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Calcaneal eversion in a dancer's demi-plié

Although there is a broad consensus in dance that hyperpronation can cause injury and should be avoided, rearfoot pronation is discussed controversially within the dance literature. The different understanding of the biomechanics of the foot amongst dancers, dance teachers and scientists might derive from a lack of biomechanical research conducted with dancers. The purpose of the current study was to provide normative kinematic data of calcaneal eversion in a dancer's demi-plié and to compare the findings with the biomechanical norms of foot movements during gait. The main hypothesis was that the degrees of calcaneal eversion in a dancer's turned-out demi-plié defers from the reported degrees in gait-analyses done on non-dancers.

Thirty-two contemporary dancers (25 female, 7 male) performed three trials in three different conditions: demi-plié in parallel, demi-plié in turned-out position and normal walking. The motion capturing system FASTRAK was used to measure calcaneal eversion and the tracking-distance from the tibial tuberosity over the second toe during the different trials.

The mean values for calcaneal eversion in turned-out demi-pliés was found to be 3.36°±4° (M±SD) in maximal eversion, 3.73°±1.42° for total range of eversion and 2.42°±4.56 for eversion at maximum ankle dorsiflexion. The differences between calcaneal eversion in turned- out pliés and the suggested value of 6 degrees in gait was large and highly significant. Differences in total range of calcaneal eversion between the three trials were found (paired t-test). Only among parallel plié and walking trials the differences were statistically significant ($p=0.023$, $d=0.42$). Maximal eversion was significantly different between

parallel pliés and turned-out pliés ($p<0.001$, $d=0.97$) and between turned-out pliés and walking ($p<0.001$, $d=0.9$). The total range of knee-second-toe-tracking was significantly different between parallel pliés and turned-out pliés ($p<0.001$, $d=0.81$) and between turned-out pliés and walking ($p=0.022$, $d=0.42$). The Pearson correlation coefficient between the coupling of ankle dorsiflexion and calcaneal eversion in demi-pliés showed a high variance between participants ranging from highly negative to highly positive correlations in parallel $r=-0.97$ to $r=0.95$ and turned-out pliés $r=-0.95$ to $r=0.97$.

Compared to walking in gait analysis with non-dancers, the magnitude of calcaneal eversion in a dancer's demi-plié is significantly lower. Dancers also show a high variety of different coupling mechanisms between ankle dorsiflexion and calcaneal eversion. This study is the first to deliver normative data on foot movements in dance-specific movements such as a demi-plié. This is a starting point for a better understanding of foot mechanics in dance movements.

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Anna Schrefl hat an der Amsterdamer Kunsthochschule zeitgenössischen Tanz studiert und an der Uni Bern einen MAS in Dance Science absolviert. Sie ist Spiraldynamik® Dozentin und Pilates Teacher Trainer.

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