THE INFLUENCE OF CLUB SHAFT CHARACTERISTICS ON THE HIP-SHOULDER SEPARATION ANGLE DURING THE GOLF DRIVE

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INTRODUCTION: The way in which club head speed is generated during the golf swing has often been explained using the 'double pendulum model' (e.g. Budney and Bellow, 1992). However, recent research has suggested that club head speed generation is related to the separation angle between transverse plane hip and shoulder rotations (e.g. Cheetham et al., 2001). It is possible that the shaft characteristics of golf drivers may affect swing mechanics and alter the magnitude of the hip-shoulder separation angle. Generally, it is now recognised that single-individual designs are valuable in sports science research (Bates, 1996). The purpose of this preliminary study was to investigate the effect of club shaft characteristics on the hip-shoulder separation angle during the golf drive using a single-individual design.

METHODS: One male right-handed golfer (mass = 72 kg; height = 1.82 m; age 22 years; handicap 14 strokes) gave informed consent before data collection began. For the 15 trials with each of the three clubs (TaylorMade 3-series drivers with 'light' graphite, firm graphite and firm steel shafts) 3D co-ordinates of the left and right shoulder and hip were obtained at 120 Hz using an Eagle camera Motion Analysis Corporation system (Santa Rosa, CA, USA). Transverse plane hip and shoulder angles were determined using custom-written algorithms for MATLAB (MATLAB, Natick, MA, USA). Angles were 0° when parallel to the tee-to-flag line and positive for rotations away from the flag. The hip-shoulder separation angle was calculated by subtracting the hip angle from the shoulder angle. Maximum hip-shoulder separation angle in addition to hip-shoulder separation angle at the top of the backswing were measured. The top of the backswing was defined as the point of maximum hip rotation. Differences between club conditions for each dependent variable were tested using two analyses of variance; the Scheffe test was used for post-hoc analysis and the sizes of the differences were estimated using Effect Size (ES) calculations.

RESULTS AND DISCUSSION: No significant differences ($P > 0.025$) were seen in the hip-shoulder separation angle at the top of the back swing between the light graphite shaft (44.7° ± 0.7°), firm graphite shaft (45.3° ± 0.9°) and firm steel shaft (45.2° ± 0.9°) club conditions. However, significant differences ($P < 0.025$) were seen in the maximum hip-shoulder separation angle. A lower maximum hip-shoulder separation angle was seen when using the light graphite shaft club (47.5° ± 1.2°) compared to the firm graphite (51.0° ± 1.2°, ES=1.76) and firm steel (50.9° ± 1.1°, ES=1.69) shaft clubs. Increasing the magnitude of the maximum hip-shoulder separation angle has been linked with increased club head speed during a golf drive (Cheetham et al., 2001). This suggests that the participant attempted to reduce club head speed whilst using the club with a light graphite shaft. In this preliminary study, altering the characteristics of the driver shaft resulted in a larger maximum hip-shoulder separation angle for the firm graphite and firm steel shafts compared to the light graphite shaft for this participant. A future study with more participants to ascertain whether this result can be generalised to a larger population is warranted.

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