

## SYMMETRY IN FLUTTER KICKING IN SWIMMING

Shuping Li<sup>1,2</sup> and Ross Sanders<sup>1</sup>

<sup>1</sup>Centre for Aquatics Research and Education, PESLS, The University of Edinburgh, Edinburgh, United Kingdom

<sup>2</sup>Faculty of Physical Education, Hubei University, Wuhan, China

**KEY WORDS:** flutter kicking, movement pattern, swimming, symmetry

**INTRODUCTION:** The most efficient swimming comes when an athlete's stroke is symmetrical. However, research on symmetry in swimming kicking is lacking. The way of optimising performance for young learners is to develop and establish appropriate movement patterns. This process should begin from early in the development of the skill because inappropriate movement patterns may be difficult to change once they have become established by the individual as a preferred movement pattern (Sanders and Myers, 2005). The purpose of this study was to investigate symmetry of flutter kicking in swimming.

**METHODS:** Seven male children (mean age = 12.4 years, weight = 44.2 kg, height = 158.6 cm) who had at least one year previous swimming experience in swimming club) each performed (*how many trials?*) flutter kicks in a prone position at maximum pace for 10 metres. Both sides of their bodies were recorded at 50 fields per second by two synchronised underwater cameras (KY32 CCD, JVC Corporation, Japan). The cameras were on opposite sides of the pool at a distance of 7m from the subject. Their axes were perpendicular to the line of the swimmers' planes of motion and the field of view was equivalent to two body lengths to ensure that one complete kicking cycle was captured near the centre of the 10m test zone. The subject's joint centres were digitised using an APAS System (Ariel Dynamics Ltd., USA). Left and right sides were compared for one complete cycle for minimum and maximum angular displacements and timing measures of joints relative to each other and the start of the cycle. A cycle was defined as the interval between successive instants of highest ankle position.

**RESULTS:** Statistically significant ( $p < .05$ ) within subject differences between right and left sides in maximum, average range, and average angular displacements in both knee and hip for part of subjects indicated that young swimmers with at least one year experience of regular swimming in a swimming club had asymmetries in the prone flutter kick. Figure 1 exemplifies the asymmetry by showing the mean knee range of motion for right and left sides. Work is continuing to investigate the differences in timing and coordination.

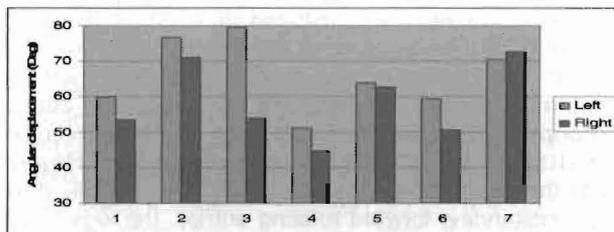


Figure 1 Knee angle range.

### REFERENCES:

Sanders R. and Myers, K. Convergence of kinematic characteristics of the prone flutter kick with increasing skill. (under review).