Comparison of Female and Male Golf Swing Kinetics and Force Production

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INTRODUCTION

- Golf is a popular sport that is enjoyed by both men and women across the world
- It is beneficial to understand if men and women perform the golf swing differently in order to properly match training techniques and golf equipment to enhance performance
- Previous research found that men used higher joint moments in the downswing phase than women which resulted in stronger force production [1]
- Women were found to produce a wider swing with larger hip and shoulder joint rotation at the top of their backswing [2]
- This study aimed to determine the possible reaction force (RF) differences between males and females during a golf swing
- We hypothesized males will generate larger RFs than women during a golf swing

METHODS

Subjects

- 9 skilled players (4 male, 5 female) from CLU men's and women's golf teams volunteered in accordance the local IRB. Average weight for male (82.52 BW ± 10.78) and female (74.45 kg ± 22.56)

Procedure

- Players performed 10 golf shots towards a downrange with their own 6-iron club. **(Fig 1.)**
- Each foot was fully supported by a force plate (Kistler, 1200 Hz). Force plates were covered with turf allowing the players to wear their spiked gold shoes. **(Fig 2.)**

Figure 1: Showing configuration of downrange golf shot

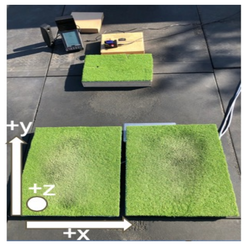

Figure 2: Showing turf on top of two force plates and the reference system utilized

Data collection

- RFs were calculated in the mediolateral (ML) and anteroposterior (AP) directions, normalized by body
- Linear impulse was calculated as the area under the force-time curve, representing the downswing phase. The downswing began when the y-value created a negative RF, representing a push forward by target leg and opposite for rear **(Fig 3.)**
- Ball contact represents the end of the phase and is when t=0

Statistical Analysis

- Differences in kinetic variables between males and females were determined with independent t-tests (α = 0.05)

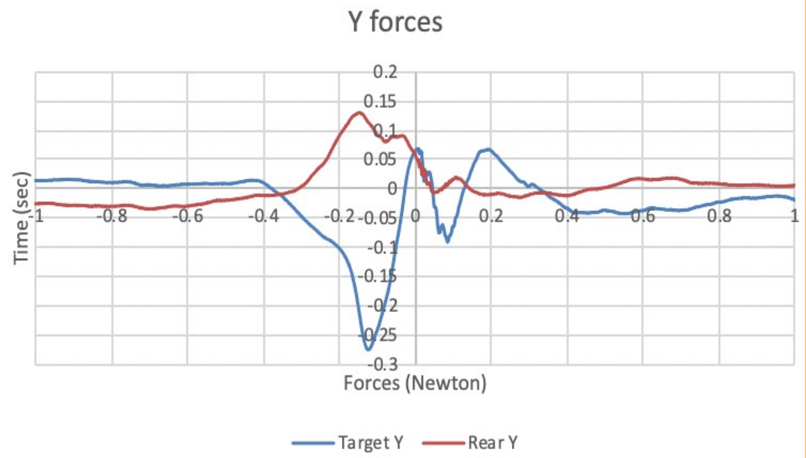

Figure 3: Resultant reaction forces in the AP direction for both target and rear legs during the golf swing with the 6-iron of one swing from an exemplar subject. Forces normalized by body mass.

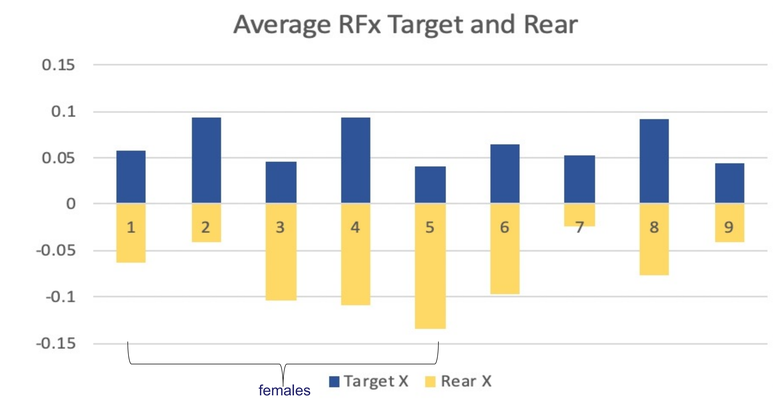

Figure 4: Mean reaction forces of both groups in the mediolateral direction for target and rear legs (normalized by body weight) of players' golf swing during the downswing. There were no significant differences in the target leg or rear leg for males and females.

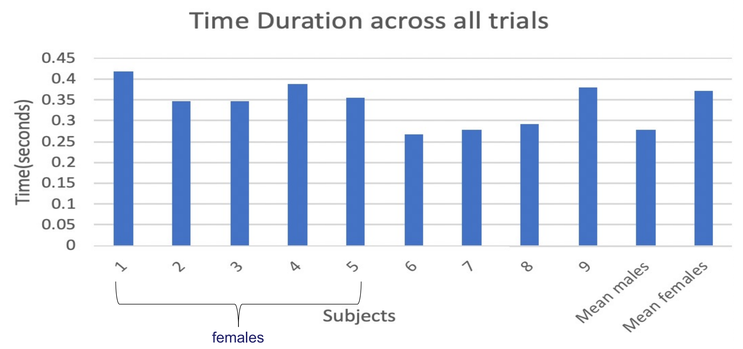

Figure 5: Average time duration for each subject, both males and females during the downswing with the 6-iron. There were significant differences in the time between males and females.

RESULTS AND DISCUSSION

- In general, male and female generated similar linear impulses to produce the required outcome, though women tended to have a longer duration of linear impulse period than the males
- Females and males generated similar ML and AP linear impulse
  - The average target leg ML RF was directed away from the target for females (0.066 ± 0.026 BW) and for males (0.064 ± 0.021 BW, p=0.088)**(Fig 4.)**
  - The average target leg AP RF was directed posteriorly for females (-0.098 ± 0.026 BW) and for males (-0.137 ± 0.032 BW, p = 0.088)
  - Rear leg ML RF was directed towards the target for females (-0.090 ± 0.038 BW) and (-0.059 ± 0.032 BW, p = 0.241) for males. **(Fig 4.)**
  - Average rear leg AP RF pointed anteriorly for females (0.054 ± 0.019 BW) and males (0.065 ± 0.028 BW, p = 0.511)
  - Males showed a larger peak target leg AP RF (0.122 ± 0.057) than females (0.043 ±0.045 BW, p= 0.0523) **(Fig 3.)**
  - Females generated linear impulse over a longer duration of time (0.371 ± 0.032 s) than males (0.304 ± 0.051 s, p = 0.046) **(Fig 5)**

CONCLUSIONS

- Males and females generated similar linear impulse and forces to complete the golf swing
- Females could be longer force generation durations as a mechanism to create the necessary linear impulse or it's possible that females have a swing strategy than males to achieve the same outcome
- This information is beneficial to both players and coaches to help tailor golf training programs to the individual

REFERENCES AND ACKNOWLEDGMENTS

[1] Bae, K., Lee, J., Han, K., Shin, J. (2018). Biomechanical Analysis of Golf Driver Swing Motion According to Gender. *Korean Journal of Sport Biomechanics, 28*(1).

[2] Egret, C. I., Nicolle, B., Dujardin, F. H., Weber, J., & Chollet, D. (2006). Kinematic analysis of the golf swing in men and women experienced golfers. *International journal of sports medicine*, *27*(06), 463-467.

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