

## Introduction

- Ideally, golfers should have a simple, consistent and repeatable golf swing with any variation seen as being detrimental to performance (Glazier & Lamb, 2017).
- Golfers are able produce the same final task outcome (i.e the ball landing in the same position) with a variety of different ball flights, clubs and swing mechanics (Langdown et al, 2012).
- **Aim** – The aim of this study was to measure golf club kinematics, to see whether this changes for different wedges and different hitting distances.

## Methods

- One participant was used within this study (n=1, Gender = F, Height = 1.72 m, Mass = 70 kg, Golf Handicap = 14).
- The participant was required to perform at least 3 golf shots per club, per yardage.
- The clubs were the pitching (PW), sand (SW) and lob wedge (LW).
- The target areas were 30, 40, 50 and 60 yards, shown in figure 1.
- A USB3 1.3 MP camera (350 fps, 896 x 900), 4.4-11 mm Zoom Lens and LED Light was used to record the video footage of the golf swing.
- Reflective tape was placed on three different locations on the golf club (bottom of grip, mid shaft and hosel).

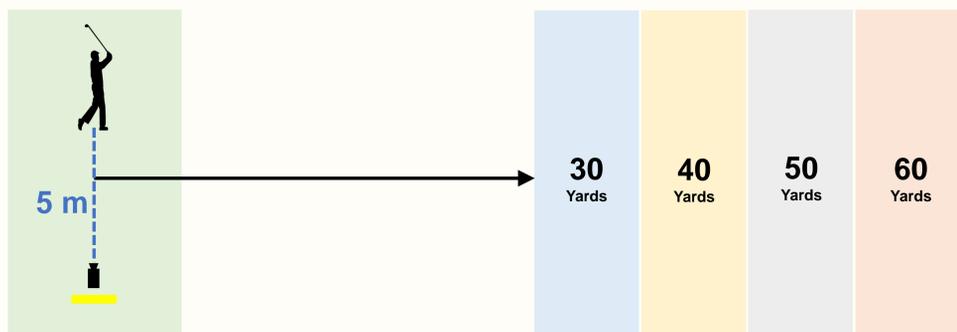


Figure 1. The experimental design.

- Automatic Digitisation was used within Quintic Biomechanics software (Coleshill, UK) to measure linear distances, velocities and accelerations of the grip, shaft and hosel, at varying phases of the golf swing, highlighted in figure 2.
- Ball speed and launch angle were also recorded.

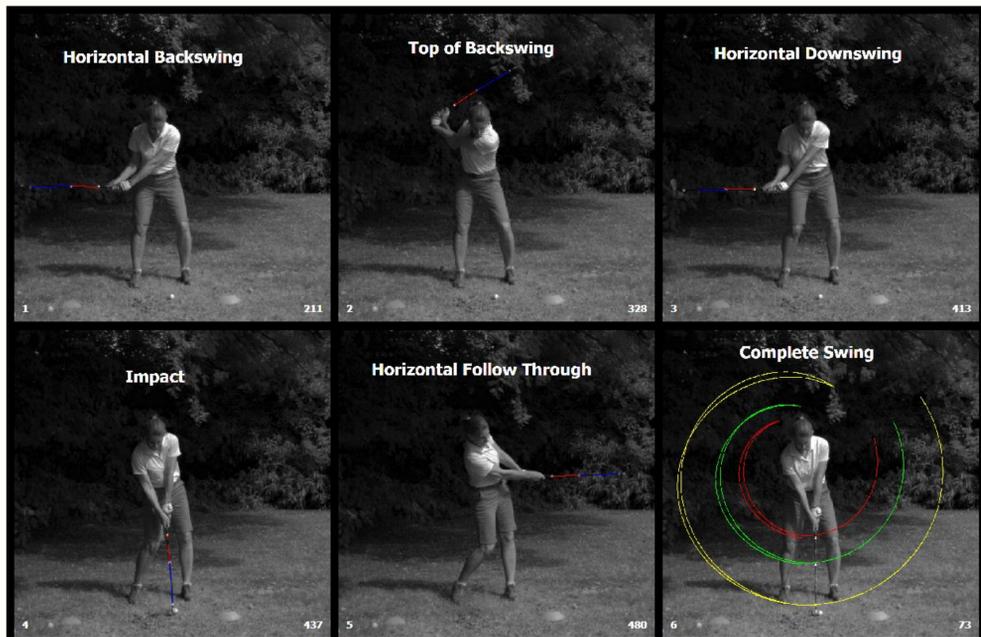


Figure 2. Shows the different phases of the golf swing that were measured, as well as the complete digitised swing

## Results

Table 1: Shows the average length of backswing (LB) in metres, Impact Club Speed (IS) in m/s, Impact Acceleration (IA) in m/s<sup>2</sup>, Ball Speed (BS) in m/s and Launch Angle (LA) in degrees of the three different clubs at 30, 40, 50 and 60 yards.

