Effect of Forward Head Posture on Stork Balance Test in College Going Students - An Observational Study

Khushi Makwana[1], Darshan Parmar[2]

[1]BPT Student, KD Institute of Physiotherapy,
[2]PhD. Scholar (Gujarat University), Assistant Professor, Shree Swaminarayan Physiotherapy College, Swaminarayan University.

Corresponding Author: Khushi Makwana

ABSTRACT

Background: Forward Head Posture (FHP) is a common postural issue among college-going students due to their lifestyles. Poor cervical alignment can affect postural stability and neuromuscular control, potentially impacting balance. This study aims to examine the effect of FHP on balance performance using the Stork Balance Test.

Method: 40 participants were divided into two groups: Group A (FHP group) and Group B (Control group), based on their Craniovertebral Angle (CVA). Participants with a CVA of < 52° were assigned to Group A, while those with a CVA > 52° were placed in Group B. Each group received 20 participants. Balance was then assessed in both groups using the Stork Balance Test. The duration of three attempts was recorded for each participant and later averaged for analysis.

Result: A paired t-test revealed a highly significant difference between the groups (p < 0.05). Comparison of mean values showed that young adults with FHP had significantly poorer balance than those with normal posture.

Conclusion: The study concluded that FHP affects balance in college-going students, emphasizing the need for postural awareness and corrective exercises to improve stability and prevent long-term musculoskeletal issues.

Keywords: Forward Head Posture, Balance, Postural Stability, Craniovertebral Angle

INTRODUCTION

College students today spend long hours attending lectures, studying, and engaging with digital devices, all activities that often require prolonged sitting. These academic and lifestyle demand frequently encourage poor postural habits, contributing to the development of Forward Head Posture (FHP). FHP is characterized by the anterior displacement of the head relative to the shoulders, which increases mechanical stress on the cervical spine, upper back, and surrounding musculature. As the popularity of laptops, smartphones, and online learning environments continues to grow, the prevalence of FHP among young adults has also risen significantly. Prolonged screen exposure, inadequate ergonomic setups in dorms or libraries, and sedentary study routines further amplify this problem. (1)

When the head shifts forward from its optimal alignment, the body's center of gravity (COG) moves anteriorly, compelling compensatory changes in spinal and pelvic alignment. These biomechanical

adjustments can impair postural stability and make balance maintenance more challenging (1,2). Under normal conditions, the COG is located near the pelvis, just anterior to the sacrum; however, deviations such as FHP disrupt this balance and may negatively influence postural control mechanisms. (3,4,5)

The Stork Balance Test is a widely used clinical tool for evaluating static balance and postural steadiness. It requires an individual to stand on the toes of one leg while the examiner measures the duration the position can be maintained. Factors such as postural alignment, neuromuscular coordination, and proprioception play a key role in performance on this test. Previous studies suggest that altered cervical posture may influence balance by affecting sensory input and motor responses involved in maintaining stability (1,2,3).

College students face increasing academic stress and often spend extended hours in environments lacking proper ergonomic support. Over time, these habits may contribute not only to FHP but also to chronic discomfort, muscular imbalance, and long-term spinal issues. Despite the growing concern about postural problems in this age group, limited research has explored the direct influence of FHP on balance performance, particularly using the Stork Balance Test. (6,7,8,9,10)

Therefore, this study aims to examine the effect of Forward Head Posture on balance performance in college students using the Stork Balance Test. The objective is to determine whether individuals with FHP exhibit altered balance compared to those with normal cervical alignment. The need for this study arises from the increasing prevalence of FHP among college-going students and the lack of focused research assessing its implications on balance and stability using standardized testing procedures.

MATERIALS & METHODS

Research Design	Observational Study
Sample Design	Convenient Sampling
Study Population	College going Students
Sample Size	40
Study Duration	3 Months

This observational study was carried out on forty college-going students who volunteered to participate. Before enrolling them, each participant underwent a brief screening process to ensure they were suitable for the study. The purpose and procedures were explained clearly, and written informed consent was obtained from all participants.

