Knee Extension and Flexion Strength in Recreational Surfers

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Abstract

Background: A trend for increased leg strength in the leg positioned in the back compared to front of the surfboard has been reported previously in a study with limited sample size. This preliminary data suggests that an asymmetry may exist in surfer's leg strength and that this may be influenced by surfer's stance on the surfboard. **Purpose:** The purpose of this investigation was to test the hypothesis that leg strength in surfers, as assessed by isokinetic knee extension and flexion at contraction velocities ranging from 60-300deg/sec, would be greater in the leg positioned in the back compared to front of the surfboard. **Methods:** Forty-four recreational surfers (5 female, 39 male) with a mean age of 41.0±2.1yrs participated in this study. Leg dominance was assessed in all subjects using a ball kicking task prior to measurements of strength. Single leg isokinetic knee extension and flexion strength was measured in both legs using an isokinetic dynamometer (Biodex, System 3). Following a five-minute warmup on a cycle ergometer (Monark), subjects performed five repetitions of maximal knee extension and flexion at contraction velocities of 60, 120, 180, 240, and 300deg/sec. A thirty-second recovery period was provided between each contraction velocity. **Results:** All subjects reported surfing to be their primary form of physical activity with 8.8±0.8hrs/wk and had 23.9±2.2yrs of surfing experience. There were no significant differences in torques between legs for knee extension (60deg/sec: 141.4±5.3 vs. 150.1±5.9, 120deg/sec: 107.2±4.2 vs. 109.8±4.7, 180deg/sec: 84.4±3.8 vs. 87.2±3.7, 240deg/sec: 71.7±3.5 vs. 72.2±3.6, 300deg/sec: 61.2±3.4 vs. 63.0±3.5ft-lbs) and flexion (60deg/sec: 86.8±3.5 vs. 87.2±3.4, 120deg/sec: 72.1±2.9 vs. 72.3±2.7, 180deg/sec: 62.1±2.6 vs. 62.3±2.5, 240deg/sec: 56.3±2.6 vs. 56.5±2.4, 300deg/sec: 49.0±2.4 vs. 49.2±2.5ft-lbs) across all contraction velocities. **Conclusions:** Contradictory to previously reported data, the current results suggest that recreational surfers' leg strength is not influenced by surfing stance.

Background

- Surfing has evolved from a counter-culture activity into a multi-billion dollar sport (Lazarow, 2008).
- Wave riding is the most important component of surfing which consist of popping up from a prone position to the feet and maneuvering the board with coordination and leg strength (Young, 1985, Mendez-Villanueva, 2005, Bruton, 2013).
- A preliminary study in surfers reported a trend for increased leg strength in the leg positioned in the back compared to the front of the surfboard, which suggests that an asymmetry may exist in surfers leg strength and this may be influenced by surfer's stance on the surfboard (Baron, 1990).

Purpose

The purpose of this investigation was to test the hypothesis that leg strength in surfers, as assessed by isokinetic knee extension and flexion at contraction velocities ranging from 60-300deg/sec, would be greater in the leg positioned in the back compared to front of the surfboard.

Methods

Subjects:

- Forty-four recreational surfers (5 female, 39 male) age 19-65 participated in this study.
- Primary form of exercise documented was surfing.
- Consent, health history questionnaire, and surfing history forms were filled out by subjects.

Protocol:

- Leg dominance was assessed in all subjects using a ball kicking task prior to measurements of strength.
- Single leg isokinetic knee extension and flexion strength was measured in both legs using an isokinetic dynamometer (Biodex, System 3). Following a five-minute warmup on a cycle ergometer (Monark), subjects performed five repetitions of maximal knee extension and flexion at contraction velocities of 60, 120, 180, 240, and 300deg/sec. A thirty-second recovery period was provided between each contraction velocity.

Statistical Analysis:

- Knee flexion and extension torques at various contraction velocities were analyzed using a repeated measure analysis of variance (ANOVA**).**
- A paired t-test was generated to compare peak torques between front and back legs at each contraction velocity for flexion and extension.
- Statistical Significance was set at $p < 0.05$. All data is presented as mean ± SE.

Overall Results

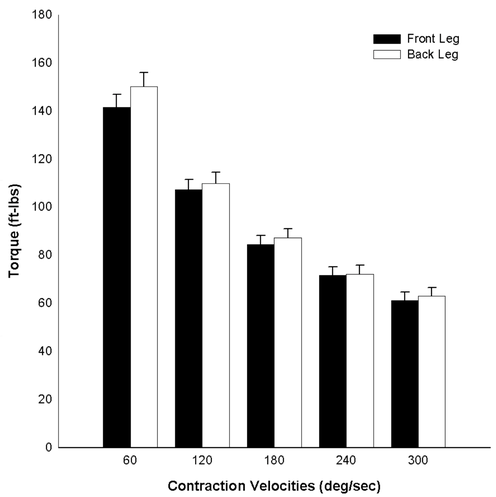

Figure 1. Peak knee extension torque of front vs. back leg at multiple contraction velocities.

