AN ANALYSIS OF SWIMMING RELAY CHANGE-OVERS AT THE 2008 BEIJING GAMES – WHAT FACTORS INFLUENCE A GOLD MEDAL PERFORMANCE?

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INTRODUCTION

The relay is the only event in competitive swimming where an athlete has the opportunity to compete in a single event as part of a team. The performance of the relay at the Olympic and Paralympic games is often regarded as the measure of swimming performance depth for a particular nation, and success in the relay is considered to have a positive influence on the psyche of a nation's competing swimmers. A key rule difference in a relay change-over, as compared to an individual swim start, is that the change-over swimmer is permitted to move on the blocks (but must not leave the block until the previous swimmer has touched the wall). Due to numerous individual starts, the swimmer is well skilled in the movement pattern for a stationary swim start – but the optimal movement pattern for a moving relay change-over is more uncertain. In addition, the ability to move prior to the start of the race should enable the swimmer to generate a quicker time to 15 m. The aim of this research was to firstly measure the kinematic and kinetic components of the start in a relay change-over. Based on this information the pattern of movement for the relay change-over was used to enhance performance. Finally, the official relay change-over times were compared from performances at the 2008 Beijing Games.

METHODS

Kinematic and kinetic swim relay changeover data were collected at the Australian Institute of Sport aquatic centre over a series of national training camps. The incoming swimmer hitting the touch pad was used as the trigger to initiate the start for the outgoing swimmer. Four 100Hz progressive scan, Gigabit Ethernet, genlocked cameras, placed in the sagittal plane (one above and three below water level) were utilized to collect the kinematic data. The cameras were synchronized with the kinetic data using custom built software. The kinematic and the kinetic data were collected from one second prior to the starting trigger for 11 seconds. The kinetic data were collected from a purpose built force plate located on the swim block which was synchronized with the touch pad placed in the water and the magnetic timing gates. This enabled block time (gun time to departure from block), flight time, entry distance, underwater time and distance, and free swim time and distance to be accurately measured.

Descriptive statistics were presented for the relative time and distance components. Time, distance and velocity components were analyzed for reliability using intra-class coefficients. Between group differences were analysed using ANOVA, where Kendall's rank correlation coefficients were used to investigate the relationship between components of the relay change-over.

RESULTS AND DISCUSSION

Analysis of international swimming competitions has found the mean block time to be 0.76 s. In a relay change-over this time reduces to a mean value of 0.24 s (Table 1). By manipulating the movement pattern on the start blocks for a relay change-over (by comparing typical starts, utilising arm movements, a typical start plus step, or a combination of all), this has reduced the block time together with generating a higher flight velocity (Figure 1). This also resulted in a quicker start to 15 m time. These adaptations occurred for each individual change-over, and when cumulated for the three change-overs resulted in a faster leg and overall relay race time as compared to individual events.

Table 1: Official block time (s) from 2008 Beijing Games

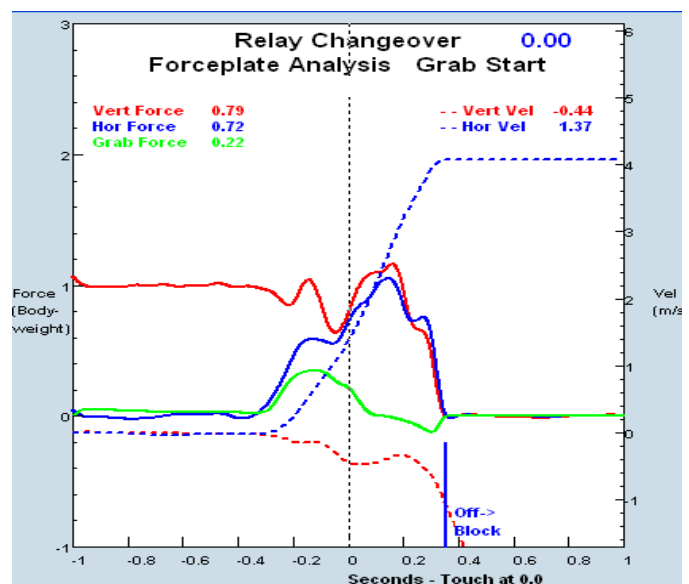|	Women Olympics		Men Olympics		Men Paralympics	
	First	Relay	First	Relay	First	Relay
Avg	0.77	0.22	0.74	0.18	0.77	0.34
SD	0.05	0.08	0.06	0.11	0.11	0.16
Min	0.68	0.06	0.64	0.00	0.68	0.13
Max	0.84	0.37	0.85	0.38	0.95	0.71

Figure 1: Typical time and force profile for relay change-over.

CONCLUSIONS

The information obtained from this start analysis system provided essential feedback to enhance performance for a moving relay start in competitive swimming.

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