, repeated three times with 15-second rest intervals. Participants were instructed to maintain controlled breathing, avoid compensatory movements, and record session adherence in self-reported exercise logs. [29-31]

2. Active Stretching Group

Participants performed the same active stretching protocol as described above, but without KT application. Periodic supervision ensured correct technique and adherence. Participants were encouraged to maintain optimal posture during daily activities and complete self-reported exercise logs.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 26.0. Data normality was assessed using the Kolmogorov–Smirnov test, with $p > 0.05$ indicating a normal distribution. Descriptive statistics were expressed as mean ± standard deviation (SD). Baseline (pre-test) and post-intervention between-group comparisons were performed using independent-samples t-tests. Within-group differences between pre- and post-intervention measurements were analyzed using paired-samples t-tests. Given that baseline Forward Shoulder Angle (FSA) values differed significantly between groups, additional between-group analyses were conducted using change scores (Δ = post-intervention − pre-intervention) to account for baseline differences. Mean change scores were calculated for all outcome measures, and between-group differences in these scores were evaluated using independent-samples t-tests. Pearson's correlation analysis was conducted using pooled baseline data from all participants (n = 70) to examine the relationships among body mass index (BMI), pain intensity (NPRS), Forward Shoulder Angle (FSA), and Craniovertebral Angle (CVA). Statistical significance was set at $p < 0.05$.

RESULT

Demographic Characteristics and Normality Testing

A total of 70 participants were analyzed, with 35 in each group (KT + AS & AS Group).

Normality testing using the Kolmogorov-Smirnov test confirmed that all demographic and outcome variables were normally distributed ($p > 0.05$), supporting the use of parametric analyses. **(Table 1)**

Table 1. Demographic Characteristics and Normality Testing of Study Participants (Mean ± SD)

Variables	KT + AS Group (n = 35)	AS Group (n = 35)	*p*-value
Age (years)	20.59 ± 0.92	21.10 ± 0.97	0.38
Height (cms)	161.91 ± 8.16	165.00 ± 8.80	0.32
Weight (kgs)	70.03 ± 1.48	71.90 ± 1.75	0.64
Body Mass Index (BMI, kg/m²)	26.65 ± 3.2	27.60 ± 3.7	0.30
Forward Shoulder Angle (FSA, °)	55.68 ± 1.87	51.40 ± 2.08	0.26
Craniovertebral Angle (CVA, °)	50.92 ± 2.90	51.86 ± 3.30	0.69
Numeric Pain Rating Scale (NPRS)	3.54 ± 1.19	3.28 ± 1.47	0.59

Note: *Data are presented as Mean ± Standard deviation (SD). The distribution of all variables was assessed using the Kolmogorov–Smirnov test, which confirmed normality (p > 0.05 for all variables).*

Within-Group Comparisons

Both intervention groups demonstrated significant pre-test to post-test improvements in all outcome measures (NPRS, CVA, FSA).

- KT + AS group: NPRS decreased from 3.54 ± 1.19 to 2.84 ± 1.35, CVA increased from 50.92 ± 2.90° to 54.06 ± 4.51°, and FSA decreased from 55.68 ± 1.87° to 50.68 ± 3.26° ($p < 0.001$).
- AS group: NPRS decreased from 3.28 ± 1.47 to 2.62 ± 1.47, CVA increased from 51.86 ± 3.30° to 54.72 ± 4.62°, and FSA decreased from 51.40 ± 2.08° to 47.12 ± 3.31° ($p < 0.001$).

