ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 10 | October - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EFFECT OF TRUNK STABILIZATION EXERCISES AND POSTURAL CORRECTION ON MUSCLE ENDURANCE AND SITTING POSTURE IN STUDENT POPULATION

Physiotherapy

C. Venkata Ramesh MPT(Orthopaedics), College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupati 517501, Andhra Pradesh, India.

Dr. K. Senthil Kumar MPT(Orthopaedics), Ph.D., Assistant professor, College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupati 517501, Andhra Pradesh, India.

Dr S. Raghava Krishna MPT(Orthopaedics), Ph.D., Faculty, College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupati 517501, Andhra Pradesh, India.

Dr. C. Shanthi MPT(Orthopaedics), Ph.D., Assistant Professor, College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupati 517501, Andhra Pradesh, India.

Dr. K. Madhavi MPT (Cardiovascular & Pulmonary), College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences, Tirupati 517501, Andhra Pradesh, India

ABSTRACT

Background: Poor posture and reduced trunk muscle endurance are common among students, particularly those who ride scooters regularly. Prolonged sitting and poor ergonomic practices contribute to musculoskeletal discomfort, especially lower back pain. Trunk stabilization and postural correction exercises have shown potential in enhancing core strength and improving sitting posture. **Objective:** To evaluate the effect of trunk stabilization exercises and postural correction on muscle endurance and sitting posture in the student population. **Methodology:** A single-group, pre-post interventional study was conducted over four weeks with 40 participants aged 18–25 years. Participants underwent trunk stabilization exercises and postural correction sessions three times per week. Postural assessments were carried out using the APECS mobile app, while muscle endurance was measured via the Bourbon Trunk Muscle Endurance Test, which included plank, side plank, and back extension evaluations. **Results:** after the data analysis the results revealed significant improvement ($p<0.05$) in neck posture, trunk muscle endurance. **Conclusion:** trunk stabilization exercises posture correction exercises like stretching's and strengthening are more effective in improving neck posture, and trunk muscle endurance.

KEYWORDS

postural correction, APECS app, Muscle endurance, trunk stabilization exercises.

INTRODUCTION

Posture is the alignment of the body in relation to gravity, maintained through coordinated action of muscles, bones, and joints. Good posture reduces strain on the musculoskeletal system, while poor posture contributes to discomfort and long-term health problems. School-aged children are particularly vulnerable due to factors like heavy school bags, prolonged sitting, and poor ergonomic habits, with studies showing that nearly 65% display postural irregularities. Posture can be classified into ideal (neutral) posture, where the head, shoulders, spine, hips, knees, and ankles are properly aligned, and abnormal types such as kyphosis, lordosis, scoliosis, forward head posture, and flat back. Cervical posture is especially important, as the cervical spine supports the head's weight and allows various movements. Ideally, the cervical spine has a natural inward curve with the head balanced over the shoulders, but conditions like forward head posture (FHP) place excessive stress on the neck and upper back. Misalignments may result from poor ergonomics, sedentary lifestyle, muscle imbalance heavy loads, or even psychological factors like stress and low self-esteem. Poor posture often presents with visible imbalances such as rounded shoulders, protruding head, or asymmetrical hips, along with discomfort, stiffness, and reduced flexibility. Over time, it may cause headaches, breathing issues, or impaired coordination and balance. Posture assessment involves visual inspection, simple tools like plumb lines and posture grids, or advanced techniques such as digital apps, X-rays, or MRI scans.

Physiotherapy remains the main corrective approach, using stretching and strengthening routines to restore balance, supported by ergonomic training and sometimes taping or bracing. The craniovertebral angle (CVA) is a common measure of FHP, with smaller angles (<50°) linked to neck and shoulder discomfort.

Rehabilitation often emphasizes trunk stabilization and muscle endurance exercises, such as planks, bridges, bird-dog, cycling, or resistance band routines, which enhance core stability and support proper alignment. In addition, digital tools like the Advanced Posture Evaluation and Correction System (APECS) provide reliable smartphone-based assessments, detailed reports, and corrective exercise guidance, making posture evaluation more accessible and effective.

MATERIALS:

Materials used for this study Android Mobile Posture Evaluation Mobile app APECS (AI), Marker for mark the bony land marks, Couch, Stop watch, Exercise mat.

METHODS:

This study was conducted at SVIMS college of physiotherapy, Tirupathi, over 6 months of period. The participants were selected through convenient sampling method and taken as single group. The study duration was four weeks.