	30 yards			40 Yards		
	LW	SW	PW	LW	SW	PW
LB	1.82	1.58	1.25	1.99	1.79	1.65
IS	19.64	16.66	16.41	20.89	19.66	18.24
IA	-549	-727	-625	-508	-405	-746
BS	21.76	20.46	21.25	24.13	23.63	24.65
LA	39.70	35.36	30.88	37.36	42.50	32.54
	50 yards			60 Yards		
	LW	SW	PW	LW	SW	PW
LB	2.26	2.25	1.90	2.24	2.21	1.99
IS	26.25	24.96	20.60	25.83	24.03	23.10
IA	-325	-372	-821	-399	-394	-625
BS	26.83	28.49	26.69	29.67	30.10	30.79
LA	51.43	40.64	33.19	36.27	34.64	28.37

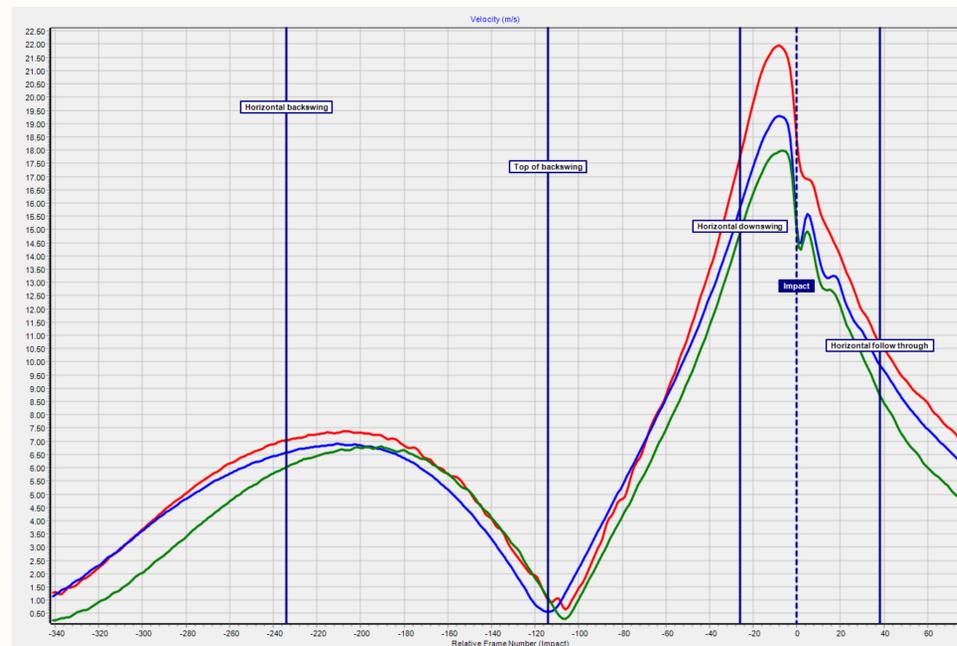


Figure 3: Shows the average velocity of the hosel throughout the swing, for the LW (Red), SW (Blue) and PW (Green) for the 30 yard distance.

## Discussion

- Impact Acceleration highlighted that all clubs were decelerating just before the moment of impact, shown in table 1.
- For every club, there was an increase in Ball Speed as the yardage increased.
- For the pitching wedge, this coincided with an increase in the Length of Backswing for the increasing yardage.
- From 30-50 yards there was also an increase in the LB for the lob and sand wedge, with both decreasing at 60 yards.
- Launch Angle decreased at 60 yards for both the lob and sand wedge, indicating the ball had a lower trajectory to gain the extra yardage required.
- **Conclusion** – There are multiple different ways to swing a golf club to ensure the correct yardage is achieved.