METHODS: Ten collegiate swimmers (1.77±0.07 m, 72.4±4.7 kg, 19.8±1.0 yrs) experienced with dolphin and flutter kicking completed eight 10 m maximal effort underwater kicking trials. Body position and kicking style were randomly varied between trials such that half of all trials were performed using each kicking style and each body position. A calibrated underwater camera was used to record each trial at 60 Hz. Six body landmarks were digitized for three complete kicking cycles to determine linear and angular kinematic measurements. Whole body speed was defined as horizontal hip velocity. Kicking amplitude and frequency were determined using vertical toe movements. The Strohal number, a dimensionless index related to the efficiency of underwater undulatory movement, was computed using the kicking amplitude, frequency and velocity. Kinematic data were filtered using a fourth order Butterworth low-pass digital filter with cutoff frequencies individually determined for each coordinate. Linear velocities were computed using the first central difference method. Kinematic measures were compared between kicking style and body positions using a 2x2 (kick x position) repeated measures ANOVA.

RESULTS: Dolphin kicking velocity (1.22±0.18 m/s) was faster (p<0.001, η²=0.88) than flutter kicking velocity (0.99±0.12 m/s). Dolphin kicking amplitude (0.58±0.10 m) was larger (p<0.001, η²=0.93) than flutter kicking amplitude (0.48±0.08 m). Dolphin kicking frequency (1.85±0.34 Hz) was lower (p=0.002, η²=0.68) than flutter kicking frequency (2.33±0.33 Hz). Dolphin kicking (0.88±0.12) was more efficient as indicated by a lower Strohal number (p=0.001, η²=0.71) than flutter kicking (1.11±0.21). Body position had no effect on any measure of kicking performance (p>0.05).

CONCLUSION: For these participants, dolphin kicking was a faster, more efficient form of underwater movement. However, body position had little effect on the ability of these participants to perform the respective kicking style.