Chapter-V

Summary, Conclusion And Recommendation

SUMMARY:

Historically swimming is as old as ancient mythology but for practical purposes a review of progress over the last 50 years all that is necessary. During this period methods of water progression has changed remarkably, each change in stroke is signalized a corresponding increase in speed 50 years ago the breast stroke was in general used for all purposes including racing. Then overhand sidestroke was discovered.

Thirty years ago the topic of discussion was whether a man would ever swim 100 meters within 60 sec. skeptics and there were many skeptics in those days asserted that it was beyond men’s physical powers ‘to break the one minute barrier for the century’, now the 100 meters record stands 47.84 sec. on the name of P. v. d. Hoogenband of Netherlands.

Swimming starts have come a long way since the ‘bottom first’ entry used in the 17th century. In current competitive swimming, the dive start is a critical component of swimming performance. This is especially true for the shorter distances where the start has been estimated to contribute up to 30% of the total race in the 50-meter sprints. Numerous examples can be cited to highlight the importance of starts. In the men’s 50 meters freestyle final in the Sydney
Olympics Games, there was only 0.05 sec. separating 1st and 3rd place and in the same event at the 2003 world championships, 0.52sec. separated 1st and 8th place. At the 1996 Olympics, SCOTT MILLER lost the 100 meters butterfly final to Dennis Pankratov by 0.28sec. although he was already 0.40 seconds behind at the initial 15 meter mark.

Therefore, a small improvement in starting performance can potentially lead to substantial improvement in the event placing. Despite the importance, it is still common for swimmers and coaches to select their starting technique using a ‘follow the leader’ approach, mimicking the technique used by successful swimmers, rather than using objective information.

The results of studies looking at elite swimmers have, on the whole, found angels of takes-off to be in the region of –5 to 10 degrees indicating that a flat take-off profile may be beneficial. This is in contract to the take-off angles closer to 45 degrees suggested by general coaching material given that the take-off point is higher than the entry point (necessitating) a lower optimal angle) and that the only way to increase the angle of take-off is by increasing the vertical velocity (which will result in a concurrent decrease in the horizontal velocity), the optimum take-off angel will be lower that this suggested value.

The question of optimizing dive entry has implications for the swimmer’s underwater gliding performance as it dictates the initial drag conditions experienced by the swimmer. The angle the swimmer
enters the water will be party determined by the swimmer’s take-off angle along with their body movements while in fight. Limited work has been done looking at the angle the swimmer enter the water at and the optimum angle still unknown. Previous results have demonstrated that elite swimmers tend to enter the water at an angle of between 30 to 40 degrees. Pike entries usually result in higher angles of entry (closer to 50 degrees), resulting in a very steep entry and increased glide depth.

Another crucial factor is the body position upon entry. Variations in the swimmer’s streamlined position at entry have a marked effect on the rate of deceleration experienced by the swimmer. Despite the obvious importance of a streamlined entry, this still presents an area which is typically done poorly even at the elite level. Common technique flaws include dropping the head, a separation of the hands or feet and flexion about the ankles of knees. All these factors result in dramatically increased drag levels upon entry and an increased deceleration of the swimmer.

Glide Phase – The entry and glide phase of the start represent the highest velocity experienced by the swimmer during a swimming race (between 4-6 m/s). Given that the drag forces are directly related to the speed of the swimmer, the less streamlined the swimmer is, the greater the deceleration rate (resulting in reduced start times). By maintaining a streamlined position at the higher velocities encountered at entry, the deleterious drag experienced by the swimmer during the streamlined glide are minimized. These reductions in drag will translate directly to improve start times.
Research has shown that swimmers should aim to perform their glides at a depth of approximately 0.5 m underwater to benefit from the reduced drag forces. This optimum depth is gradually decreased closer to stroke resumption as the drag experienced by the swimmer is related to the swimmer’s velocity as well as the depth underwater. Any further increase in the glide depth will not produce any substantial reductions in drag forces and despite being a power strategy for some international level swimmers, should be discouraged. Form drag and wave drag are important factors in determining the total drag force experienced by the swimmer and thus, it is important that the swimmer holds a good streamline throughout the glide without excess body movements. Small deviations in body positions will have a large impact on the drag characteristics. Common faults during the glide include: not having the hands together and arms fully extended above head; lifting (or lowering) the head; and having the feet not together with toes extended. A more efficient glide depth and streamlining will result in an increased glide distance for the same time period, thereby increasing the effectiveness of the start.