Inclusion Criteria
- College-going students aged between 18–25 years
- Individuals willing to participate and provide informed consent
- Participants able to perform balance tests without assistance

Exclusion Criteria
- History of moderate to severe scoliosis
- Any diagnosed neuromuscular disorder
- Recent fractures or musculoskeletal injuries affecting posture or balance
- Individuals with vestibular problems or balance-related disorders

Assessment of Forward Head Posture
Forward Head Posture was evaluated using the Craniovertebral Angle (CVA), which is a widely accepted method for assessing cervical alignment. Lateral photographs were taken while participants stood in a relaxed and natural posture. To maintain consistency for every participant, the camera was set at shoulder height.

The tragus of the ear and the C7 spinous process were marked, and a small plastic pointer was placed over C7 to enhance visibility in the photograph. The CVA was defined as the angle formed between the line connecting the tragus to C7 and a horizontal line passing through C7. All

photographs were later analyzed using Kinovea software to obtain accurate measurements.

Based on the CVA readings, participants were divided into two groups:

- FHP Group: CVA < 52°
- Control Group: CVA ≥ 52°

Each group consisted of 20 participants.

Stork Balance Test

Balance performance was assessed using the Stork Balance Test. Participants were first shown how to perform the test and then asked to stand barefoot on their dominant leg. They were instructed to place both hands on their hips and raise the heel of the stance leg while lifting the opposite foot off the ground. (4)

Timing began as soon as the participant held the correct position. The test ended if the hands came off the hips, if the stance foot moved, or if the lifted foot touched the ground. Each participant performed three trials, and the average duration was used as their final balance score.

STATISTICAL ANALYSIS

A skewness test was performed to determine whether the data followed a normal distribution. A paired t-test was then used to compare the Stork Test duration between the two groups. All statistical analyses were conducted using SPSS version 23.0 and a p-value of <0.05 was considered statistically significant.

RESULT

A total of 40 participants were included in the study, with 20 in the Forward Head Posture group (Group 1) and 20 in the Control group (Group 2). A skewness test was conducted to check the normality of the data. The skewness values for Group 1 (0.007) and Group 2 (0.09) indicated that the dataset was normally distributed, allowing the use of parametric tests.

Baseline Characteristics

The baseline characteristics of both groups are summarized in Table 1. The two groups were comparable in terms of age and BMI, indicating that both groups had similar demographic profiles. However, a significant difference was observed in the Craniovertebral Angle (CVA). Participants in the FHP group showed a markedly lower CVA (48.2 ± 4.50) compared to the control group (57.49±5.54), confirming the presence of forward head posture in Group 1.

Table 1: Baseline Characteristics of Participants

Variable	Group 1 (FHP)	Group 2 (Control)
Age (years)	19.64	19.72
BMI (kg/m²)	21.15	20.64
CVA (degrees)	48.2 ± 4.50	57.49 ± 5.54

Stork Balance Test Performance

The Stork Test duration, which reflects static balance ability, was significantly lower in the FHP group. Group 1 demonstrated a mean duration of 2.141 ± 0.694 seconds, whereas Group 2 maintained the position for 3.507 ± 1.058 seconds on average. This difference is presented in Table 2.

A paired t-test was performed to compare the balance performance between the two groups. The analysis revealed a mean difference of –1.365 seconds with a standard deviation of 1.228, and a t-value of –4.973. The p-value was 0.001, indicating a highly significant difference between the groups.

Table 2: Comparison of Stork Test Duration Between Groups

Measure	Group 1 (FHP)	Group 2 (Control)	Mean Difference	p-value
Stork Test Duration (seconds)	2.141 ± 0.694	3.507 ± 1.058	–1.365	**0.001**

DISCUSSION

The findings of the present study show a clear and significant impact of Forward Head Posture (FHP) on postural balance, with individuals in the FHP group demonstrating noticeably reduced balance performance compared to those with normal cervical alignment. This suggests that altered head and neck posture can compromise the body's ability to maintain stability during static balance tasks such as the Stork Balance Test.

