

2018

# Braking ground reaction force during 90deg sidestep cut and leg muscle strength.

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Originally published as: Yu, W., Nimphius, S., Haff, G. G. & Nosaka, K. (2018). Braking ground reaction force during 90<sup>0</sup> sidestep cut and leg muscle strength. *Poster presented at the 11th International Conference on Strength Training 2018, held Perth, Western Australia, 30 November – 3 December, 2018.*

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## Recommended Citation

Yu, Walter; Nimphius, Sophia; Haff, Greg; and Nosaka, Kazunori, "Braking ground reaction force during 90deg sidestep cut and leg muscle strength." (2018). *ECU Posters*.

<https://ro.ecu.edu.au/ecuposters/27>

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## Introduction

Change of direction (COD) total time is influenced by linear sprint ability and technique. Therefore, COD performance should be isolated from COD total time by measuring only the time taken to perform the COD and COD technique should be controlled. Current COD studies focus on the plant and penultimate (PEN) braking steps (Dos Santos et al, 2016, Jones et al, 2017), however, deceleration during a COD extends beyond these two steps (Nedergaard et al, 2014), thus, **more braking steps ground reaction forces (GRF) needs to be examined**. Cross sectional COD studies have shown that athletes with faster COD performance were stronger during eccentric squat (Spiteri et al, 2015) and produced higher force during eccentric isokinetic knee extensor and flexor test than athletes who exhibit slower COD performances (Jones et al, 2017). Therefore, it seems that **eccentric strength is associated with COD performance**. It is necessary to examine braking steps before the PEN step to examine braking strategies of faster and slower performers. Additionally, eccentric strength, which is deemed advantageous for COD braking should be further examined using a multi-joint strength assessment to further determine eccentric capacity during COD performance.

## Purpose

- To compare GRF of three braking steps, the plant, PEN & the step prior to PEN (PEN-1), the entry and exit velocity of the COD and muscle function measures (leg press and leg curl one-repetition maximum, isometric and isokinetic strength of the knee flexor and extensors, and drop jump performance) between faster and slower participants for a 90° sidestep cut.

## Methods

- Twenty-two male recreational athletes from AFL, soccer, rugby, basketball, squash and tennis (22.4 ± 3.4 years, 73.5 ± 6.7 kg, and 177.3 ± 5.6 cm) performed six cuts over five force plates to measure GRF during deceleration.
- The plant leg that resulted in the participant's faster COD was defined as the dominant leg (DL) and the slower side defined as the non-dominant leg (NDL).
- COD performance was determined by the time taken from 1m before and 1m after the COD cut step, time was measured by single beam timing gates (Smartspeed, Fusion Sports, Coopers Plain, Australia) shown in Figure 1.
- Faster (n = 10) and the slower (n = 10) groups were identified based on 1m – 1m COD time and the dependent variables between the groups were compared using independent t-tests.
- Two-way ANOVA was used to determine if braking GRF differences exist between faster and slower participants of DL and NDL groups.

### Muscle Function Tests

- Drop jump reactive strength index at three heights
- Leg press and hamstring curl machine for one-repetition max (eccentric only and concentric only)
- Dynamometer (Biodex System 3, Biodex Medical, Shirley, New York) measured isokinetic concentric and eccentric peak torque of the knee extensor and flexor peak torque on). Isometric peak torque was also measured on the dynamometer
- Pearson's correlation was used to examine the relationship between COD performance and muscle function measures

