Coaching Applications

Seasonal Variations in Swimming Force and Training Adaptation

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Abstract

Gauging the optimal workload is a challenge for swim coaches. This study was designed to address whether seasonal hand force variations provide information for adjusting the workload to maximize the training effect. Nine national caliber swimmers from a team known for training with a substantial workload participated in the study. The swimmers were tested seven times over an eight month season. The average hand force over a 10 m swim at maximum swimming velocity was calculated for each trial. Each swimmer had a depressed hand force value in the middle of the season as compared to the baseline at the beginning of the season. Each swimmer's force value was elevated at the end of the season as compared to the middle of the season. However, only five of the nine swimmers (55%) had a higher force value at the end of the season as compared to the baseline. The results suggest that a workload that is too severe (because of training distance and/or intensity) may not allow swimmers to recover enough to improve performance. Periodic hand force testing can provide feedback about training adaptation, both to optimize performance and minimize the risk of illness and injury.

Introduction

A basic objective in training swimmers is to elicit a response that improves performance. To accomplish that goal, programs generally increase the workload (training distance and intensity) throughout most of the season and then decrease the load at the end of the season. However, even the most conventional training plan can have a variety of outcomes. Periodic information about how swimmers respond to training (so that adjustments can be made) is essential to ensure an optimal result.

Because of the relationship of hand force and swimming velocity, a test of hand force can indicate the status of a swimmer's readiness to perform. The test can be administered quickly and is completely specific to performance. As the standard test protocol requires only a maximum effort for 10 m of swimming, factors like motivation are less likely to impact test results. This study was designed to address the question: Can hand force variations over a season provide information for adjusting workload to maximize the training effect?

Methods

Nine national caliber swimmers from a team known for training with a substantial workload participated in the study. The swimmers were tested with the standard Aquanex protocol while swimming freestyle (Figure 1) during seven trials over an eight month season. Tests were conducted in December, January, February, March, May, June, and July. Average hand force over a 10 m swim at maximum swimming velocity was calculated for each trial.

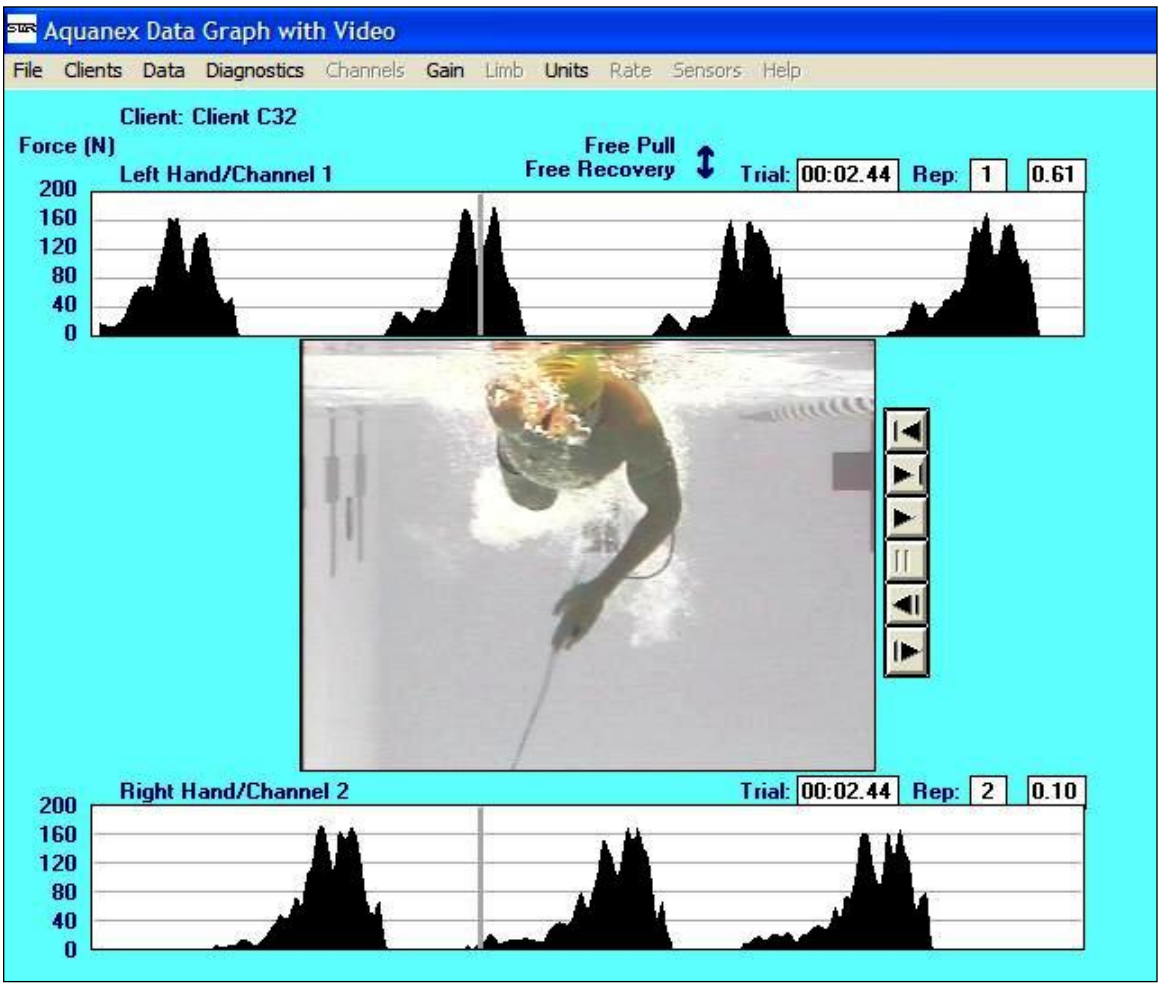

Figure 1. Hand force curves for a freestyle trial using the Aquanex protocol. The vertical gray lines on the graphs are synchronized with the video image.