Inclusion Criteria And Exclusion Crietria:

The study participants will be male and female students aged between 18 and 25 years, who ride a Scooty for less than 20 km per day, and will undergo a static postural evaluation conducted by a physiotherapist.

Participants with any past or current major musculoskeletal injuries, spinal pathologies, neurological conditions, tumours, or a history of spinal deformities will be excluded.

Treatment Procedure:

A total number of 40students who met the inclusion and exclusion criteria were recruited for the study. The following pre test data were recorded: trunk muscle endurance (plank test, side plank and superman test) and craniovertebral angle. Subjects were instructed to perform one practice trail that last for few seconds to confirm correct positioning and ten one set trail was recorded per position where the maximum time {seconds} subjects could maintain a static position was to be measured. The therapist was used the commands start and stop to initiate and conclude the test while an assistant therapist record the time using stopwatch.

The trunk stabilization and postural correction program was designed to improve core stability, strength, and flexibility. Participants performed 12 sessions over four weeks, three times a week on alternate days, with both static (30-second holds) and dynamic (10 repetitions) exercises, each done three times with rest intervals.

Strengthening focused on muscles like the deep neck flexors, trapezius, serratus anterior, rhomboids, and rotator cuff using exercises

such as chin tucks, Y-to-I movements, prone horizontal abduction, and side-lying external rotation. Stretching targeted tight muscles including the pectoralis minor, sternocleidomastoid, and levator scapulae.

The program was progressive: Week 1 emphasized learning proper form with light work, Week 2 increased sets and endurance, Week 3 added resistance and longer stretches, and Week 4 integrated strength and flexibility with moderate resistance and longer hold times. This gradual progression helped improve posture, muscle balance, and overall trunk stability.

OUTCOME MEASURES:

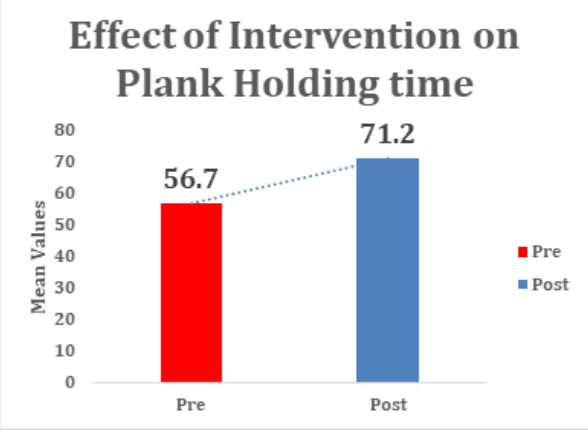
- The outcome measures include the Mobile Apecs App to evaluate posture.
- The Bourbon Trunk Muscle Test to assess trunk muscle endurance, which consists of the Prone Bridge (plank test), Side Bridge, and Back Extension (superman test).

RESULTS:

The data were entered into the software and analysed using SPSS version 25.0. A paired t-test was conducted to examine the pre- and post-test values of the subjects, with a p-value of < 0.01 considered statistically significant."

Table: 1- Shows Pre And Post Comparison Within Group Of Plank Test (Data Is Normally Distributed, Paired T Test Was Done

OUTCOME	Pre Mean ± SD	Post Mean ±SD	Mean Differnce	T - Value	P-value
Plank test	56.7± 1.38	71.2± 1.03	14.5	14.99	0.00

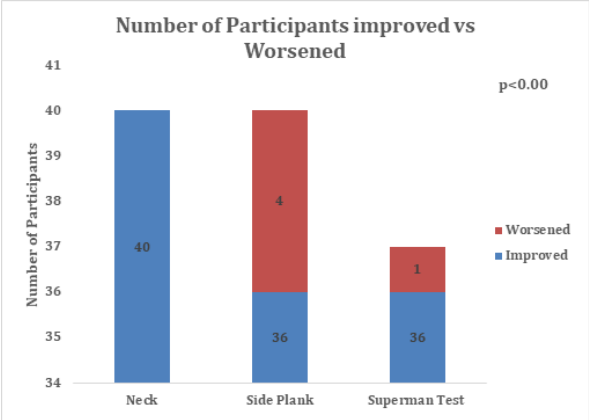


Graph-1 - Pre And Post Comparison Within Group Of Plank Test

"In the Plank Test, participants' average holding time improved from 56.7 seconds before the intervention to 71.2 seconds after the intervention, showing a mean improvement of 14.5 seconds. A paired t-test confirmed this difference was statistically significant (t = 14.99, p = 0.00), indicating that the intervention had a strong positive effect."

