Sebastian Fischer | Armin Kibele (Eds.)

contemporary swim start research

Conference Book: Young Experts' Workshop on Swim Start Research 2015

MEYER & MEYER SPORT

Sebastian Fischer & Armin Kibele (Eds.)

Contemporary Swim Start Research

To Gunnar, Johan, and Julien,
who could not attend the conference!

Sebastian Fischer & Armin Kibele (Eds.)

CONTEMPORARY SWIM START RESEARCH

Conference Book: Young Experts' Workshop

on Swim Start Research 2015

Meyer & Meyer Sport

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Contemporary Swim Start Research
Maidenhead: Meyer & Meyer Sport (UK) Ltd., 2017
ISBN 978-1-78255-783-8

1st edition 2017
Auckland, Beirut, Dubai, Hägendorf, Hong Kong, Indianapolis, Cairo, Cape Town, Manila, Maidenhead, New Delhi, Singapore, Sydney, Tehran, Vienna

Member of the World Sport Publishers' Association (WSPA)
www.w-s-p-a.org
ISBN: 978-1-78255-783-8
E-Mail: info@m-m-sports.com
www.m-m-sports.com

Contents

Preface

This book includes contemporary studies on swim starts conducted by young scientists from around the world. The various topics relate to individual starts from the block, backstroke starts, and relay starts highlighting different aspects and phases of the corresponding movement behavior.

Most of the studies published in this book have been presented during the 2015 Young Experts Workshop of Swim Start Research supported by the Federal Institute of Sport Science in Germany.

Acknowledgments

The conference on which this book is based on was financially supported by the Federal Institute for Sport Science in Germany.

CHAPTER 1:

HOW IMPORTANT IS THE UNDERWATER PHASE TO ELITE SWIMMING START PERFORMANCE?

Elaine Tor, Victoria University, Australia

Introduction

> *The swimming dive start is a complex movement involving the reaction to a stimulus; the coordination of explosive movements of the arms, trunk, and legs to propel the body forward with maximum velocity; and the ability to maintain a streamlined position to minimize the loss of horizontal velocity in the water (Guimaraes & Hay, 1985). The international rules of swimming dictate that swimmers must resurface from the underwater phase before the 15m mark following starts in all strokes except for breaststroke (FINA, 2010). Total start time for elite swimmers is typically between six to eight seconds and is the time from the starting signal to when the center of the swimmer's head reaches the 15m mark (Cossor & Mason, 2001).*

The start phase is typically broken into three phases for analysis: on-block, flight, and underwater. A number of start techniques have been examined in the literature as a result of new techniques being developed and changes in the start block itself. With the introduction of the Omega OSB11 starting blocks to international competition, many swimmers are now using a new kick-start technique during competition. The new start block surface consists of two components: the main platform, which is angled at 10 degrees; and an adjustable back plate, foot rest, or kick plate, which is angled at 30 degrees to the main deck. The latter can be moved through five consecutive steps of 35 mm that start 350 mm from the front edge of the block. The performance differences between the 'kick-start' technique and earlier styles (such as the track start, grab start, and swing start) mean that previous start literature may not be relevant to what swimmers are currently employing during competition. Research concerning the on-block and flight phase of the kick start has established that utilizing the kick plate would allow swimmers to generate larger horizontal take-off velocities, which translate into faster start performances (Honda et al., 2010). The contribution of the underwater phase of the kick start has also been evaluated and found to be important to overall start performance, particularly the trajectory adopted by the swimmer to reduce the amount of drag acting on the swimmer (Tor et al., 2015c).

The start in swimming is crucial to performance in competition. Hence, this chapter will summarize start literature and distinguish characteristics of the elite swimming kick-start with particular emphasis on the underwater phase. The underwater phase—the longest phase of swimming—has been identified as the most important part of the start and is the point at which the swimmer is travelling the fastest through the water. A number of different aspects of the swimming start's underwater phase will also be explored. This phase contributes to guidelines for the ideal underwater trajectory swimmers should adopt to reduce the amount of drag acting on them.