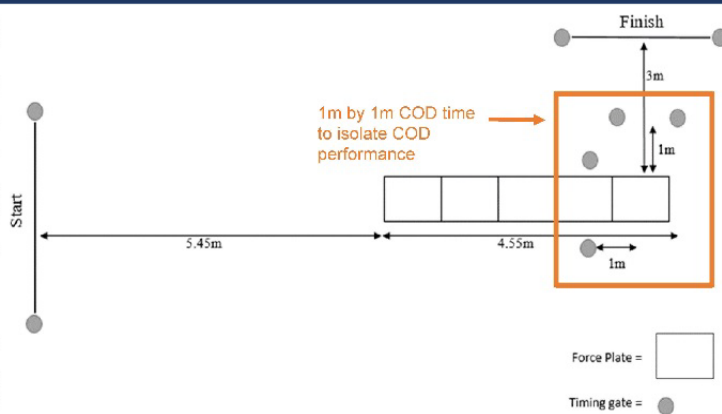
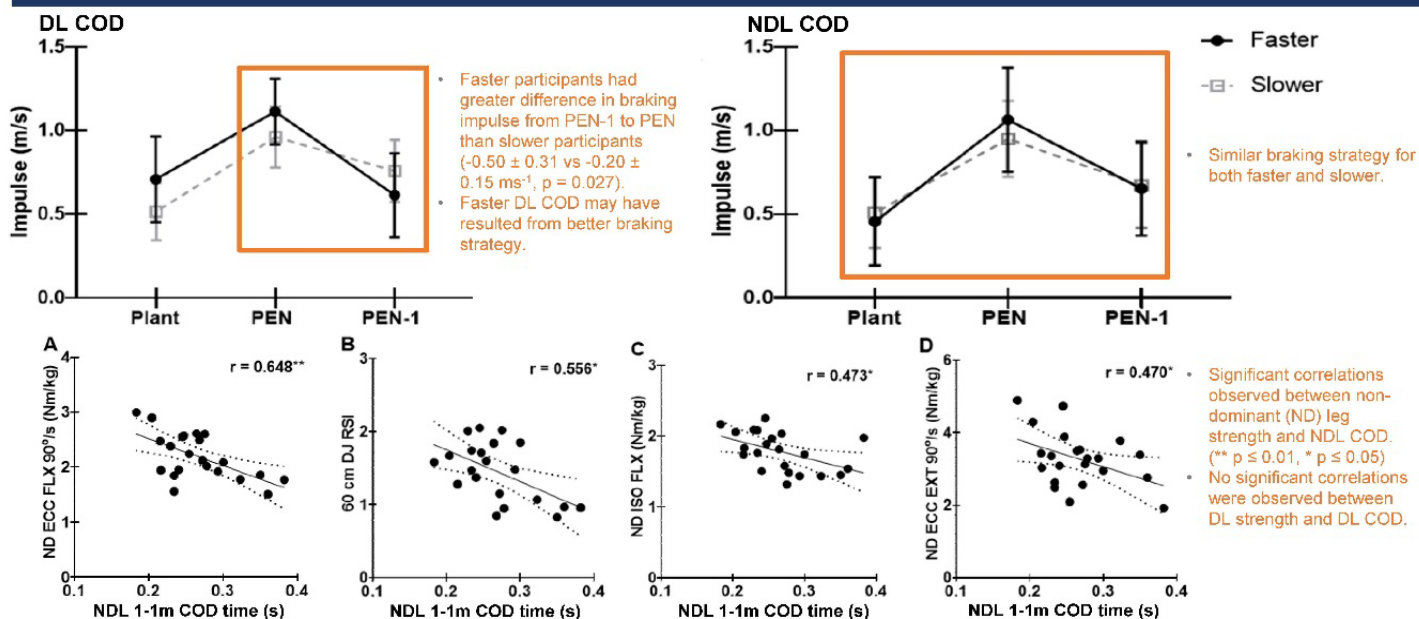


Figure 1. Layout of the COD task. For the right cut, only the timing gates position were mirrored.

## Results and Discussion



## Conclusion

- Mechanical factors between the DL and NDL COD were different among recreational athlete population.
- Participants may have relied on a **braking strategy during faster DL COD** but **exhibited a strength control strategy to control braking during faster NDL COD**.
- Further kinematic, kinetic and strength examination of COD deceleration is needed to capture the multiple strategies present for COD deceleration.

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