Table 2: Shows Pre And Post Comparison Within Group Of Neck Posture, Side Plank Test And Superman Test (Data Is Not Normally Distributed, Wilicoxin Signed Test Was Done

VARIABLE	IMPROVED (POSITIVE RANKS)	WORSENED (NEATIVE RANKS)	Z VALUE	P-VALUE
Neck posture test (pre vs post)	40 (mean - 20.50)	0 (mean - 0.00)	5.524	0.00
Side plank test (pre vs post)	36 (mean - 21.53)	4 (mean - 11.25)	4.97	0.00
Superman test (pre vs post)	36 (mean - 19.15)	1 (mean -13.5)	5.16	0.00

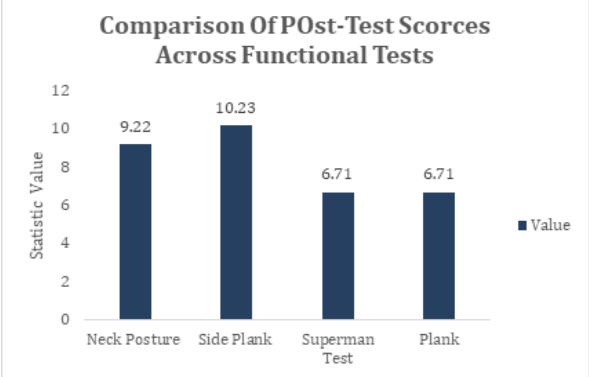


Graph -2- Pre And Post Comparison Within Group Of Neck Posture, Side Plank Test And Superman Test

Since the data was not normally distributed, the Wilcoxon signed-rank test was used for the Neck Posture Test, Side Plank Test, and Superman Test. In the Neck Posture Test, all 40 participants showed improvement after the intervention (Z = 5.524, p = 0.00). In the Side Plank Test, 36 participants improved while 4 worsened (Z = 4.97, p = 0.00). In the Superman Test, 36 participants improved and only 1 worsened (Z = 5.16, p = 0.00). All three tests demonstrated statistically significant positive changes, indicating that the intervention effectively improved posture and strength."

Table 3: - Shows Comparison Between Post Data Of Neck Posture, Side Plank Superman, And Plank Test.

VARIABLE	STASTICAL TEST	P-VALUE
Neck posture test	9.22 (chi square value)	0.026
Side plank test	10.23 (chi square value)	0.017
Superman test	6.71 (F-value of Anova)	0.001
Plank test	6.71 (F-value of Anova)	0.001



Graph-3 Comparison Between Post Data Of Neck Posture, Side Plank Superman, And Plank Test.

The Neck Posture Test showed a significant difference between groups (Chi-square = 9.22, p = 0.026). The Side Plank Test also demonstrated a significant difference (Chi-square = 10.23, p = 0.017). For both the Superman Test and the Plank Test, ANOVA results were highly significant (F = 6.71, p = 0.001). These findings indicate that there were significant differences between the groups in all post-test scores, suggesting that the intervention had a strong positive effect."

DISCUSSION:

Many students experience poor posture and decreased muscle endurance due to a sedentary lifestyle, prolonged classroom sitting, frequent use of mobile phones, and improper posture while riding scooters. Various exercises can help correct posture and boost muscular endurance. This study aimed to assess trunk muscle endurance and craniovertebral angle using the advanced APECS app, which offers precise posture analysis. Students participated in trunk stabilization exercises designed to improve core strength and endurance, and their progress was objectively tracked using this technology. The study focused on the impact of combining trunk stabilization exercises with posture correction in individuals who

regularly commute by scooter. A total of 40 male participants, selected based on specific criteria, formed a single group. Only males who rode a scooter daily for distances under 20 km were included. Over four weeks, participants completed three exercise sessions per week. Before and after the intervention, posture and trunk endurance were assessed using the APECS app and the bourbon trunk muscle endurance test. The post-intervention results showed statistically significant improvements ($p < 0.01$) in both posture and endurance scores. These outcomes suggest that the combined intervention effectively enhanced trunk muscle endurance and sitting posture, as measured by the bourbon test and APECS app.

CONCLUSION:

The present study concluded that trunk stabilization exercises combined with neck muscle stretching are effective in improving the craniovertebral angle (CVA) and muscle endurance in students who ride a scooter daily. By specifically targeting the lumbar extensors and cervical muscles, these exercises serve as a valuable component of rehabilitation programs aimed at enhancing posture and core stability.

