A THREE DIMENSIONAL KINEMATIC ANALYSIS OF BALANCE AND BODY POSITIONING IN ESTABLISHED BALLET POSITIONS IN PROFESSIONAL BALLERINAS WITH DIFFERENT LEVELS OF SKILL

Sam Kerr[1], Sumien Wood[1], Chloe Dafkin [1], Benita Olivier[2], Andrew Green[1], Angela Woodiwiss[3], Warrick McKinon[1]

[1]*Biomechanics Laboratory, School of Physiology, Faculty of Health Sciences, University of the Witwatersrand Medical School, Parktown, South Africa;* [2] *Department of Physiotherapy, School of Therapeutic Sciences, Faculty of Health Sciences, University of the Witwatersrand Medical School, Parktown, South Africa;* [3]*Cardiovascular Pathophysiology and Genomics Research Unit School of Physiology, Faculty of Health Sciences, University of the Witwatersrand Medical School, Parktown, South Africa*

Introduction

Ballet is a performance art that requires great skill and balance to perform. Limited literature is available documenting the balancing abilities of skilled ballerinas. The aim of this study was therefore to determine whether there were differences in balance control (centre of mass (COM) movement and COM height), as well as the area of the base of support (BoS) and skill (as defined by variables conventionally used to assess ideal execution of ballet positions) between groups of professional ballerinas with different levels of accomplishment.

Methods

Twenty one professional female ballerinas classed as Graduate dancers (≤ 1 year academy dancing experience; n = 7), Corps de Ballet dancers (1 to 2 years academy dancing experience; n = 7) and Soloists (more than 2 years academy dancing experience; n = 7) participated in this study. All ballerinas performed three unassisted, standard ballet positions en pointe (retire, arabesque and penche) held for at least 3 seconds. Retro reflective markers were attached to specific anatomic landmarks and tracked by a 12 camera system in order to estimate COM location as well as limb movements. The BoS was calculated using a pressure platform.

Results

No significant difference in balance control (COM movement or COM height difference) was detected between the three skill groups. BoS, was significantly larger in the Corps de Ballet dancers compared to Soloist ($F = 4.822$, $p = 0.011$). The Soloists also showed significantly greater leg separation angles during penche when compared to Graduate dancers ($F = 5.557$, $p = 0.027$). The leg orientation angles of the lifted leg in arabesque and penche were not significantly different between the three different classes of dancers. Mean BoS surface area for retire was significantly greater than both arabesque and penche ($F = 6.745$, $p = 0.002$).

Conclusion

Soloists, the most advanced ballerinas, were able to maintain a smaller BoS for all three tested ballet positions and showed better execution of moves (greater leg elevation angles). A smaller BoS is believed to contribute to better proficiency and skill in ballerinas. The results from our study support the notion that skill difference exist even within professional ballerinas regarding flexibility, strength and joint motions.