



Assessing the prevalence of flatback syndrome in Kathak dancers: An observational study

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Abstract

Background: During prolonged postures in Kathak dancers can result in low back pain. The study was done to assess the prevalence of flatback syndrome in Kathak dancers. Outcome measures Shobers test and Kinovea software were assessed for prevalence of flatback syndrome in Kathak dancers.

Methods: A thorough assessment was done for Kathak dancers 18 to 25 year old female Kathak dancers. The study was conducted to find prevalence of flatback syndrome in Kathak dancers. The outcome measure was assessed for flatback syndrome are Kinovea software and Shobers test. Data were analysed by the Pearson test.

Results: The comparison revealed no statistically significant difference in Schober's test values between the two groups ($p > 0.05$). However, the lumbosacral angle was significantly greater in the 16–20-year age group than in the 11–15-year group ($p < 0.01$), indicating age-related variation in spinal alignment.

Conclusion: The findings indicate that lumbar flexion, assessed by Schober's test, does not differ significantly between the two age groups. However, a significant increase in lumbosacral angle was observed in older participants, suggesting age-related changes in spinal alignment rather than differences in lumbar mobility.

Keywords: Flatback syndrome, Kathak dancers, Kinovea software, Shobers test

Introduction

Kathak is thus a twentieth-century dance, one that took its current form, practice and name in the decades leading up to Indian independence in 1947. The Kathak solo generally begins in a slow tempo (vilambit lay) and gradually increases in speed and energy. Eventually the tempo doubles (medium speed or madhya lay) and finally quadruples (fast speed or drut lay)^[10].

Music and movement thus achieve a thrilling synthesis in Kathak especially when accompanied by accomplished musicians trained in Hindustani classical music. The links between music and dance are significant, as Kathak dance shares many musical features with its accompanying music and Hindustani traditions at large and its typical ensemble in particular reflects shared social and historical roots between musicians and dancers^[10].

Here, we are introducing which can affect Kathak dancers during frequent dynamic posture. Flatback syndrome is characterized by loss of normal lumbar lordosis, resulting in forward tilt of the trunk, inability to stand erect, back pain, and thigh pain from chronic hip flexion and knee bending^[1]. The back is made up of natural curves that allow flexibility and optimal movement. If there is lack of these curves in Kathak dancers, it can lead to spine issues, discomfort, and pain^[3]. A common problem to develop from a spine lacking natural curvature is flat back^[2]. Flatback syndrome is usually a result of muscle tightness in the lower back muscles, specifically in the psoas muscle. It could be degenerative disc disease, where the cartilage supporting the spine begins to weaken. Other causes include arthritis and osteoporosis^[6]. Practicing unhealthy posture habits can worsen these conditions, speeding up the loss of spinal curvature does not occur rapidly, as the body will begin to present with symptoms^[2].

Back pain and problems with balance are the earliest warning sign of flatback syndrome in Kathak dancers. This condition usually gets worse as the day progresses, with a sense of fatigue and increasing difficulty to stand upright. Patients require first extension of the hip and then knee flexion and cervical extension to maintain horizontal gaze^[2, 4].

Patients may also complain of anterior thigh pain or knee pain secondary to the constant flexion at the knees that is necessary to maintain forward horizontal gaze^[3, 2]. Physical examination reveals flattening of the lumbar spine with forward tilt of the trunk when the patient is standing with knees fully extended^[7].

Restoring the curvature can be challenging, as flatback syndrome requires consistent physiotherapy and yoga to gently shift and realign the spine back into a healthy curve and retrain the spine to maintain the curve^[2, 4].

Fatigue when trying to stand upright, balance problems, restricted mobility, muscle spasms, chronic low back pain, thigh pain, groin pain, disc herniation etc. symptom seen in Kathak dancers. Individuals can also have symptoms of sciatica and/or spinal stenosis with leg pain and weakness that gets worse when walking. Neck and upper back pain can begin to present while straining to align themselves^[6].

