AN EXAMINATION OF THE 15-BALL DRIVER SHOT TEST FOR PREDICTING GOLF PLAYERS' SCORES

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Introduction

Patterns of body movements and golf club head movements are specific to an individual player. However, with the increasing reliability of Doppler launch monitors, it has now become possible to compare parameters related to club head movement at ball impact from a common evaluation. Our study aims to establish a statistical model that can evaluate golfing performance by analyzing the relationship between club head movement data from 15 driver shots corresponding to one round of golf and the golf scores of amateur golfers (AG) versus skilled golfers (SG).

Methods

This study included 28 subjects of whom 14 were AG (height: 165.6±28.9 cm; weight: 72.6±10.6 kg; average score: 94.2±6.3 strokes), and 14 SG, (height: 175.4±7.6 cm; weight: 73.9±8.3 kg; average score: 74.6±2.9 strokes). The study was initiated after explaining the nature of the experiment to the subjects, obtaining their written consent, and approval from the Academic Research Ethics Review Board of Tokyo International University (2018-15). Subjects aimed at a cross-shaped target 3 m away, and used their own driver to conduct three sets of five swings per set, with a one-minute rest in between, leading to a total of 15 shots. The data from these 15 shots were measured at an indoor facility using a Flight Scope X3 (Flight Scope USA, Ltd), a Doppler launch monitor measuring device. The subjects were instructed to carefully assess and hit the target accurately in each shot, as if they were playing a tee shot on an outdoor course. The results of the shot data were not shared with the subjects until all measurements were completed to prevent influencing the outcome of the remaining shots. Several parameters of the club head at the time of impact were evaluated, such as club head speed (CHS) (m/s), face-to-target angle (°), club path angle (°), face-to-path angle (°), and attack angle (°). The average score and standard deviation (SD) were calculated using Pearson's single-regression analysis. Subsequently, the average score from these five parameters was obtained using the stepwise method of multiple regression analysis, with the average score as the dependent variable and the data from each of the other parameters as independent variables. The statistical significance level was set at 5%, and IBM SPSS Statistics (IBM Japan, Ltd) version 27 was used for all statistical data analyses and processing.

Results and Discussion

Table 1 shows the results of unpaired t-tests performed between AG and SG. For SG, the CHS and attack angle tended to be significantly larger than those of AG, whereas the face-to-target and face-to-path angles tended to be significantly smaller. For AG, the club-path angle tended to be smaller than that of SG. No significant difference was observed in the SD of CHS between the AG and SG groups. However, the remaining four parameters excluding club path showed significantly smaller values for SG; intra-shot variation in club head movement was small across the 15 shots, and a trend towards greater consistency was observed despite a higher CHS. This was particularly true for face-to-target with $t(26) = 6.06$, $p < .00$, $d = 2.292$, and face-to-path with $t(26) = 4.94$, $p < .00$, $d = 1.869$. Next, we analyzed the correlation between the SD of the mean club head movement and the average value for the five parameters and found a strong correlation between the average score and face-to-target, with a correlation coefficient of $r = .714$. Multiple regression analysis revealed a significant regression equation with one variable of face-to-target as an independent factor ($Y = 66.507 + 10.414 \times$ [x: SD of face-to-target], $F = 27.060$, $p = .000$). The SD score significantly predicted the dependent variable (average score), accounting for 50% ($R = 0.714$) of the dependent variable. The standard error of the estimate is 7.944 strokes. To summarize, 50% of the average score can be explained by the SD score of the face-to-target across 15 shots, confirming that it is a very important factor during ball impact.

Significance

Across subjects, the average score showed a strong correlation with the SD of face-to-target, and the same aspect was revealed in multiple regression analyses using stepwise methods. In this study, the SD of face-to-target for SG and AG were 1.1 ± 0.5 and 2.3 ± 0.5, respectively, which is greater than a 2-fold difference. The fact that this single factor can increase one's stroke count by more than 10 strokes suggests that consistent face control when using a driver on a tee shot is important in regulating one's golf score.

Table 1. Unpaired t-test for mean values and mean scores of clubhead movement across 15 shots by AG and SG

	AG		SG					95% Cl		ES
	M	*SD*	*M*	*SD*	*t(418)*	*P*	*AG vs SG*	*LL*	*UL*	Cohen's d
CHS (m/s)	41.6	4.3	48.8	2.2	-21.72	.00	AG < SG	-7.88	-6.57	-2.12
Face to target (deg)	3.5	2.4	2.3	1.8	5.71	.00	AG > SG	0.78	1.59	0.56
Club path (deg)	3.1	2.4	3.8	2.4	-3.12	.00	AG < SG	-1.20	-0.27	-0.30
Face to path (deg)	4.1	3.4	2.5	1.9	6.05	.00	AG > SG	1.11	2.18	0.59
Attack angle (deg)	3.3	2.1	4.8	2.6	-6.33	.00	AG < SG	-1.89	-0.99	-0.62
Average score (strokes)	94.2	6.3	74.6	2.9	40.97	.00	AG > SG	18.63	20.51	4.00

Note. AG = amateur golfer (n =14), SG = skilled golfer (n = 14)

Cl = confidence interval; LL =lower limit; UL = upper limit. ES = effect size; CHS = club head speed