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Comparison of ground reaction forces on full and controlled driver shots in male professional golfers

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INTRODUCTION:

Shot distance and accuracy in golf are achieved by adjusting club head velocity (CHV). A prior study indicated that the horizontal reaction force of the front leg is diminished when a reduced shot distance is achieved with a 6-iron club [1]. However, the regulation of ground reaction force (GRF) with different CHVs of driver shots has yet to be elucidated. This study aimed to determine how skilled golfers adjust GRF variables during full and controlled driver shots.

METHODS:

Eight right-handed male professional golfers (age: 35.7 ± 1.7 years; height: 173.6 ± 7.7 cm; body mass: 75.1 ± 9.4 kg) participated in the study. Each golfer executed a full driver shot (aiming for maximum distance) and a controlled shot (aiming for the center of the fairway). Two Kistler force plates and 12 Vicon cameras were used to record GRF data for each leg and clubhead kinematics data during the swing. The maximum CHV and magnitude and angle of the front and rear leg GRF were calculated for the backswing and downswing phases. A paired t-test using statistical parametric mapping (SPM) was done to compare the GRF magnitude and vector angle of the shots [2].

RESULTS:

The full shot had a greater maximum CHV than the controlled shot (51.8 ± 3.7 vs. 49.5 ± 2.2 m/s, respectively, $p < 0.05$). SPM analysis indicated that, for both legs, the GRF magnitude in the backswing phase did not differ between the shots. In contrast, during the downswing phase, only the vertical GRF of the front leg was significantly greater in the full shot than in the controlled shot, in the range of 55%–74%. No difference was observed in the GRF vector angle between shot types.

Our results indicated that skilled golfers increased the front leg vertical GRF in the mid-downswing phase of a full driver shot. This differs from the prior study, which reported a reduction in the horizontal GRF component of the front leg with reducing shot distance using a 6-iron club [1]. This discrepancy may be due to the difference in swing using a driver or an iron. Another study showed that the magnitude of the vertical GRF of the front leg on the downswing is a major predictor of ball velocity [3]. Thus, the skilled golfer may have pushed downwards harder with the front leg during the full shot with the driver. Furthermore, adjusting the GRF magnitude without changing the GRF angle between shots may promote shot distance and accuracy in terms of leg coordination and performance, as shown in a previous study [1].

CONCLUSION:

A comparison of full and controlled driver shots of skilled golfers suggested that the full shot had a higher CHV due to a greater vertical GRF of the front leg after the mid-downswing phase.

REFERENCES:

- 1) McNitt-Gray et al., Sports Biomech, 2013
- 2) Pataky, CMBBE, 2012
- 3) Chu et al., JSportsSci, 2010

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