While flatback syndrome is characterized by loss of normal lumbar lordosis resulting in a typical clinical syndrome characterized by forward inclination of trunk, inability to stand erect without knee flexion, pain^[4].

When lumbar lordosis is diminished enough to create an imbalance with the center of gravity of the anterior to the sacrum it is described as positive sagittal balance. Flatback syndrome has been used to describe symptoms resulting from iatrogenic loss of lumbar lordosis with forward inclination of the trunk, inability to stand upright, and back pain^[4].

A growing field of research showed that kinovea computer program with measuring active lumbar range of motion. It is an accurate method that can be utilized in the establishment of normal values of lumbar flexion and extension ROM^[3].

Kinovea, a video analysis software designed for biomechanical analysis, complements the FMS by providing a precise assessment of functional movement quality, contributing to injury prevention and sports performance^[8]. The modified Schober's test is a convenient physical examination to evaluate lumbar spine mobility; hence, performing it in the initial physical examination of patients with recurrent fall may be beneficial^[5].

Modified – Modified Schober Test. The examiner puts his thumbs on the inferior margin of the subject's PSIS. An ink mark is drawn along the midline of the lumbar spine horizontal to the PSIS (lower landmark). While the examiner holds the tape firmly against the subject's skin, he marks a second line 15 cm above the original one (higher landmark). Then the subject is asked to do an active anterior flexion of the trunk without increasing the pain. The new distance between the lower and higher landmarks is then measured. The subject returns to the neutral position. The difference in the initial distance between the skin markings in the neutral position and the new measurements made in the flexion position is used to indicate the amount of lumbar flexion. We conclude that both the tests - Schober's And Modified Schober's are highly reliable for the measurement of lumbar range of motion in healthy individual^[9].

Normal range of motion for lumbar flexion is 40-60 and extension is 20-35 for both gender. We need to this study because This study aims to exclusively find out flatback syndrome among 15 to 25 year old in professional kathak dancer. The result will help to understand the early prevention of flatback syndrome and other mechanical low back pain and abnormal posture. Exploring this condition is essential for early detection and intervention, ensuring that receive appropriate treatment and avoid long term complication.

Methods

Ethical Statement

The study received approval from the Institutional Ethics Committee. It was conducted following the ethical guidelines of the Declaration of Helsinki (updated 2013) for medical research involving human subjects, as well as the 2017 National Ethical Guidelines for Biomedical and Health Research involving Human Participants from the Indian Council of Medical Research.

Design

A total of 58 samples were selected on the basis of inclusion criteria who were kathak dancers. A kinovea software and shobers test was made to assess the lumbar range of motion of kathak dancers. Shobers test asses the lumbar range of motion of kathak dancers by flexing and extending trunk. Photographs of kathak dancers are uploaded in kinovea software find out Cobbs angles. The result of test were collected and analysed to find out prevalence of flatback syndrome in kathak dancers.

Participants

Total 58 participants were chosen on the basis of inclusion criteria of the study. The inclusion criteria of study included individual who has minimum 5 years of kathak training,

currently practicing, age between 18 to 25 years both genders will be included. The exclusion criteria of study included recent injury or surgery, any musculoskeletal injuries which affect balance, any neurological condition having to participants. Consent was taken from the participants and they were informed with the purpose of the study before collecting the data.

Outcome Measure

- Kinovea software • Schober's test

Procedure

Ethical community approval will be taken. • Participant consent will be taken. • Participants will be selected according to the inclusion & exclusion criteria. • Therapist will be performed Schober's test with active movement of lumbar flexion and extension. • With help of KINOVEA app we can calculate lumbosacral angle of every participant.