LIMITATIONS:

- It was a short duration study
- Longer follow up periods are needed to confirm the effectiveness of these exercises in managing trunk muscle endurance and cranio vertebral angle

RECOMMENDATIONS:

- Furter studies with larger sample size
- The future is recommended for more than 4 weeks of duration
- The study can also be conducted on various profession's

REFERENCES:

1. Carini, F.; Mazzola, M.; Fici, C.; Palmeri, S.; Messina, M.; Damiani, P.; Tomasello, G. Posture and post urology, anatomical and physiological profiles: Overview and current state of art. Acta Biomed. 2017, 88, 11–16. [CrossRef]
2. Rodrigues, M.S.; Leite, R.D.V.; Lelis, C.M.; Chaves, T.C. Differences in ergonomic and workstation factors between computer office workers with and without reported musculoskeletal pain. Work 2017, 57, 563–572. [CrossRef]
3. Harvey, R.H.; Peper, E.; Mason, L.; Joy, M. Effect of Posture Feedback Training on Health. Appl. Psychophysiol. Biofeedback 2020, 45, 59–65. [CrossRef]
4. Hopkins, B.B.; Vehrs, P.R.; Fellingham, G.W.; George, J.D.; Hager, R.; Ridge, S.T. Validity and Reliability of Standing Posture Measurements Using a Mobile Application. J. Manip. Physiol. Ther. 2019, 42, 132–140. [CrossRef]
5. Fortin, C.; Feldman, D.E.; Cheriet, F.; Labelle, H. Clinical methods for quantifying body segment posture: A literature review. Disabil. Rehabil. 2011, 33, 367–383. [CrossRef]
6. Roggio, F.; Ravalli, S.; Maugeri, G.; Bianco, A.; Palma, A.; Di Rosa, M.; Musumeci, G. Technological advancements in the analysis of human motion and posture management through digital devices. World J. Orthop. 2021, 12, 467–484. [CrossRef]
7. Betsch, M.; Wild, M.; Jungbluth, P.; Hakimi, M.; Windolf, J.; Haex, B.; Horstmann, T.; Rapp. Reliability and validity of 4D rasterstereography under dynamic conditions. Comput. Biol. Med. 2011, 41, 308–312. [CrossRef]
8. Molinaro, L.; Russo, L.; Cubelli, F.; Taborri, J.; Rossi, S. Reliability analysis of an innovative technology for the assessment of spinal abnormalities. In Proceedings of the 2022 IEEE International Symposium on Medical Measurements and Applications (MeMeA), Messina, Italy, 22–24 June 2022; pp. 1–6.
9. Paloschi, D.; Bravi, M.; Schena, E.; Miccinilli, S.; Morrone, M.; Sterzi, S.; Sacco mandi, P.; Massaroni, C. Validation and Assessment of a Posture Measurement System with Magneto- Inertial Measurement Units. Sensors 2021, 21, 6610. [CrossRef]
10. Leirós-Rodríguez, R.; Romo-Pérez, V.; García-Soid an, J.L.; Soto-Rodríguez, A. Identification of Body Balance Deterioration of Gait in Women Using Accelerometers. Sustainability 2020, 12, 1222. [CrossRef]
11. Tyson, S.F.; DeSouza, L.H. A clinical model for the assessment of posture and balance in people with stroke. Disabil. Rehabil. 2003, 25, 120–126. [CrossRef] [PubMed]
12. Youdas, J.W.; Carey, J.R.; Garrett, T.R. Reliability of measurements of cervical spine range of motion–comparison of three methods. Phys. Ther. 1991, 71, 98–104; discussion 105–106. [CrossRef] [PubMed]
13. Timurta¸s, E.; Avcı, E.E.; Mate, K.; Karabacak, N.; Polat, M.G.; Demirbüken, ˙I. A mobile application tool for standing posture analysis: Development, validity, and reliability. Ir. J. Med. Sci. 2021, 191, 2123–2131. [CrossRef]
14. Özyürek, S., Bayraktar, D., & Genç, A. (2018). Are the alterations in body posture related to decreased trunk muscle endurance in healthy young adults? Journal of Back and Musculoskeletal Rehabilitation, 31(3), 431–436.
15 Candelier, et al. (in press, 2025) Effect of Adding Global Postural Reeducation to Kendall Exercises on Craniovertebral Angle and Cervical Mobility