These results indicate significant improvements in pain reduction and postural alignment within both groups. **(Table 2)**

Table 2. Within-Group Comparison of Outcome Measures (Mean ± SD)

Variables	KT + AS Group (n = 35)				AS Group (n = 35)			
	Pre-test	Post-test	Mean change scores	*p*-value	Pre-test	Post-test	Mean change scores	*p*-value
Forward Shoulder Angle (FSA, °)	55.68 ± 1.87	50.68 ± 3.26	5.0 ± 1.9	*p* < 0.001	51.40 ± 2.08	47.12 ± 3.31	4.28 ± 1.6	*p* < 0.001
Craniovertebral Angle (CVA, °)	50.92 ± 2.90	54.06 ± 4.51	3.14 ± 4.14	*p* < 0.001	51.86 ± 3.30	54.72 ± 4.62	2.86 ± 2.38	*p* < 0.001
Numeric Pain Rating Scale (NPRS)	3.54 ± 1.19	2.84 ± 1.35	0.70 ± 1.80	*p* < 0.001	3.28 ± 1.47	2.62 ± 1.47	0.66 ± 1.19	*p* < 0.001

Note: *Data are presented as Mean ± Standard deviation (SD). Within-group analysis was performed using the paired t-test. All outcome variables demonstrated statistically significant improvement from pre-test to post-test (p < 0.05) in both groups.*

Between-Group Comparisons

Between-group comparisons based on mean change scores (Δ = post-intervention − pre-intervention) revealed a significant difference in FSA improvement between the groups ($p = 0.007$), whereas no significant between-group differences were observed for CVA (p = 0.598) or NPRS (0.815) **(Table 3)**

The KT+AS group demonstrated a greater reduction in FSA (mean change: Δ = 5.00°) compared with the AS group (mean change: Δ = 4.28°). As baseline FSA values differed between groups, treatment effects were interpreted using change scores rather than post-intervention values alone. These findings suggest that the addition of Kinesio Taping to an active stretching program may provide additional benefits for improving forward shoulder alignment.

Table 3. Between-Group Comparison of Outcome Measures (Mean ± SD)

Variables	Pre Test (n = 35)			Post Test (n = 35)			Mean change scores (n = 35)		
	KT + AS Group	AS Group	*p*-value	KT + AS Group	AS Group	*p*-value	KT + AS Group	AS Group	*p*-value
FSA	55.68 ± 1.87	51.40 ± 2.08	*p* = 0.04	50.68 ± 3.26	47.12 ± 3.31	*p* = 0.03	5.0 ± 1.9	4.28 ± 1.6	*p* = 0.007
CVA	50.92 ± 2.90	51.86 ± 3.30	*p* = 0.61	54.06 ± 4.51	54.72 ± 4.62	*p* = 0.41	3.14 ± 4.14	2.86 ± 2.38	*p* = 0.598
NPRS	3.54 ± 1.19	3.28 ± 1.47	*p* = 0.45	2.84 ± 1.35	2.62 ± 1.47	*p* = 0.48	0.70 ± 1.80	0.66 ± 1.19	*p* = 0.815

Note: *Data are presented as Mean ± Standard deviation (SD). Between-group analysis was performed using the independent t-test. A statistically significant difference was observed only for the Forward Shoulder Angle (FSA) (p < 0.05). NPRS = Numeric Pain Rating Scale; FSA = Forward Shoulder Angle; CVA = Craniovertebral Angle*

Correlation Analysis

Pearson correlation analyses were performed using baseline (pre-intervention) measurements pooled across all participants (n = 70). Correlations were calculated between body mass index (BMI), pain intensity (NPRS), forward shoulder angle (FSA), and craniovertebral angle (CVA) values obtained prior to intervention.

Significant associations were observed among BMI, postural parameters, and pain intensity. BMI demonstrated a positive correlation with FSA (r = 0.642, p < 0.05) and NPRS (r = 0.584, p < 0.05), and a negative correlation with CVA (r = −0.438, p < 0.05). FSA was positively correlated with NPRS (r = 0.601, p < 0.05) and negatively correlated with CVA (r = −0.472, p < 0.05). Additionally, CVA showed a significant negative correlation with NPRS (r = −0.517, p < 0.05).