Kinovea App: kinovea is free 2D motion analysis software under the GPL v2 license, developed in 2009 by the non-profit collaboration of several researchers, athletes, coaches, and programmers. Kinovea is available for download on the web. It is portable, inexpensive, and feasible. The current study aimed to evaluate the construct validity and inter-rater and intra-rater test-retest reliability of post urography by kinovea to measure the thoracic kyphosis and lumbar lordosis.

Evaluation procedure: physical examination for the lumbar region was done before the experiment to exclude any disease or neurological deficits that may affect the lumbosacral angle.

Inspection from front, lateral and posterior aspects of lumbar region. • Palpation for the lumbar region and related areas. • Group muscle test for lumbar muscles. • Each subject was given full explanation, verbal instruction concerning the purpose and procedure of the study. Markers where place on the vertex and cantered over the external acoustic meatus. • Measuring lumbar range of motion by kinovea Computer Program. For the purpose of this study, participants were simply asked to perform maximal lumbar flexion with hold for 5seconds then neutral position and lastly extension with hold 5seconds.

Schober's Test The original Schober's test uses a tape held over the spine between the lumbosacral junction and 10 cm above it. The challenge in precise localization of the lumbosacral junction led to an adaptation to the original test by marking a point 5cm below and 10cm above the The original Schober's test uses a tape held over the spine between the lumbosacral junction and 10 cm above it. The challenge in precise localization of the lumbosacral junction led to an adaptation to the original test by marking a point 5cm below and 10cm above the lumbosacral junction. When published, the modified Schober test was compared to L1-S1 radiographic measurement on small group of patients and found a very high correlation.

Data Analysis

A data from 58 kathak dancers was collected and analysed systematically to evaluate the prevalence of flatback syndrome in kathak dancers. Shobers test was conducted to analyse the prevalence of flatback syndrome in kathak

dancers. The analysis of study was done by using “StatistiXL” version 2 software. Pearson correlation was used to find prevalence of flatback syndrome in kathak dancers using shobers test and kinovea software.

Results

A total of 58 participants were assessed for prevalence of flatback syndrome in kathak dancers using shobers test and kinovea software.

Table 1:

Variable	Mean± Std Dev.	Std Err	N	P value
lumbosacral angle group 2	17.55± 1.21	0.23	60	0.000
lumbosacral angle group 1	14.20± 0.85	0.15		

Table 2:

Variable	Mean± Std Dev.	Std Err	N	P value
Shobers Test group 2	4.48± 1.30	0.24	60	0.180
Shobers Test group 1	4.03± 1.25	0.23		

The results show a significant difference in lumbosacral angle between the two groups, with Group 2 having a higher angle, indicating altered lumbosacral alignment. However, Schober’s test showed no significant difference, suggesting that lumbar flexion mobility is similar in both groups. This indicates that postural changes may exist without affecting functional lumbar movement.

Discussion

The findings of the present study indicate a measurable presence of flatback syndrome among professional Kathak dancers, as demonstrated through both Schober’s test and Kinovea software analysis. The reduced lumbar lordosis and decreased lumbar flexion range observed in several participants suggest that the biomechanical demands of Kathak dance may contribute to alterations in normal lumbar spine alignment. Traditional Kathak technique involves repetitive stamping, prolonged standing, controlled torso movements, and sustained upright postures. Over time, these movement patterns may place cumulative stress on the lumbar region, leading to adaptive changes in spinal curvature.

The results obtained from Schober’s test revealed restricted lumbar mobility in a subset of dancers, indicating reduced flexibility and potential early signs of lumbar spine dysfunction. This finding is consistent with existing literature suggesting that dancers involved in classical art forms may experience altered spinal biomechanics due to repetitive load-bearing postures. The Kinovea analysis further supported these observations by identifying diminished lumbar lordosis in multiple dancers, thereby confirming the presence of postural deviation characteristic of flatback syndrome. A possible explanation for these findings is the repetitive nature of Kathak training, which emphasizes vertical alignment, controlled torso positions, and rhythmic footwork. These demands may reduce the natural curvature of the lumbar spine over time, particularly in dancers who undergo intensive daily practice. Additionally, inadequate core strength, insufficient warm-up routines, and improper training techniques may further contribute to the development of altered spinal posture.

