THE EFFECT OF CLUB DRIVER LENGTH UPON HIP, SHOULDER AND PELVIC MOTION IN GOLF

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The aim of this study was to examine the hip, shoulder and pelvic motion elicited by differing lengths of a golf driver (standard and overlength). Seven male golfers with a handicap ranging from 11 to 14 participated in the study. Clubs were fitted to each player and involved a standard length driver and an overlength driver that was 2 inches longer. A preliminary analysis of the data found no significant differences in the hip, shoulder and pelvic motion. Trunk lean, however, was found to be greater with the standard driver for the majority of the swing. This suggests that differences in the shaft length of a driver affects the motion of the trunk and spine.

KEY WORDS: low back injury, overlength driver.

INTRODUCTION: Amongst professional and amateur golf players, the majority of musculoskeletal injuries occur in the lower back or lumbar region of the spine (e.g. Sugaya et al. 1999). Research suggests this injury may be related to heightened motion of the trunk and spine. No research, however, has specifically compared the motion elicited by a standard length and overlength driver. It seems reasonable to put forward the hypothesis that a longer driver may increase trunk and spine motion. The aim of this study, therefore, was to directly compare the hip, shoulder and pelvic motion produced by differing driver lengths. This information is important in order to understand the stresses placed on the body by overlength drivers which have become popular amongst the golfing fraternity.

METHODS: Seven right-handed male golfers (age range: 27 to 54 years) with current handicaps ranging from 11 to 14 participated in this study. Each participant performed 6 drives with a comfortable standard golf driver (as measured for them) and 6 hits with an overlength golf driver which was 2 longer than the standard driver. Hitting began with the standard driver after which drivers were alternated. The driver heads were oversize or 250 cc and were made of stainless steel with a loft of 9.5 . The weight of the heads fell in the range of 201 to 202 grams. The shafts used were Microtaper regular stiff-flex manufactured by FM Precision. The grips were of a rubber type known as All Weather. Shafts and grips were modified to the size required by each participant. Shaft weights were 115 grams which is the standard weight recommended by the manufacturer. Titleist Professional 90 golf balls were used.

Participants hit the ball off a rubber tee (25 mm high) placed on a synthetic grass surface commonly used at driving ranges. The grass surface was placed on a large Rubber Industry Driving mat (refer to figure 1). Participants were dressed in firm fitting dark clothing. Spherical markers (2.5 cm diameter) were attached to the following body landmarks: (1) acromioclavicular joints of the shoulders; (2) anterior superior iliac crests of the pelvis; (3) C7 and S1 on the spine; (4) the ends of the distal phalanges of the 1st metatarsals (big toe); and, (5) the styloid process of the left ulna.

Four synchronised and genlocked Panasonic CCTV cameras (frame rate of 50 Hz; shutter rate of 1/500 sec) were used to record the golf swings. The camera set-up is shown in figure 1. A Peak Motus Motion Measurement System was used to extract the angular data. These data were filtered by a 4th order Butterworth digital filter with a cut-off frequency of 4 Hz. The angular data extracted from the video were: (1) the transverse rotation of the shoulders on the hips (shoulders-on-hips) where 180 is neutral or shoulders are in alignment with the hips; (2) the angle formed by a line drawn through the shoulders to a line drawn through the hips as shown in figure 2 (shoulder-hip incline) where 0 is neutral; (3) trunk lean where 0 is neutral or the trunk is parallel with the vertical laboratory-based axis; and, (4) the incline of the shoulders to the pelvic plane formed by the anterior superior iliac spine and S1 markers (shoulder-pelvis incline) where 0 is neutral; that is, when the line of the shoulders is parallel to the pelvic plane.