These findings suggest that higher BMI and greater forward shoulder posture are associated with increased pain intensity, whereas better craniovertebral alignment is associated with lower pain levels. **(Table 4)**

Table 4. Pearson Correlation Coefficients (r) Between BMI, Postural Parameters (FSA, CVA), and Pain (NPRS)

Variables Pairs	*r* - value	*p*-value
BMI ↔ FSA	0.642	*p* < 0.05
BMI ↔ CVA	−0.438	*p* < 0.05
BMI ↔ NPRS	0.584	*p* < 0.05
FSA ↔ CVA	−0.472	*p* < 0.05
FSA ↔ NPRS	0.601	*p* < 0.05
CVA ↔ NPRS	−0.517	*p* < 0.05

Note: *Correlation analysis was conducted using pooled baseline data from all participants (n = 70). BMI = body mass index; NPRS = Numeric Pain Rating Scale; FSA = Forward Shoulder Angle; CVA = Craniovertebral Angle. p < 0.05 indicates statistical significance.*

DISCUSSION

This study investigated the comparative effectiveness of Kinesio Taping combined with Active Stretching versus Active Stretching alone for managing Rounded Shoulder Posture (RSP) in college students. The findings provide valuable insights into both intervention strategies and their impact on pain and postural parameters, while revealing important relationships between BMI, pain perception, and postural alignment.

Our results demonstrated significant within-group improvements for both intervention approaches across all outcome measures - NPRS, CVA, and FSA. This aligns with existing literature supporting the effectiveness of active stretching protocols in addressing postural deviations. For instance, Kim et al., reported improvements in muscle length and postural alignment following regular stretching interventions targeting the anterior chest musculature. [30]

The significant pain reduction observed in both groups also supports the established relationship between improved postural alignment and decreased musculoskeletal discomfort, consistent with findings by Harman et al., who observed reduced cervical and scapular pain following forward head posture correction. [32]

Although the AS group exhibited a lower post-intervention FSA value, it also presented with a lower baseline FSA. Therefore, treatment effects were interpreted based on the magnitude of change from baseline rather than absolute post-intervention values. Between-group analysis of change scores demonstrated significantly greater improvement in FSA in the KT+AS group, which showed a mean reduction of 5.00° compared with 4.28° in the AS group. This finding suggests that the addition of Kinesio Taping to an active stretching program may provide additional benefits for improving shoulder alignment. The observed improvement may be attributed to the mechanical support and enhanced proprioceptive feedback provided by Kinesio Taping, which can facilitate more optimal scapular positioning and postural control. Similar improvements in shoulder positioning and scapular mechanics following Kinesio Taping have been reported by Dhein et al., who observed enhanced scapular kinematics in individuals with shoulder impingement.[33]

The lack of significant between-group differences for NPRS and CVA, despite greater mean improvements in the KT + AS group, should be noted. While Kinesio Taping appears to enhance the effects of stretching on shoulder alignment, its additional benefits for pain reduction and forward head posture may be modest in young adults with primarily postural RSP. This contrasts with Hwang-Bo et al., and Lee et al., who reported significant pain reduction with Kinesio Taping in patients with shoulder dysfunction, likely reflecting differences in study populations. [21,22]

A particularly novel finding of our study is the significant correlations between BMI, pain perception, and postural parameters. The positive correlation between BMI and NPRS suggests that higher body mass may increase biomechanical stress on the upper quadrant, exacerbating discomfort associated with postural deviations. Additionally, the negative correlation between BMI and CVA indicates that individuals with higher BMI tend to exhibit more pronounced forward head posture, while the positive correlation between BMI and FSA suggests greater severity of rounded shoulder posture in those with elevated BMI. These findings highlight the importance of considering anthropometric characteristics in clinical assessment, as BMI may modify treatment response.