These results contrast with the findings of Bagas Anjasmara et al. (2023), who reported no significant association between FHP and dynamic balance among student athletes. One possible explanation for this discrepancy is the difference in the populations studied. Athletes often possess superior strength, coordination, and neuromuscular control due to regular training. These factors may compensate for postural deviations such as FHP, allowing them to maintain balance even when cervical alignment is altered. In contrast, the participants in the present study were college students who may not engage in high-intensity physical activity and therefore may be more affected by postural disturbances. (2)

On the other hand, the results of this study are consistent with those reported by Hamed Abbasi et al. (2022), who observed that individuals with FHP exhibited poorer dynamic postural stability compared to those without postural deviations. FHP alters the anatomical alignment of the head and neck and can influence sensory input, muscle activation patterns, and the overall efficiency of postural control systems. These factors may collectively weaken the individual's ability to maintain stability. (5)

The findings also align with the research conducted by Roma Raykar et al. (2018), which showed that forward head posture negatively affects both static and dynamic balance. The agreement between the current study and previous evidence strengthens the understanding that cervical alignment plays a crucial role in postural control. When the head moves forward, the body's center of gravity shifts anteriorly, leading to increased muscular effort and reduced balance capacity. (6)

Overall, the current study adds to the growing body of literature emphasizing that forward head posture is not merely a postural deviation but a factor capable of influencing fundamental aspects of physical function, including balance. Given the increasing prevalence of FHP among young adults, especially due to prolonged device use and sedentary habits, these findings highlight the importance of early posture correction and preventive strategies in this population.

CONCLUSION

This study shows that forward head posture (FHP) significantly reduces balance in college students. Promoting postural awareness and early corrective exercises can help improve stability and prevent future musculoskeletal problems. Early intervention for FHP is essential for maintaining good balance.

REFERENCES

1. Silva AG, Johnson MI. Does forward head posture affect postural control in human healthy volunteers? Gait Posture. 2013 Jun;38(2):352-3. doi: 10.1016/j.gaitpost.2012.11.014. Epub 2012 Dec 7. PMID: 23219786.
2. Anjasmara B, Arti W, Mulyadi SY. The Corellation of Forward Head Posture with Dynamic Balance to Student Members of the Umsida Sports UKM. ACTIVE: Journal of Physical Education, Sport, Health and Recreation. 2023 Mar 12;12(1):59-63.
3. Lee JH. Effects of forward head posture on static and dynamic balance control. J Phys Ther Sci. 2016 Jan;28(1):274-7. doi: 10.1589/jpts.28.274. Epub 2016 Jan 30. PMID: 26957773; PMCID: PMC4756019.

4. Lee JH. Effects of forward head posture on static and dynamic balance control. J Phys Ther Sci. 2016 Jan;28(1):274-7. doi: 10.1589/jpts.28.274. Epub 2016 Jan 30. PMID: 26957773; PMCID: PMC4756019.

5. Abbasi H, Alizadeh M H, Rajabi R, Mohammadi F. Comparison of Static and Dynamic Postural Stability Between Individuals with and Without Forward Head Posture. PTJ 2020; 10 (3) :127-134

6. Raykar R, Tajne K, Palekar T. Effect of Forward Head Posture on Static and Dynamic Balance; World Journal of Pharmaceutical Research; 2018;7(9):789-808

7. PARRACA, JOSE A., OLIVARES, PEDRO R., CARBONELL-BAEZA, ANA, APARICIO, VIRGINIA A., ADSUAR, JOSE C., GUSI, NARCÍS. Test-Retest Reliability of Biodex Balance SD On Physically Active Old People. Journal of Human Sport and Exercise, vol. 6, núm. 2, 2011, pp. 444-451

8. Cug M, Wikstrom EA. Learning effects associated with the least stable level of the biodex® stability system during dual and single limb stance. J Sports Sci Med. 2014 May 1;13(2):387-92. PMID: 24790494; PMCID: PMC3990894.

9. Um JY: Correlation between forward head posture and body weight support distribution & static balance ability of children in growth phase. Kyoung Hee University Graduate School of Physical Education Major in Sports Science and Medicine, 2014.

10. Robinson R, Robinson HS, Bjørke G, Kvale A. Reliability and validity of a palpation technique for identifying the spinous processes of C7 and L5. Man Ther. 2009 Aug;14(4):409-14. doi: 10.1016/j.math.2008.06.002. Epub 2008 Sep 14. PMID: 18793865.

******