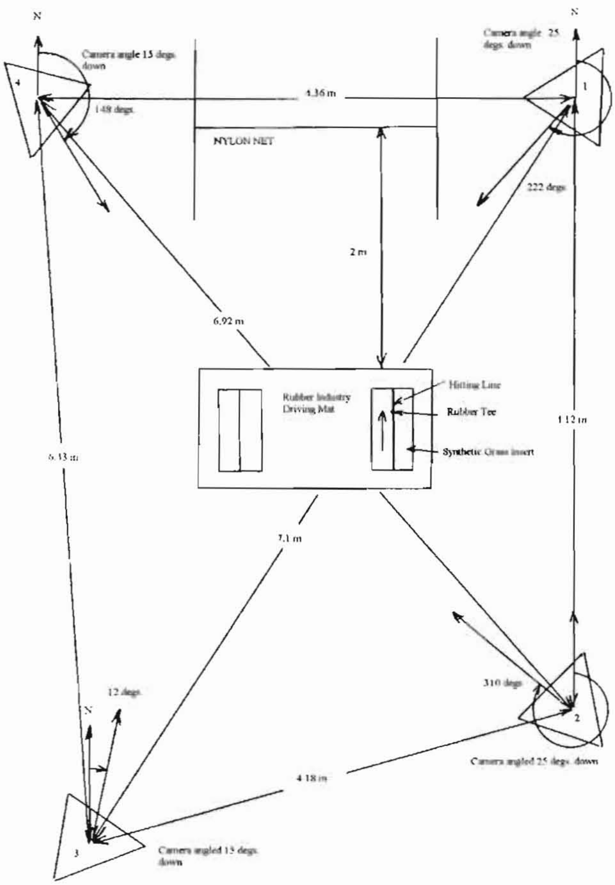

Figure 1: Schematic representation of experimental setup.

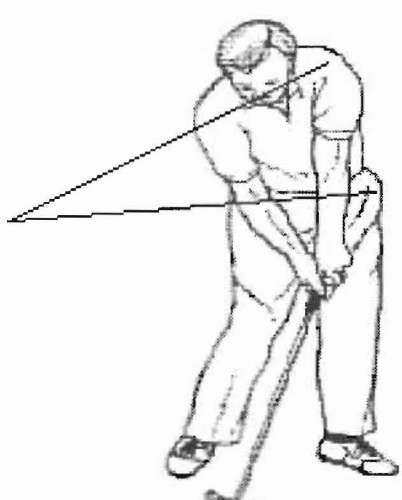

Figure 2: Pictorial representation of shoulder-hip incline.

RESULTS AND DISCUSSION: No significant differences in the angular motion were found. The angular displacement and angular velocity patterns of the drivers was similar. Interestingly, for the majority of the swing, trunk lean was greater for the standard length driver (refer to figure 3) but peak trunk lean and range of motion were similar (peak trunk lean: standard = 36.3 ; overlength = 36.5 ; range of motion: standard = 10.4 ; overlength = 11.7).

Table 1 Descriptive statistics for temporal measures.

Driver	Backswing (%)	Impact (%)	Swing Time (sec)
Standard	53.6 ± 2.1	72.0 ± 3.4*	1.78 ± 0.28
Overlength	53.1 ± 1.9	70.4 ± 5.2	1.80 ± 0.41

$*p < .05$

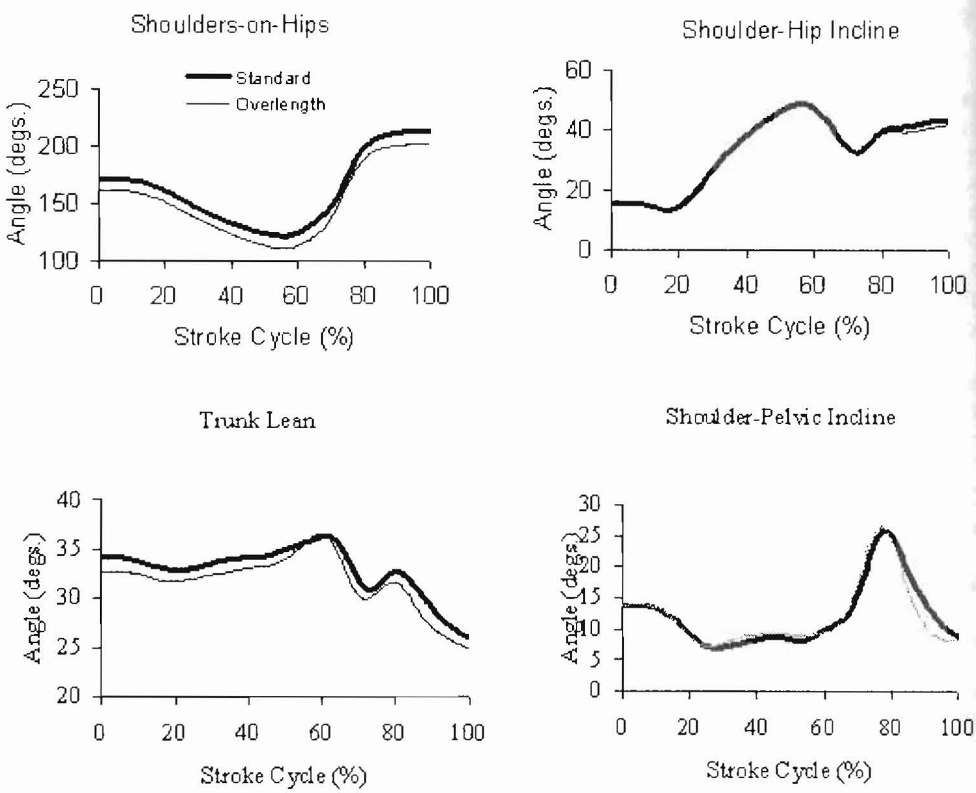

Figure 3: Ensemble average plots of hip and pelvic motion.