**Stroke Preparation Phase:** The stroke preparation phase after a dive start consists of underwater kicking prior to the first stroke cycle for freestyle and butterfly and a split-stroke maneuver for breaststroke. With the exception of the breaststroke, the flutter and dolphin kicks are used in current competition position used as well as the stroke. For freestyle, butterfly and backstroke, the dolphin kick has become the preferred underwater kicking style in recent years.
The declaration was less during underwater dolphin kicking than flutter kicking and the velocity above that of free swimming was maintained longer when using the dolphin kick technique. Significant difference in the net forces (propulsive minus drag forces) between the underwater dolphin and flutter kicks for elite swimmers, although there was a tendency for the dolphin kicks to produce better results. The magnitude discussed in the glide phase, it could be reasoned that a small initial kick initially would be better (less of a deviation from a streamline position and therefore less drag) than a large initial kick while at the faster glide velocities.

The optimum time to initiate underwater kicking presents another area for improving starting efficiency. Observation of swimmers (of all levels) has shown that the initiation of underwater kicking can occur at any stage from immediately upon entry until after arm stroke resumption. Intuitively, by kicking immediately after the dive entry, the drag created by deviating from a streamline position is likely to offset any propulsive force created by kicking. Conversely, by waiting too long before initiating underwater kicking, the full benefits of the underwater kick will not be realized. While towing swimmers performing underwater kicks at velocities which are representative of those experienced during the glide phase of a start.

A common problem associated with turns is that age-group swimmers frequently lose time by gliding and kicking too long or too little after the streamlined glide. In the first case, the swimmers decelerated to less that their free swimming velocity and additional time and energy was required in order to regain in order to regain race
velocity. Conversely, when stroking was commenced too early in the glide phase, the swimmer’s velocity was too high and any propulsive movements increased resistance before fully utilizing the velocity advantage gained from the dive entry. Two-thirds of male and female age-group backstrokes did not hold the streamlined position long enough to gain optimum distance from the wall and the premature initiation of stroking resulted in an increased deceleration back to the free swimming velocity. The remaining one-third maintained the streamlined glide for too long, and this was typically a result of diving in at too great in angle. This resulted in a return to stroking at below free-swimming speed and required increased energy expenditure to regain race pace.

Thus, a logical explanation would be that the better starters have a greater horizontal speed at entry and are therefore going faster at the beginning of the underwater period. Underwater phase is critical to dive performance and that this is relatively independent of variables affecting flight from the block. However, the results suggest that to determine how swimmers should optimize their start performance, research should focus on what the swimmer does in the underwater phase rather than on the issue of whether to use a track or grab start. Given that differences in horizontal speed at takeoff appear to have little bearing on the period from entry to 15 m. Differences must be related to swimmers ability to minimize resistance and maximize propulsion during the underwater phase. Thus, attention should be paid to streamlining and to kicking. With regard to the latter, the timing of initiation of the kick is important. As explained kicking in
the article on turns, the kick should not commence until the swimmer’s speed is less than that which can be generated by kicking. It may be that many swimmers are kicking too soon. Swimmers should concentrate on adopting and holding a streamlined glide position until this time.

Another interesting finding in the study was that height and weight were significantly related to the time from entry. Thus, it may be that longer swimmers have hydrodynamic advantages in reducing drag and producing propulsion. As far as mass is concerned, possible explanations include that fact that the deceleration caused by any resistive force is proportional to mass and that differences among subjects in mass may be partly due to differences in musculature. Muscular swimmers may be able to generate more propulsive force from kicking.