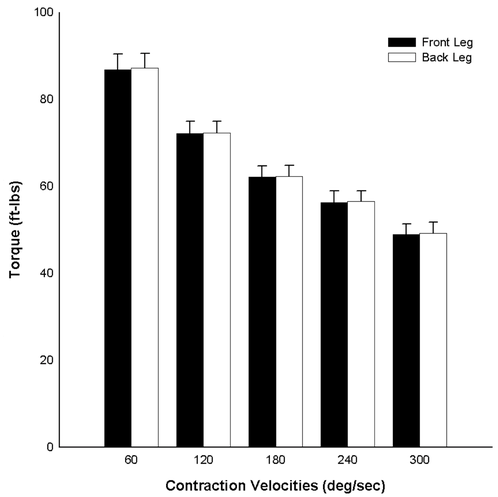

Figure 2. Peak knee flexion torque of front vs. back leg at multiple contraction velocities.

Subgroup Results

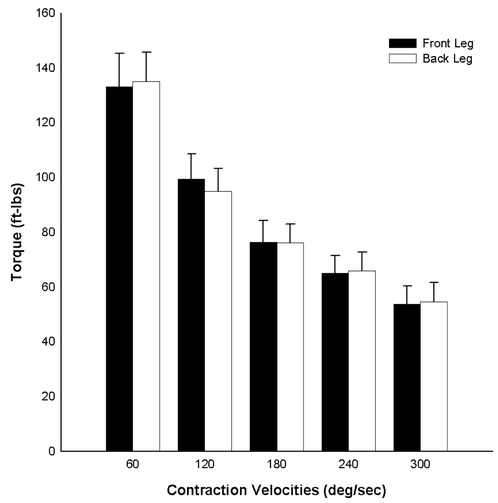

Figure 3. Peak knee extension torque of front vs. back leg for subgroup where dominant leg was not the back leg at multiple contraction velocities.

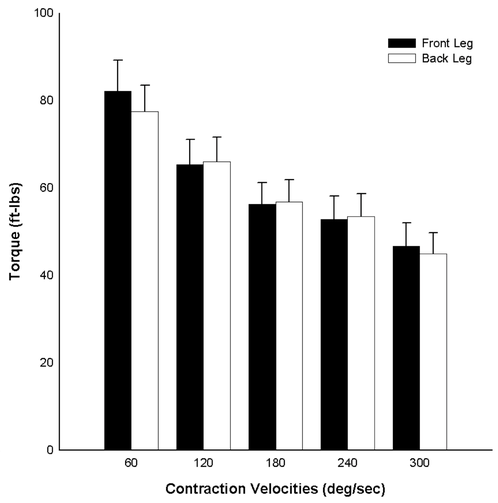

Figure 4. Peak knee flexion torque of front vs. back leg for subgroup where dominant leg was not the back leg at multiple contraction velocities.

Characteristic Results

	Male		Female		Total	
Sex (# of subjects)	39		5		44	
Age (years)	39.9±2.3		49.6±2.3		41.0±2.1	
Height (m)	1.80±0.01		1.67±0.03		1.79±0.01	
Body Weight (kg)	80.6±1.8		62.0±4.3		78.5±1.9	
Body Fat Percentage (%)	15.3±0.9		24.9±2.1		16.4±0.9	
BMI (kg/m²)	24.9±0.5		22.1±1.0		24.6±0.5	
Kicking Leg (# of Subjects)	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**
	36	3	5	0	41	3
Stance (# of Subjects)	**Regular**	**Goofy**	**Regular**	**Goofy**	**Regular**	**Goofy**
	27	12	2	3	29	15
Surfing Experience (years)	25.2±2.4		13.8±4.4		23.9±2.2	
Time Spent Surfing (hrs/week)	8.8±0.8		9.5±1.9		8.8±0.8	

Table 1. Summary of subject characteristics expressed in mean ± SE.

Conclusions

- There were no significant differences in torque between the front and back leg for knee extension in a subgroup of subjects whose back leg was not their dominant leg (Figures1 & 3).
- There were no significant differences in torque between front and back legs for knee flexion across all contraction velocities (60-300deg/sec) (Figures 2 & 4).
- Contradictory to previously reported data, the current results suggest that recreational surfers' leg strength is not influenced by surfing stance.

References

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Acknowledgements

We would like to acknowledge the students of the California State University, San Marcos Kinesiology 326 class for their help in data collection and the surfers who participated in our research study.