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# Lower leg and foot contributions to turnout in university-level female ballet dancers: A preliminary investigation

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# Lower leg and foot contributions to turnout in university-level female ballet dancers: A preliminary investigation

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## INTRODUCTION

- Functional turnout in ballet involves maximal external rotation through the lower limb kinetic chain.
- Dancers will tend to increase their functional turnout angle through additional tibiofemoral external rotation and pronation of the foot/ankle complex.[1] ( Figure 1 - 3 )
- Hip external rotation measures in functional turnout has received extensive examination in dance science. [2-5]
- The relationship between the 'below the hip' assessments with functional turnout is poorly understood.

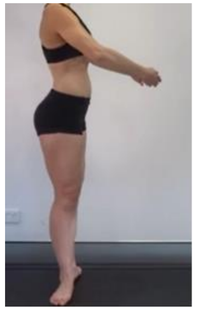

Figure 1. A dancer performing forced turnout in sagittal view.

**Figure 2** Dancer demonstrating hindfoot eversion, medial bulging of the talar-navicular joint, forefoot abduction, toes gripping the floor and lateral deviation of the hallux.

## AIM

- To explore the non-hip components of turnout to dancers' functional turnout in first position by assessing passive external tibiofemoral rotation (pTFR) and active measures of foot pronation; navicular drop and Foot Posture Index (FPI © Version 6).

## METHODS

- Nineteen female university-level classical ballet and modern dance students (mean age 17.9 ± 0.9 years) volunteered in this descriptive correlational study.
- Navicular drop, FPI, pTFR (Figure 4) and functional turnout were measured for the participants' right and left lower limbs. Measures of pronation were conducted with the dancer standing in parallel and turnout. All clinical measures demonstrated excellent reliability, ICC 0.90-0.93.
- A multiple linear regression model was used to estimate the amount of variance in functional turnout which can be explained by the measured variables.

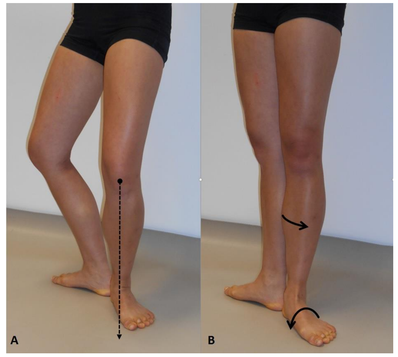


Figure 3. A: Forced turnout in demi-plie, plumb line (dotted line) demonstrating poor knee-foot alignment (knee is medial to the second metatarsal). B: Forced turnout in first position with an excessively externally rotated tibia and pronation through the foot.

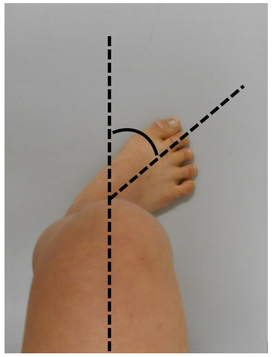

Figure 4. Measurement technique to assess passive tibiofemoral external rotation angle.

## RESULTS

- Stepwise multiple linear regression model analyses revealed a weak relationship between pTFR and functional turnout, with the latter accounting for approximately 19.0 % variance of functional turnout.
- Spearman's rho correlation analysis revealed a moderate negative relationship between pTFR and FPI in functional turnout ($\rho = -0.47$, $P = 0.043$).
- Results suggest dancers with limited tibiofemoral rotation recruited pronation about the foot/ankle complex to further increase their functional turnout angle.

## CONCLUSIONS

- Our findings suggest dancers used variable amounts of motion at the anatomical locations depending on their functional and anatomical capability.
- Ongoing research would benefit from in situ measures of dancers' lower leg contributions to functional turnout such as that provided by modern three-dimensional biomechanical evaluations

## ACKNOWLEGEMENTS

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