The Study of Kinetics and Kinematics of Single-Leg Landing Tasks Between Males and Females Using Inertial Measurement Units (IMU) and Force-Plate

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Background

- **Various sports** frequently incorporate single-leg landing (**SLL**)
- ***70% to 90%* ACL injuries** occur as non-contact injuries
- Often **associated with single-leg landings**
- Numerous systematic investigations **gender disparities** concerning that females tend to exhibit greater knee abduction motion
- **However**, a **limited number** of studies have delved into the kinetic and kinematic aspects of **whole-body rotation** during single-leg landings, encompassing both **male and female participants**

Research Objective

- To investigate the **gender differences** in the kinetics and kinematics of **single-leg landing tasks**

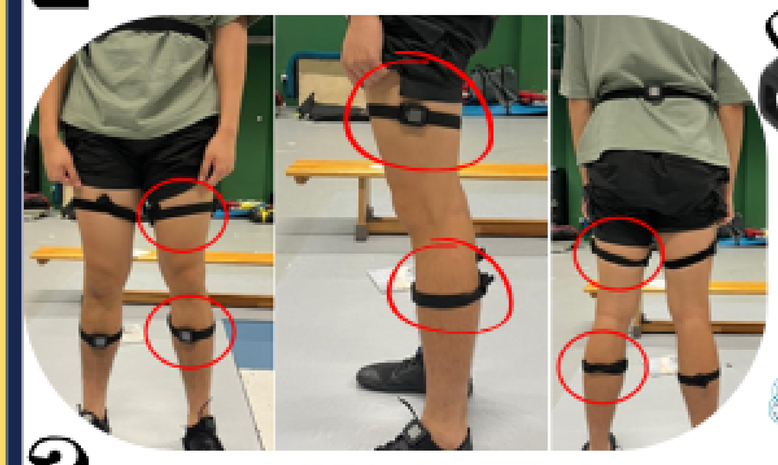
Methods

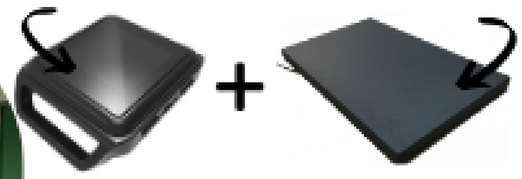
High: 30 cm
Distance: 20 cm

- Quasi-experimental design, one-shot study
- Total number of subjects: N = 30, 15 male; 15 female)

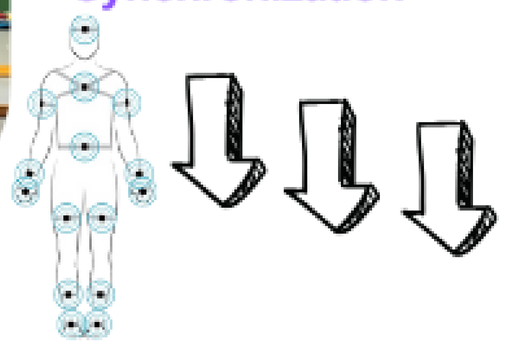
1 **Warm-up (Stationary bike) and familiarization section**

2 **Equip IMUs, Synchronization of IMUs and Force Plate**





Synchronization



3 **IMUs Location**

Perform 2 testing conditions:

1) **Single-Leg Drop Landing** (**SLL**) (Dominant leg) x 3
2) **Single-leg drop landing + 90-degree Rotation** (**SLLR**) (Dominant leg) x 3

Notes: 1-minute rest between tests

4 **Statistical analysis**

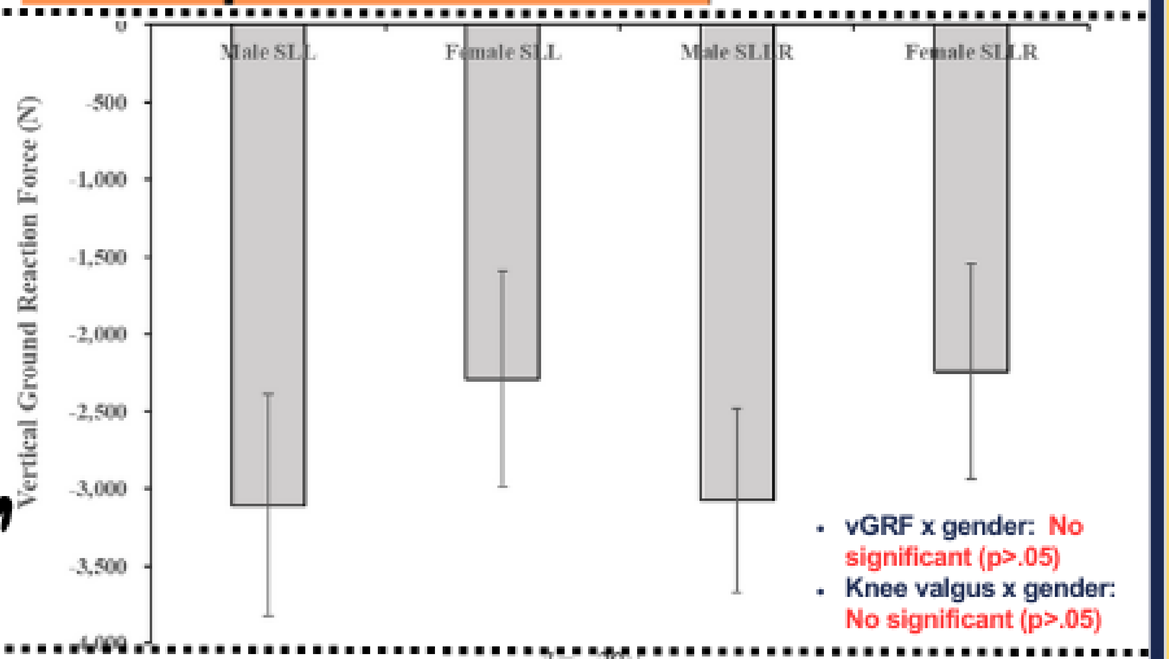
- IBM SPSS Statistics 27.0 & Microsoft Excel (2023)
- Normal distribution -> Shapiro-Wilk test (P > 0.05)
- Two-way repeated measures analysis of variance (ANOVA) & Post-hoc (Bonferroni)