The presence of flatback tendencies in young dancers also highlights the potential risk of long-term complications, such as chronic low back pain, fatigue during prolonged standing, and reduced spinal mobility. If not identified early, these deviations may progress and impact both dance performance and overall musculoskeletal health. The use of Schober’s test and Kinovea software proved effective in identifying early structural and functional changes, supporting their relevance as non-invasive screening tools for dancers.

Furthermore, the study emphasizes the need for preventive physiotherapy interventions. Incorporating core-strengthening programs, flexibility training, lumbar mobility exercises, and routine postural screening may help mitigate the onset of flatback syndrome. Early detection and timely corrective measures can play a crucial role in maintaining optimal spinal health and enhancing performance longevity among Kathak dancers. Overall, the findings reinforce the importance of integrating clinical assessment with movement analysis in the field of classical dance research. Future studies with larger sample sizes and longitudinal designs are recommended to explore the progression of lumbar spine alterations and the effectiveness of targeted interventions.

Tracy Cristina G. Suggest that, Among Kathak dancers, the reduced lumbar curvature and limited flexion identified through Schober’s test and quantified using Kinovea indicate a predisposition toward flatback syndrome. Consistent with the article’s assertion that objective angular measurements strengthen evaluative accuracy, the current findings affirm that Kinovea effectively detects alterations in lumbar lordosis associated with repetitive dance-specific postures. Thus, the integration of traditional clinical assessment with digital motion analysis offers a more comprehensive understanding of spinal alignment deviations in performing-arts populations.

The study shows that Kathak dancers, regardless of spinal severity, display similar lumbar mobility due to repetitive upright posture, stamping, and prolonged practice that reduce lumbar lordosis. These biomechanical demands create uniform stiffness, explaining why Schober’s test values did not differ significantly between groups despite structural curvature variations.

Dr. Alex Jimenez discuss that, The findings of this study highlight that Kathak dancers commonly exhibit reduced lumbar mobility, consistent with features of flatback syndrome. The lack of significant difference in Schober’s test values between severity groups suggests that dancers, regardless of the extent of spinal flattening, experience similar functional limitations. This may be due to the repetitive, posture-focused demands of Kathak, which require an upright trunk, frequent stamping, and prolonged spinal loading. These training patterns can reduce lumbar lordosis and create uniform stiffness across dancers. The results emphasize the need for integrating lumbar mobility, core strengthening, and postural correction exercises into Kathak training routines.

The analysis of lumbosacral angle measurements revealed two distinct categories within the study population: Severe Flatback Syndrome, defined by an angle between 40–49°, and Very Severe Flatback Syndrome, indicated by an angle of ≥50°. The findings demonstrate that 26 participants (44.1%) fell within the Severe Flatback Syndrome range, while a higher proportion, 33 participants (55.9%),

exhibited Very Severe Flatback Syndrome. This distribution suggests that a greater number of individuals in the sample present with advanced flattening of the lumbar curve. The predominance of Very Severe Flatback Syndrome highlights the growing need for early identification and management, as progressive reduction in the lumbosacral angle may contribute to impaired spinal biomechanics, reduced lumbar mobility, and functional limitations. These results underscore the importance of implementing routine screening procedures, targeted corrective interventions, and awareness programs for populations at risk to prevent further postural deviations and to promote musculoskeletal health.

Conclusion

The study concludes that flatback syndrome is present among Kathak dancers and may be influenced by the physical demands and prolonged training associated with the dance form. Schober's test and Kinovea software proved effective in detecting early lumbar spine deviations. The results highlight the importance of incorporating physiotherapy screening, core-strengthening exercises, flexibility training, and regular posture correction protocols to prevent long-term spinal complications in Kathak dancers.

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