Obviously, much work must be conducted to investigate these possible explanations.

The time that a swimmer spends starting in an event is invariably less than they spend stroking or turning, the differences between winning and losing a race are often so small that this can be decisive. It can also be said that the technical success of the start, as with many other sports, sets the athlete up for the race to follow. The grab start technique is performed by gripping the front edge of the starting block with the hands while in the set position.
EXPLOSIVE STRENGTH: - It is as a combination of strength and speed abilities. It can be defined as “the ability to overcome resistance with high speed” (Hardayal Singh 1991).

Explosive strength always finds expression of motor movements i.e. it is form of dynamic strength. Explosive strength performance are markedly influenced by the level of motor coordination required for a movement, e.g. inter and intra muscular coordination as a result explosive strength is highly to the nature of a movement and for its development of specific movements or part of the movement have to be used as exercise. A high percentage of movement in sport is of explosive nature and involves overcoming of same external resistance or one’s body weight and plyometrics training.

Performance in the start is strongly related to overall swim performance.

The term refers to exercises that are characterized by powerful muscular contractions in response to rapid, dynamic loading or stretching of the involved muscles. This loading or stretching of the involved muscles is an advantage of phyometric exercises in that they involve the dynamic stretch-shorten cycle movement similar to those adopted in sporting action.

Traditional phyometric training uses the acceleration and deceleration of body weight as the overload in dynamic activates such as depth jumps and bounds. Thus, activities eliminate the deceleration achieve zero velocity at the end of the concentric movement.
Therefore plyometrics involve the production of high forces and accelerations throughout the entire range of motion, which is again specific to most athletic movements like the swimming block start. Another advantage is that phyometrics are also performed at higher velocities than traditional weight training methods, increasing their specificity to competitive performance.

In current international competition, the grab and the track starts (with the weight either forward or backwards) are the most commonly used starting technique. The major difference between the starting techniques is how the lower limbs are placed on the block and used to propel the body forward.

Unfortunately dry land exercises and weight-training programs in the sport of swimming frequently focus their attention on the development of upper body strength. In accordance with the concept of specificity, much time and effort has been spent on the development of specific exercises or weight training procedure that closely mimic swimming movement. Because of this it has been suggested that swimmers, in general, lack the dynamic lower body strength needed to maximize performance in the block start and turns. This may also be because the benefits of developing explosive strength have not been properly investigated.

In competitive swimming, the fundamental goal is to cover a set distance in the least amount of time (Adrian’s Cooper, 1995). The swimming starts has been defined as including those events that takes
place between the command, “take your marks” and the of beginning the first stoke (Ambruster, Allen, Billingsley, 1973).

Performance in the start is strongly related to overall swim performance. (Ross Sanders, Bonner Stephen, 2001)

The main aim of the swimming start is to propel the swimmer away from the starting block as quickly as possible and with the greatest momentum that can be developed. Due to this, the swimming block starts can be seen as an explosive event with a movement pattern, which requires high force production over a short period.

1) First hypothesis of this present study is that the performance of swimmers depend upon a good start which proved by each age group under-14, under-17 and under19 for the starts.

2) Second hypothesis of this present study is that the proper starts can help to improve the timing of the swimmer. After explosive strength, training there is average 1sec. difference between their pre-test start and post-test start in initial 15-meter mark. This proved by the values of mean by experimental group in each age groups under-14, under-17, under-19. (Under 14:- mean tarts, forward weighted track starts and rear weighted track starts.

3) Third hypothesis of this present study is that significant performance is expected in the experimental group. Completely accepted by this study.
4) Forth hypothesis of this present study is that grab start is better than other starting styles in age group swimmers. Completely accepted in under-17 and partially accepted in under-19.