Findings

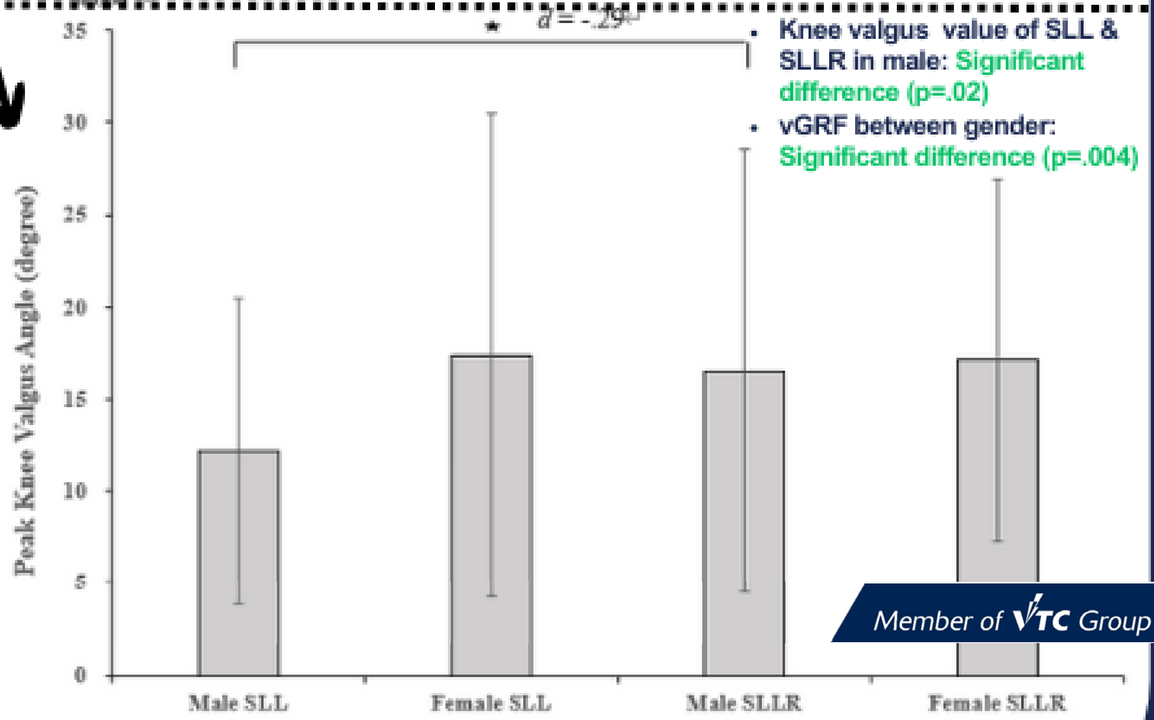
Reliability index (ICC) of SLL & SLLR:

SLL (vGRF)	Male Moderate (.64) (p<.001) Female Excellect (.91) (p<.001)
SLLR (vGRF)	Male Good (.79) (p<.001) Female Excellect (.95) (p<.001)
SLL (Knee valgus)	Male Excellect (.91) (p<.001) Female Excellect (.68) (p<.001)
SLLR (Knee valgus)	Male Poor (.46) (p=.002) Female Moderate (.65) (p<.001)

All conditions: <u>Moderate to Excellect reliability</u> (p<.001) (Except Male SLLR)



- vGRF x gender: No significant (p>.05)
- Knee valgus x gender: No significant (p>.05)



- Knee valgus value of SLL & SLLR in male: Significant difference (p=.02)
- vGRF between gender: Significant difference (p=.004)

Conclusion

- The **current study** found **no gender differences** in the two landing tasks (**SLL** & **SLLR**)
- **Men** showed **greater ground reaction forces** and **knee valgus angles** in rotational landings, potentially raising the **ACL injury risk**
- **Gender-specific training** is recommended for injury prevention and performance
- **More research** is needed on **gender effects** in **rotational landings** for sports safety and effectiveness