We also observed interrelationships between postural parameters and pain perception. Specifically, CVA negatively correlated with NPRS, FSA positively correlated with NPRS, and CVA negatively correlated with FSA. These correlations provide empirical support for the biomechanical cascade described by Seidi et al., where forward head posture is associated with rounded shoulders, contributing to increased pain. [34]

This reinforces the need to address postural components collectively rather than in isolation and underscores that effective management of RSP should consider the interactions among posture, pain, and anthropometric factors. Griegel-Morris et al. also emphasized that postural correction requires integrated strategies targeting both muscular and neuromuscular components. [35]

The clinical implications of these findings extend beyond the comparative effectiveness of interventions. The selective benefit of combining Kinesio Taping with Active Stretching for FSA, coupled with the identified correlations, suggests that clinicians might adopt a more tailored, staged intervention strategy. For example, individuals with higher BMI and more severe FSA may benefit most from the addition of Kinesio Taping, whereas those with primary CVA deviations might require interventions specifically targeting cervical posture.

Several limitations should be noted. First, while significant correlations were observed, the cross-sectional nature of these analyses limits causal inference. Longitudinal studies tracking changes throughout intervention periods are needed to clarify directionality. Second, focusing solely on BMI does not account for body composition or regional mass distribution, which may have more specific effects on FSA, CVA, and Pain. Third, the four-week intervention period, while sufficient to demonstrate improvements, may not capture the full dynamics of postural adaptation. Fourth, although objective postural measurements were obtained using validated photogrammetric techniques, incorporating dynamic postural assessments and functional movement screens could enhance understanding of how static improvements translate to functional outcomes.

Future research should explore longer intervention periods with multiple assessment points to track temporal progression of postural changes. Incorporating three-dimensional motion analysis and electromyography would provide deeper insight into neuromuscular mechanisms. Additionally, examining stratified intervention approaches based on BMI and severity of postural deviations could inform personalized rehabilitation strategies. Investigating different age groups or clinical populations with established shoulder dysfunctions may further generalize these findings beyond healthy college students.

Overall, both interventions effectively improved postural parameters and reduced pain associated with Rounded Shoulder Posture (RSP), with Kinesio Taping providing additional benefits for shoulder alignment. The correlations among Body Mass Index (BMI), postural parameters, and pain intensity emphasize the importance of considering anthropometric factors in assessment and intervention planning. These findings enhance understanding of the biomechanical relationships underlying RSP and support the development of targeted, individualized rehabilitation strategies for college students with RSP.

CONCLUSION

Based on the study findings, Active Stretching (AS), either alone or combined with Kinesio Taping (KT), significantly improved postural alignment and reduced pain in college students with Rounded Shoulder Posture (RSP). The addition of KT resulted in greater improvements in shoulder alignment, as evidenced by larger reductions in Forward Shoulder Angle (FSA). Significant associations among Body Mass Index (BMI), postural parameters, and pain intensity further highlight the influence of anthropometric factors on postural deviations and treatment outcomes. These findings support the use of individualized rehabilitation strategies that consider body composition, with the combined application of AS and KT serving as an effective, non-invasive approach for improving shoulder alignment and musculoskeletal function in college students with RSP.

Declaration by Authors

Ethical Approval: Ethical approval was obtained from the Institutional Human Ethics Committee, PSG IMS & R (Approval Number - PSG/IHEC/2019/Appr/FB/004).