Results

The highest average hand force from the December and January tests was used as the baseline value (early season). The lowest average force from the February, March, May, or June tests was used as the value for the heaviest workload (middle season). The average force from the July test was used as the taper value (late season). The three seasonal values for all nine swimmers are graphed in Figure 2.

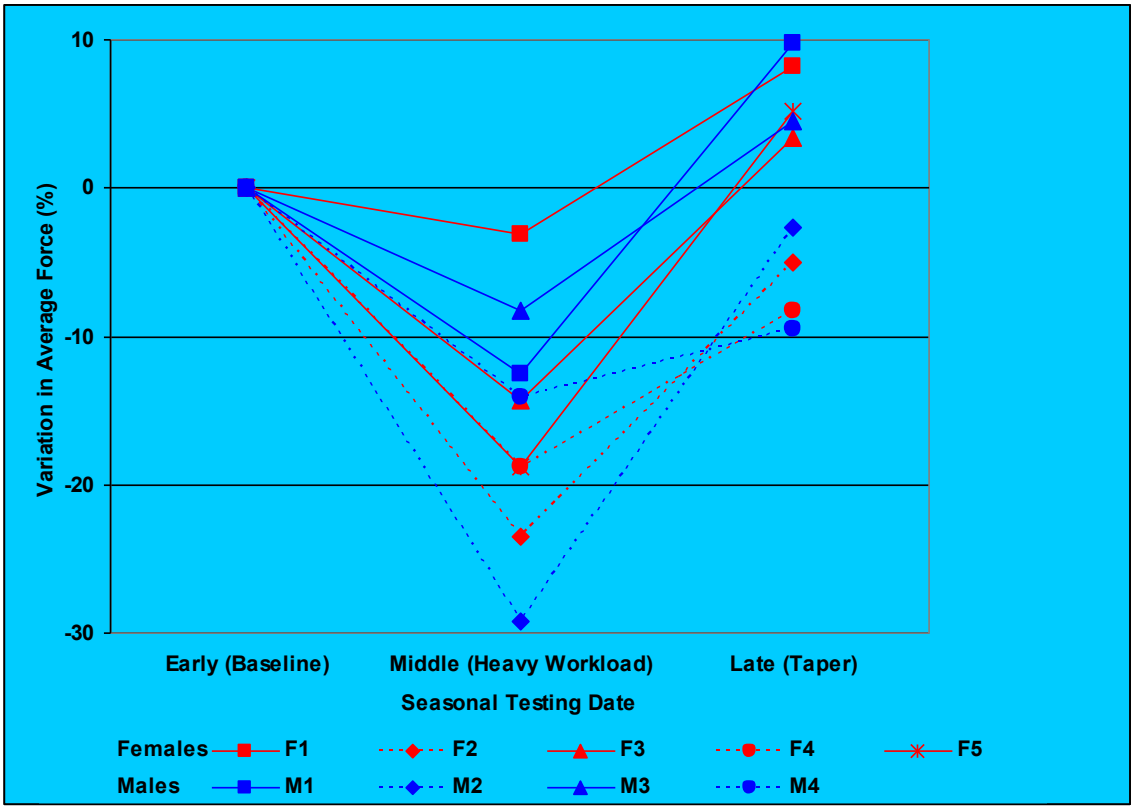

Figure 2. Variation in average hand force values by seasonal testing date for all nine swimmers. The solid lines connect data points for swimmers that had taper values greater than baseline. The dotted lines connect data points for swimmers with taper values lower than baseline.

Each swimmer had a depressed hand force value in the middle of the season as compared to the baseline at the beginning of the season. Each swimmer's force value was elevated at the end of the season as compared to the middle of the season. However, only five of the nine swimmers (55%) had a higher force value for the taper as compared to the baseline.

Discussion

The depressed hand force values in the middle of the season are consistent with the heavy workload. It was expected that swimmers would be able to generate less force during the heaviest training phase. The increase in force from middle season to taper is consistent with the reduced workload and was also expected. However, the comparison of the taper values with the baseline shows that only about one-half of the swimmers (5 of 9) had taper values greater than baseline. Only taper values above baseline are consistent with the goals of an effective training program.

The results suggest that a workload that is too severe (because of training distance and/or intensity) may not allow swimmers to recover enough to improve performance. A more moderate training effect may have benefits other than performance. In addition to less chance of illness and injury, swimmers with less

depressed force values during the middle of the season can be more competitive in swim meets other than the championship at the end of the season. Swimmers with more of an ability to generate force during the season will probably be healthier and faster for competitions throughout the entire season.

Conclusion

Periodic hand force testing can provide feedback about training adaptation. If the force value is depressed from baseline by less than 10% during the heaviest seasonal workload, continuation of the training plan seems appropriate. If the force value is depressed by more than 10%, an increase in testing frequency is warranted. If the force value continues to drop, an adjustment in workload may be appropriate. If the force value is depressed by more than 20%, an immediate reduction in workload, a complete (although temporary) cessation in training, or even a medical evaluation may be necessary. A regular hand force testing program can help to optimize training adaptation and performance, while minimizing risk of injury and illness.