The Differences in Knee Kinetic and Kinematic Movement Patterns Between Performing a Lunge Exercise and a Lunge Whilst Performing a Dual-Task

Abdulmajed Alzaid
School of Healthcare Sciences, Cardiff University, Cardiff

Dr. Kate Button
School of Healthcare Sciences, Cardiff University, Cardiff

Dr. Mohammad Al-Amri
School of Healthcare Sciences, Cardiff University, Cardiff

Abstract:

Background: The forward lunge is a commonly prescribed closed-chain exercise in rehabilitation programs, used to strengthen lower limb musculature and enhance functional performance. Incorporating a motor dual-task, such as reaching for a virtual object while lunging, increases task complexity; however, its influence on knee biomechanics remains insufficiently explored.

Objective: This study investigated the effects of a motor dual-task on knee kinetics and kinematics by comparing peak knee flexion, knee extensor moment, lunge duration, and lunge distance between standard lunges (LungeFR) and dual-task lunges (LungeDT).

Methods: Thirty healthy adults (23 males, 7 females; aged 21–43) performed both LungeFR and LungeDT conditions using the GRAIL system with integrated 3D motion capture and virtual reality. A within-subject experimental design was employed. Paired t-tests and Wilcoxon signed-rank tests were used to identify significant differences ($\alpha = 0.05$).

Results: Peak knee flexion was significantly greater in LungeFR compared to LungeDT ($110.01° \pm 10.68$ vs. $99.23° \pm 12.35$; $p < 0.001$). Similarly, knee extensor moment was higher in LungeFR (0.0052 ± 0.0017 vs. 0.0045 ± 0.0018 Nm/kg; $p = 0.001$). In contrast, lunge duration and distance were significantly greater in LungeDT (3.82 ± 0.75 vs. 3.47 ± 0.64 s; $p = 0.0045$, and 0.875 ± 0.09 vs. 0.828 ± 0.13 m; $p = 0.025$).

Conclusion: These findings indicate that LungeFR requires greater knee flexion and extensor demand, while LungeDT imposes greater spatiotemporal demands. Dual-task lunges appear to be more