Acknowledgement: The Authors gratefully acknowledge the Institutional support and academic guidance received during the execution of this research. We further Thank the participants for their willingness and commitment to contribute to this study.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Carini F, Mazzola M, Fici C, Palmeri S, Messina M, Damiani P, Tomasello G. Posture and posturology, anatomical and physiological profiles: overview and current state of art. Acta Biomed. 2017 Apr 28;88(1):11-16. doi: 10.23750/abm. v88i1.5309.
2. Debra Coglianese, Muscles: Testing and Function with Posture and Pain, ed 5 (with Primal Anatomy CD-ROM), *Physical Therapy*, Volume 86, Issue 2, 1 February 2006, Pages 304–305, https://doi.org/10.1093/ptj/86.2.304.
3. Sahrmann SA. Diagnosis and Treatment of Movement Impairment Syndromes. St Louis (MO): Mosby; 2002.
4. Neumann DA. Kinesiology of the Musculoskeletal System: Foundations for Rehabilitation. 3rd ed. St. Louis (MO): Elsevier/Mosby; 2017.
5. Czaprowski D, Stolinski L, Tyrakowski M, Kozinoga M, Kotwicki T. Non-structural misalignments of body posture in the sagittal plane. Scoliosis Spinal Disord. 2018; 13:6. doi: 10.1186/s13013-018-0151-5.
6. Vakili L, Halabchi F, Mansournia MA, Khami MR, Irandoost S, Alizadeh Z. Prevalence of common postural disorders among academic dental staff. Asian J Sports Med. 2016;7(2): e29631. doi: 10.5812/asjsm.29631.
7. Page P. Shoulder muscle imbalance and subacromial impingement syndrome in overhead athletes. Int J Sports Phys Ther. 2011;6(1):51-58.
8. Kang KW, Jung SI, Lee DY, Kim K, Lee NK. Effect of sitting posture on respiratory function while using a smartphone. J Phys Ther Sci. 2016;28(5):1496-1498. doi: 10.1589/jpts.28.1496.
9. Lukasiewicz AC, McClure P, Michener L, Pratt N, Sennett B. Comparison of 3-dimensional scapular position and orientation between subjects with and without shoulder impingement. J Orthop Sports Phys Ther. 1999;29(10):574-583. doi: 10.2519/jospt.1999.29.10.574.
10. Ludewig PM, Cook TM. Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. Phys Ther. 2000;80(3):276-291. doi: 10.1093/ptj/80.3.276.
11. Scibek JS, Carcia CR. Assessment of scapulohumeral rhythm for scapular plane shoulder elevation using a modified digital inclinometer. World J Orthop. 2012;3(6):87-94. doi: 10.5312/wjo. v3.i6.87.
12. Guduru RKR, Domeika A, Domeikiene A. Effect of rounded and hunched shoulder postures on myotonometric measurements of upper body muscles in sedentary workers. Appl Sci. 2022;12(7):3333. doi: 10.3390/app12073333.
13. Varacallo MA, El Bitar Y, Sina RE, et al. Rotator Cuff Syndrome. [Updated 2024 Mar 5]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK531506/
14. Singla D, Veqar Z. Association between forward head, rounded shoulders, and increased thoracic kyphosis: a review of the literature. J Chiropr Med. 2017;16(3):220-229. doi: 10.1016/j.jcm.2017.03.004.
15. Chu ECP, Lo FS, Bhaumik A. Plausible impact of forward head posture on upper cervical spine stability. J Fam Med Prim Care. 2020;9(6):2517-2520. doi: 10.4103/jfmpc.jfmpc_95_20.
16. Koseki T, Kakizaki F, Hayashi S, Nishida N, Itoh M. Effect of forward head posture on thoracic shape and respiratory function.

