

## **Investigating the Effect of Hand Position on Hand Force and Rotation Time When Performing a Freestyle Flip-Turn**

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### **ABSTRACT**

Havriluk (2004) found that an increase in hand force will increase a swimmer's velocity. While the effect of hand force on a swimmer's velocity has been studied, the forces produced by the hands as well as the effect of forearm position on hand force production during a freestyle flip-turn has not been investigated.

**PURPOSE:** To investigate the effect of forearm orientation on freestyle flip-turn performance.

**METHODS:** A convenience sample of ten experienced swimmers (6 Female, 4 Male,  $20 \pm 1.15$  years) was recruited to participate. Prior to data collection, participants completed an accommodation session to familiarize them with the techniques and protocol. Freestyle flip-turns were performed with both a swimming approach and a kicking only approach under two forearm position conditions: (1) pronated so that the palms faced upward and (2) supinated so that the palms faced downward. Rotation time in the turn, defined from initial downward movement of the feet prior to the turn to the instant the feet contact the wall, was measured using underwater video collected at 50 Hz during the trials using a swimming approach. Peak hand force was measured using a differential pressure transducer system (Aquanex, Inc.) during the trials using a kicking approach. A paired samples t-Test was used to compare rotation time between hand conditions. Hand force data were analyzed using a 2x2 (forearm position x hand) repeated measures ANOVA. **RESULTS:** The mean (sd) rotation times were 0.849 (0.075) s and 0.885 (0.094) s for the pronated condition and supinated condition, respectively. Rotation time was significantly faster under the pronated condition ( $p = 0.046$ ). The mean (sd) peak force measurements were 6.76 (3.02) lbs, 5.67 (2.82) lbs, 4.82 (2.41) lbs, and 4.60 (2.51) for the left and right hand under the pronated and supinated condition, respectively. No significant main effect on hand force was found for forearm position ( $p = 0.146$ ), and hand ( $p = 0.071$ ). No significant interaction was found between forearm position and hand ( $p = 0.300$ ). **CONCLUSION:** This study provides novel evidence that performing a freestyle flip-turn with the hands in the pronated position will lead to a faster rotation time and that there is no significant effect of hand position on hand force production during a freestyle flip-turn. As a majority of the participants felt more comfortable performing freestyle flip-turns with their hands in the pronated position, it is possible that additional accommodation to the novel technique is required to comfortably perform freestyle flip-turns with supinated forearms.