Kinematic Comparison of Dolphin Kicking Performed in a Prone and Supine Body Position

MICKEY B. SCHARBOROUGH, PETER E. ROBINSON, EMMA E. ALBIN, JUSTIN K. BROUSSARD, TAYLOR L. ADAMS, ERIKA R. DUBROS and SCOTT P. MCLEAN

Human Performance Laboratory; Department of Kinesiology; Southwestern University; Georgetown, TX

Category: Undergraduate

Advisor / Mentor: McLean, Scott (mcleans@southwestern.edu)

ABSTRACT

Underwater dolphin kicking has become an essential element in competitive swimming but little research has been performed to provide an understanding of this movement. PURPOSE: To examine hip and knee kinematics of prone and supine dolphin kicking as they relate to speed. METHODS: Six collegiate swimmers (1.77±0.07 m, 72.4±7.6 kg, 19.8±1.0 yrs) experienced with dolphin kicking completed six 10 m maximal effort underwater kicking trials; three trials in a prone position and three trials in a supine position. An underwater camera was calibrated using a projective scaling technique and subsequently used to record each trial at 60 Hz. Twelve body landmarks were digitized from the video recordings to determine whole body center of mass location and hip and knee joint angles. Data were filtered using a fourth order Butterworth low-pass digital filter with cutoff frequencies individually determined for each coordinate or each landmark. Linear velocity of the center of mass was computed using the first central difference method. Hip and knee joint ranges of motion (ROM) were compared between body positions using a 2x2 (joint x body position) repeated measures ANOVA. Kick rate (KR) and horizontal velocity of the center of mass were compared between body positions using a two-tailed dependent t-test. RESULTS: Neither horizontal velocity ($t(4)=0.308$, $p=0.774$) nor kicking rate ($t(4)=0.371$, $p=0.730$) were different between body positions (Table 1). ROM was significantly greater in the knee than the hip ($F(1,4)=110.967$, $p<0.001$, $\square^2=0.965$). ROM was not affected by body position ($F(1,4)=1.068$, $p=0.36$, $\square^2=0.211$). ROM did not interact between joint and body position ($F(1,4)=1.461$, $p=0.818$, $\square^2=0.015$). CONCLUSION: Despite some recent suggestions that a supine dolphin kick may be more effective than a prone dolphin kick, no kinematic difference were observed in this sample of swimmers.

Table 1. Dolphin Kicking Kinematics.

	PRONE	SUPINE
KNEE ROM (degrees)	69.7±4.5	73.6.7±6.7
HIP ROM (degrees)	37.7±8.3	40.5±9.0
HORIZONTAL VELOCITY (m/s)	1.82±1.13	1.80±1.04
KICK RATE (kicks/min)	135.0±71.9	136.4±67.3