5) Fifth hypothesis of this present study is that there would be significant change in performance of swimming starts after training of explosive strength ability.

\[ H_5 : M_1 \neq M_2 \]

This hypothesis shows that, in Under-14 experimental group the means of the pre-test and post-test are 10.59 and 9.65 in conventional start and which are not equal. Similarly, in grab start the means are 10.06 and 9.28, in forward weighted track start the means are 10.28 and 9.49 and in rear weighted track start the means are 10.65 and 9.71 and which are not equal. From these means, it is clear that the **grab start is the best start** for Under-14 age group swimmers.

Similarly, in Under-17 experimental age group, the means of the pre-test and post-test in each starts are not equal that is, in conventional start the means are 8.21 and 7.33, in grab start the means are 7.36 and 6.34, in forward weighted track start the means are 7.54 and 6.65 and in rear weighted track start the means are 7.94 and 6.80. From these means, it is clear that for Under-17 age group swimmers the **grab start is the best start**.

Now in Under-19 experimental age group the means of the pre-test and post-test of experimental group in each start are not equal. In conventional start the means are 5.89 and 5.40, in grab start the means
are 5.58 and 4.90, in forward weighted track start the means are 5.57 and 5.23 and in rear weighted track start the means are 5.91 and 5.38. From these means, it is clear that again the grab start is the best start for Under-19 age group swimmers.

This shows from all experimental groups that, the grab start is the best start for all age group swimmers.

Null Hypothesis: There would be no significant difference in swimmers starting style after the explosive strength programmed.

\[ H_0 : \ M_1 = M_2 \]

This null hypothesis fully rejected by all age groups.

CONCLUSION:

Finally, the following conclusions were drawn in the present study:

1) Performance in the start is strongly related to the overall swim performance.

2) There are indications that, regardless of the posture used, intensive practice of start results in significant improvement even among experienced competitive swimmers.

3) Increasing the amount of start practice significantly increases start performance.
4) For those swimmers with a large asymmetry in terms of force production in the grab start (one leg produces significantly more force than the other), it may be worthwhile changing to a track start with the dominant force producing leg forward.

5) For swimmers who are very explosive and symmetrical in their force production, it may be worthwhile changing to a grab start where they can produce very high force levels in a short period.

6) For swimmers with a disproportional high level of power in the upper body may be best suited for the slingshot track start technique.

7) In the track start, the dominant force producing leg should be in front as this is where the greatest force production comes from.

RECOMMENDATION:

The finding of the present study would lead to the following recommendations:

1) It is unclear whether particular postures on the blocks such as those used for grab, track, and handled starts and their variants yield an advantage compared to the others.

2) There is evidence to suggest that the underwater phase following entry is highly important. Therefore, much more research should be focused on this phase.

3) There is some evidence that anthropometrics factor have a strong influence on performance. In particular, taller and
heavier swimmers may have an advantage. More research is required to establish how anthropometrics characteristics affect performance.

4) An optimal projection angle will vary slightly between people and has not been quantified for the dive start before.

i) The optimal angle will be between 0 degree and 10 degree.

ii) If the angle is, too shallow (> -5?) the swimmer will minimize the performance benefits of being in the air by hitting the water early and decelerating rapidly. This will also decrease the chance of entering though the water cleanly through the same entry point (the swimmer will enter too flat) and will result in a shallow streamline.

iii) Too great an angle (> -15?) will also result in the swimmer hitting the water short spending more time in the air without a concurrent increase in dive distance. This will also result in a steep angle of entry into the water and an increased depth for streamlining (unless the athlete corrects for it by leveling out as soon as they hit the water). The only way to increase the angle at take-off is to increase the vertical velocity and this cannot occur without decreasing horizontal velocity at the same time.

5) The end objective is to maximize the resultant velocity with an angle of between 0? to 10?, while minimizing the time spent on block, an efficient dive entry and appropriate timing for
underwater kicking and stroke resumption are also required to maximize the starting performance.

6) A major implication of the existing research is that coaches and swimmers should devote considerable effort to minimize resistance and maximize propulsion during the underwater phase of starts. The timing of initiating kicking action is an important consideration in ‘fine tuning’ the underwater phase of starts.

Finally, the information obtained in this study provides a platform for further research.