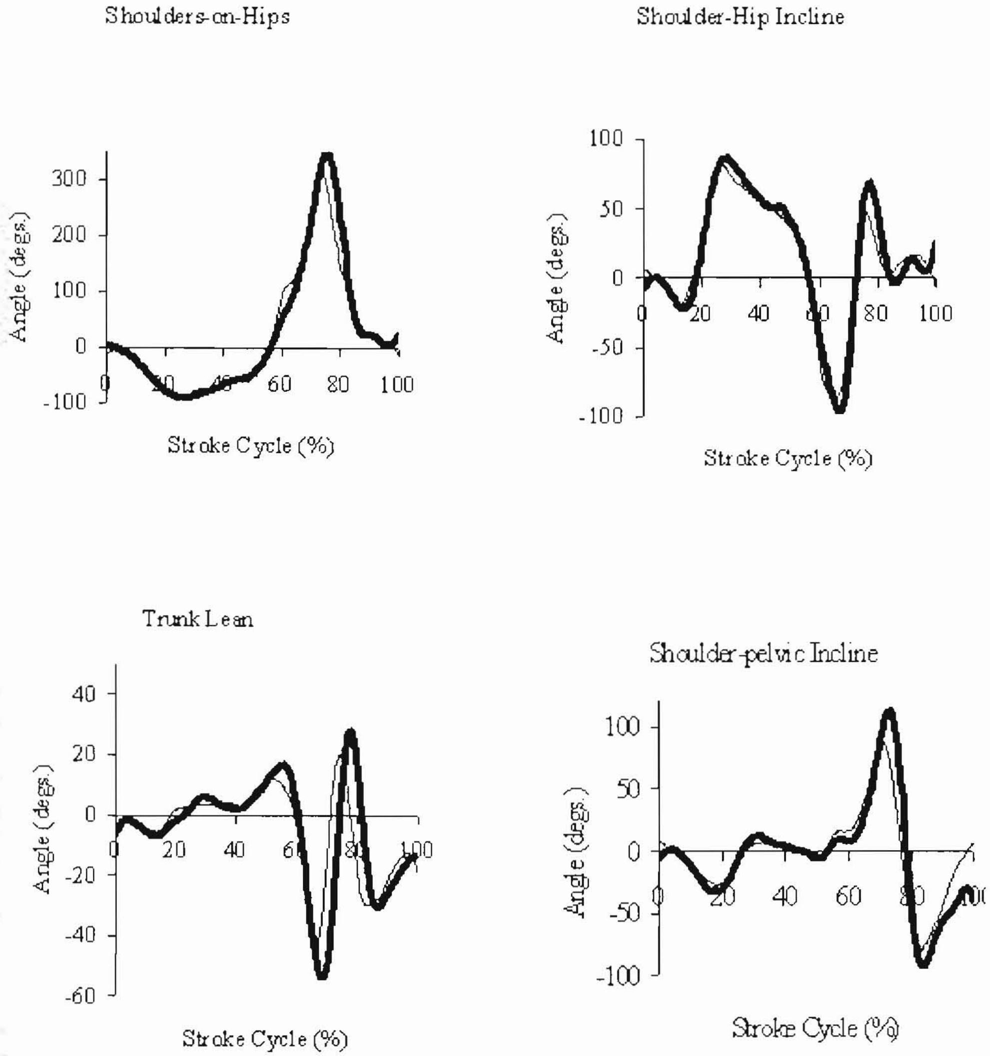

Figure 4: Ensemble average plots of shoulder, hip and pelvic angular velocity.

CONCLUSION: The results reported in this paper are preliminary. Further analysis may reveal individual differences in the motion of the shoulders, hips and pelvis when using drivers of differing length. The only conclusion to be drawn from these findings is that trunk lean is greater for a standard driver but range of motion is greater for an overlength driver. Both of these factors may contribute to lower back injury and require further investigation.

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