Background

Importance of the Swimming Start

Start times have been shown to be influential to overall performance during competition, contributing between 1-26% of total race time depending on the distance of the event (Lyttle & Benjanuvatra, 2005; Mason et al., 2007; Tor et al., 2014b). Race analysis at the 1998 World Swimming Championships in Perth showed high correlations between start time and overall performance, particularly in events 100 m or less (Mason, 1999). Further, in correlational analysis of nine international competitions over a seven-year period, Robertson et al. (2009) observed that fast starts were the most successful strategy in shorter events for improving performance. Additionally, Girold et al. (2001) found that for the women's 200 m freestyle, the first 50 meters of the race was the most important variable for medalists at the Sydney Olympics. Subsequently, any small improvements in time gained during the start phase of the race can be advantageous to many elite swimmers, as they may result in significant improvements to overall competition performance (Breed & McElroy, 2000).

Figure 1. Omega OSB11 Starting Block.

The Kick-Start Technique

After the 2008 Beijing Olympics, a new start block (see: Figure 1) was introduced to all international competition (Honda et al., 2010). Despite research on the new start technique being scarce, studies that have compared start styles to the kick start have suggested the use of the new technique is advantageous (Barlow et al., 2014; Biel et al., 2010; Honda et al., 2010; Nomura et al., 2010; Takeda et al., 2013) This advantage is due to Omega's claiming that the kick plate enables the swimmer to push-off with a rear knee angle of 90°, which allows for optimal force production. As a result of the perceived benefits, this start is now used by most swimmers during competition.

The start position configuration of the kick start has also been studied. Honda et al. (2012) investigated block position by testing kick-plate position and changing the position of the swimmers' weight prior to leaving the block. In testing the theory on elite swimmers, it was found that a neutral-weighted to slightly rear-weighted kick start on the swimmers' preferred kick plate setting was the best combination to produce the best dive performance (Honda et al., 2012). However, as swimmers were asked to perform an unpreferred technique, results may have been skewed in favor of the swimmers' preferred technique. Consequently, future start studies should take into account the swimmers' preferred technique.

Comparisons between kick-start and track-start performance has also been previously examined. Murrell and Dragunas (2013) compared the kick-start technique to the grab start and found that the newer start was faster to 2 m on all occasions. This study contained low subject (n = 4) numbers, did not allow swimmers to place the kick plate at their desired positions and only used time to 2 m not time to 15 m (the normal criterion for start performance). Similarly, Honda et al. (2010) found that the kick start was faster than the track start to 5 and 7.5 m. This was due to a faster block time and greater horizontal impulse. However, this study assessed dive performance using a dive and glide technique to eliminate the influence of other underwater variables, potentially changing the results when full dive performance to 15 m was assessed. While a number of different study designs were used to investigate the kick start, it is clear that the kick start is advantageous to overall start performance if used correctly.

Phases of the Swimming Start

The start phase can also be broken into three phases: on-block, flight, and underwater (Cossor & Mason, 2001; Elipot et al., 2009; Hay, 1986; Thow et al., 2012). The on-block phase is typically defined as the time between the starting signal and the time when the swimmer's feet leave the blocks. The flight phase begins when the feet leave the block and ends when the swimmer's head makes contact with the water. Finally, the underwater phase is defined as the interval between the head's contact with the water and the head resurfacing.

On-Block Phase

The on-block phase is the time from the starting signal to the moment when the swimmer's toe leaves the block (Guimaraes & Hay, 1985; Issurin & Verbitsky, 2002; Ruschel et al., 2007). Total on-block time is a combination of reaction time (the interval between the starting signal and the first movement on the block) and movement time (Garcia-Hermoso et al., 2013). However, there has been some evidence that this phase changes depending on the swimmer's specialty event.

Regardless of event, a faster block time has been shown to directly relate to improvements in overall start performance (Garcia-Hermoso et al., 2013; Vantorre