J Phys Ther Sci. 2019;31(1):63-68. doi: 10.1589/jpts.31.63.
17. 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. Curr Rev Musculoskelet Med. 2019;12(4):562-577. doi: 10.1007/s12178-019-09594-y.
18. Lauman ST, Anderson DI. A neuromuscular integration approach to the rehabilitation of forward head and rounded shoulder posture: systematic review of literature. J Phys Med Rehabil. 2021;3(2):61-72. doi: 10.33696/rehabilitation.3.021.
19. Jones MR, Prabhakar A, Viswanath O, Urits I, Green JB, Kendrick JB, et al. Thoracic outlet syndrome: a comprehensive review of pathophysiology, diagnosis, and treatment. Pain Ther. 2019;8(1):5-18. doi: 10.1007/s40122-019-0124-2.
20. Levine NA, Rigby BR. Thoracic outlet syndrome: biomechanical and exercise considerations. Healthcare. 2018;6(2):68. doi: 10.3390/healthcare6020068.
21. Hwang-Bo G, Lee JH, Kim H. Efficacy of kinesiology taping for recovery of dominant upper-back pain in a female sedentary worker having rounded shoulder posture. Technol Health Care. 2013;21(6):607-612. doi: 10.3233/THC-130753.
22. Lee DY, Nam CW, Sung YB, Kim K, Lee HY. Changes in rounded shoulder posture and forward head posture according to exercise methods. J Phys Ther Sci. 2017;29(10):1824-1827. doi: 10.1589/jpts.29.1824.
23. Umehara J, Nakamura M, Nishishita S, Tanaka H, Kusano K, Ichihashi N. Scapular kinematic alterations during arm elevation with decrease in pectoralis minor stiffness after stretching in healthy individuals. J Shoulder Elbow Surg. 2018;27(2):1214-1220. doi: 10.1016/j.jse.2018.02.037.
24. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NPRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). Arthritis Care Res (Hoboken). 2011;63(Suppl 11): S240-S252. doi: 10.1002/acr.20543.
25. Singla D, Veqar Z, Hussain ME. Photogrammetric assessment of upper body posture using postural angles: a literature review. J Chiropr Med. 2017;16(2):131-138. doi: 10.1016/j.jcm.2017.01.005.
26. Kase, K., Wallis, J. and Kase, T. (2003) Clinical Therapeutic Applications of the Kinesio Taping® Method. 2nd Edition, Kinesio Taping Association, Dallas, 12; 2003.
27. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of Kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. J Orthop Sports Phys Ther. 2008;38(7):389-395. doi: 10.2519/jospt.2008.2791.
28. Hsu YH, Chen WY, Lin HC, Wang WT, Shih YF. The effects of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome. J Electromyogr Kinesiol. 2009;19(6):1092-1099. doi: 10.1016/j.jelekin.2008.11.003.
29. Kim EK, Kim JS. Correlation between rounded shoulder posture, neck disability indices, and degree of forward head posture. J Phys Ther Sci. 2016;28(10):2929-2932. doi: 10.1589/jpts.28.2929.
30. Kim MK, Lee JC, Yoo KT. The effects of shoulder stabilization exercises and pectoralis minor stretching on balance and maximal shoulder muscle strength of healthy young adults with round shoulder posture. J Phys Ther Sci. 2018;30(3):373-380. doi: 10.1589/jpts.30.373.
31. Page P. Current concepts in muscle stretching for exercise and rehabilitation. Int J Sports Phys Ther. 2012;7(1):109-119.
32. Harman K, Hubley-Kozey CL, Butler H. Effectiveness of an exercise program to

improve forward head posture in normal adults: a randomized, controlled 10-week trial. J Man Manipulative Ther. 2005;13(3):163-176. doi: 10.1179/106698105790824888.

33. Dhein W, Wagner Neto ES, Miranda IF, Pinto AB, Moraes LR, Loss JF. Effects of Kinesio Taping on scapular kinematics and electromyographic activity in subjects with shoulder impingement syndrome. J Bodyw Mov Ther. 2020;24(2):109-117. doi: 10.1016/j.jbmt.2019.10.007.
34. Seidi F, Bayattork M, Minoonejad H, Andersen LL, Page P. Comprehensive corrective exercise program improves alignment, muscle activation and movement pattern of men with upper crossed syndrome: randomized controlled trial. Sci Rep. 2020 Nov 26;10(1):20688. doi: 10.1038/s41598-020-77571-4.
35. Griegel-Morris P, Larson K, Mueller-Klaus K, Oatis CA. Incidence of common postural abnormalities in the cervical, shoulder, and thoracic regions and their association with pain in two age groups of healthy subjects. Phys Ther. 1992; 72(6):425-431. doi: 10.1093/ptj/72.6.425.

How to cite this article: Ashraf. Y, Aswin Siva Kumar, Jeseema Begum. A, Sangeetha. M, Shanthini. P. Effect of kinesiology taping and active stretching among college students with rounded shoulder and its impact on craniovertebral angle - a comparative study. *Int J Health Sci Res.* 2026; 16(6):291-302. DOI: *https://doi.org/10.52403/ijhsr.20260632*

******