THE EFFECT OF VARYING CLUB HEAD MASS ON VELOCITY AND KINETIC ENERGY

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INTRODUCTION: Typically, the standard club head mass of a driver is 0.2 kg approximately (White 2006). The golfing governing bodies do not stipulate driver club head mass. Theoretically, an increase in club head mass will lead to an increase in momentum transfer, but it is thought the increased mass leads to a reduction in club head velocity which is a more important determinant of how far the ball travels. The present study investigated the effect of increasing driver club head mass on club head velocity and total kinetic energy applied to the club at the grip by means of a computer simulation.

METHODS: Kinematic data for one subject (25 yrs, 91.3 kg, +2 handicap) was collected using a 5-camera set-up (Motion Analysis Corp). The subject performed eight shots with his own driver. A LifeMOD computer model was constructed with 42 degrees-of-freedom. Kinematic data collected using MAC was used to drive the model inverse dynamics and forward dynamics simulations. Validation for this model was carried out for club head velocity (r=0.999), kinematics (r=0.983) and kinetics (for more details see, Kenny *et al.*, 2008).

RESULTS: Table 1 lists club head velocity and kinetic energy of the hand-club interface, at impact.

Table 1 Impact Velocity ms^{-1} and Total Kinetic Energy (J) Values at different club head masses

Mass (kg)	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	1.00
Velocity (m/s)	31.84	32.42	33.10	33.77	34.25	34.96	35.52	35.89	36.50	36.99	40.52
Kinetic Energy (J)	61.12	61.83	62.06	62.10	61.65	62.26	62.41	61.42	62.37	62.28	61.20

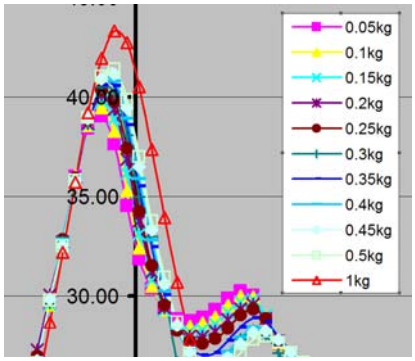

Figure 1: Club head velocities at impact – (y-axis indicates impact position)

DISCUSSION: The results show that for increased club head mass, there was an increase in club head velocity but no increase in kinetic energy applied by the hand on the club. Thus, these simulation results indicate that the increase in velocity was an equipment effect and not due to increased energy input from the subject.

CONCLUSION: This study identified that increasing club head mass can lead to increased club head velocity without increased energy input at the point where the hand grips the club. Further investigation is needed to ascertain if this holds true in "real" subjects.

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