THE POWER FLOW THROUGH THE SWINGING LIMB DURING AN INSTEP KICK IN SOCCER

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INTRODUCTION: Studies concerning soccer kicking have looked extensively at the kinetics (Nunome *et al*., 2001) involved with the skill. However, there remains a dearth of literature concerning the energetic transfer which occurs between the segments. Early work by Zernicke and Roberts (1978) used two dimensional kinematics and inverse dynamics to estimate the joint contact forces of the kicking limb. They proposed a 'flail' like movement pattern where the thigh is rapidly decelerated at the onset of knee extension, suggesting a large passive contribution to rapid knee extension. Putman (1983) developed further theories suggesting the motion of the shank segment affects thigh deceleration prior to ball contact.

Hip flexor and extensor muscle activity would intuitively answer some of the questions regarding the contribution of the thigh segment to kicking velocity. Dörge *et al*. (1999) monitored EMG activity of the iliopsoas during instep kicking, showing it has constant activity and suggesting deceleration of the thigh did not influence angular velocity of the shank. Accurate measurements of joint centres are required to determine inverse dynamics solutions and provide a good estimate of joint power. Joint power measures can then provide information on energy generation and dissipation, and transfer components by comparison of the instantaneous moment powers for adjacent segments. Therefore, this study aims to explain energetic transfer during kicking using net joint power calculations.

METHOD: Nine professional level soccer players with no recent injury or pathology were recruited. A Vicon 612 workstation with 12 cameras operating at 250Hz was used to define a movement space of 5m (long) x 2.5m (wide) x 3m (high). The laboratory door opens to permit the placement of a goal 11m from the stationary ball to simulate a penalty kick. A customised marker set and associated lower body model, based on that published by Besier *et al*. (2003), was developed by the School of Sport Science, Exercise and Health at the University of Western Australia. Subjects performed five penalty instep kicks to the lower central portion of the goal with their preferred striking foot. A five point polynomial extrapolation from one point before impact (Knudson and Bahamonde, 2001) will ensure no oversmoothing through impact. Data analysis will compare instantaneous moment powers for the adjacent segments during the kicking action to gain an insight into energetic transfer.

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