Warm Down & Active Recovery

Introduction

The recovery process is an extremely important one and one which is receiving increasing attention in attempts to maximising performance. For the purposes of this Fact Sheet, recovery is the process of returning all body systems to resting levels following intensive swimming. It is generally accepted that the process of steady swimming after an intense rep or race will improve the speed of recovery more than passive rest.

Objectives of most Warm Down procedures are to maximise speed of recovery and to improve subsequent performance. This applies to competitive races and most training sets. Recovery is a complex process and although most people consider the reduction in blood lactate as the best indicator of recovery, it only considers part (albeit an important one) of the story. The following additional issues should be considered:

1. Recovery of blood lactate may be different to conditions in the muscle
2. There may be a difference between blood lactate and muscle pH (far more important)
3. Phosphocreatine resynthesis
4. Hormonal imbalances
5. Muscle damage and repair

Each of these systems has a different time-scale for recovery and should be considered when planning the training programme or competition schedule. For instance, muscle lactate will begin to drop (and pH increase) as soon as exercise ends; blood lactate on the other hand will tend to continue to rise for several minutes following a maximal swim as it takes time for the lactate to diffuse out of the muscle and into the circulatory system. The majority of Phosphocreatine (PCr) resynthesis occurs within 6 minutes, although research suggests that approximately 75% will take place in the first 2 minutes (Bogdanis *et al.*, 1995). Hormonal imbalances will tend to take several hours to revert to pre-exercise levels, whilst muscle damage may take several days to repair.

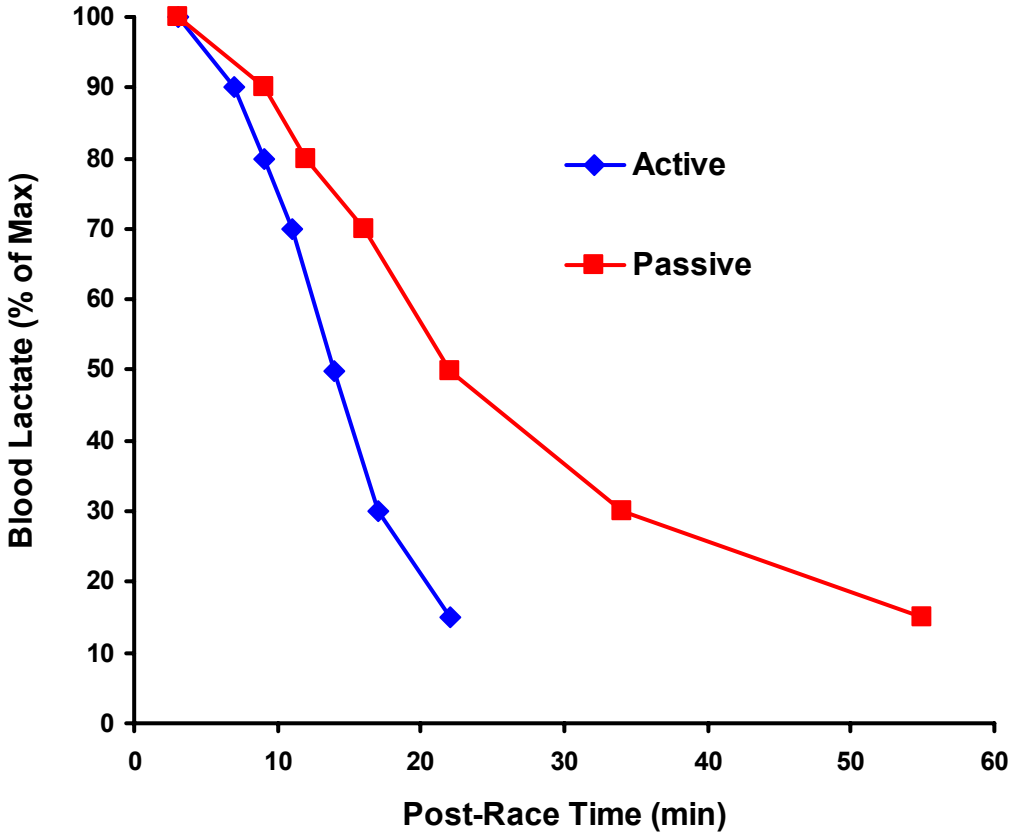
Key Issues

Some general recommendations that will aid the speed of recovery can be made (although adjustments can be made on an individual basis):

- Immediately – Maximise oxygen consumption to enhance PCr resynthesis (linked) and to help reconvert lactate to pyruvate and metabolise aerobically (allow free-breathing).
- Initially – very light exercise to aid PCr resynthesis.
- Good blood flow will enhance PCr resynthesis and stimulate muscle lactate removal, therefore ensure large muscles and those stressed during swimming are used.
- Swimming at a moderate pace to stimulate the muscle pump action and increase muscle circulation will aid the process after the initial light swim.

Blood lactate removal

Clearly, the ability to remove lactate and restore pH in the muscle are major factors in recovery and the ability to perform well in subsequent races/ repetitions. The following figure shows the positive benefits of active over passive recovery (adapted from Cazorla *et al.*, 1983):



In this particular example, if both swimmers reached a maximal value of 10 mM, the 20% mark would represent 2 mM (the level we would like swimmers to drop below to ensure adequate recovery). Swimmer A performing active recovery in this case would achieve the 2 mM level in approx 20 min whereas swimmer B conducting passive or static recovery would take almost 50 min to reach this point.

It is important also to recognise that although the swimmer B reaches this point eventually, there may still be some residual lactate within the muscle, that hormonal imbalances are still evident and that other products such as those from muscle fibre disruption are present. For these reasons, it is always recommended that some active Warm Down is performed following intense swimming.

Individual differences

Sprinters tend to have a larger muscle mass and a higher percentage fast twitch (FT) muscle fibres than middle distance and distance swimmers. The consequence is that they will tend to produce more lactate and suffer lower muscle and blood pH concentrations following maximal sprinting such as in a race. As a result, higher lactate levels will usually necessitate a longer Warm Down in order to return the body closer to resting levels quickly. Thousands of blood samples collected from British Swimmers in National and International competition in the past 3 years support this pattern. On average it takes approximately 1400m to achieve blood lactate concentrations < 2mM. Individual adjustments should be made depending on the type of swimmer, the event and the circumstance (i.e. when the next race or intense swim is planned). One anomaly is that distance swimmers are capable of more Swim Down, but that sprinters usually need it more!

Guidelines

Coach Rhys Gormley has recently demonstrated that swimming at A2 (approx 50 BBM) in well trained age group swimmers will remove lactate faster than either other forms of exercise or passive (inactive) rest. Alternative forms of exercise (for instance when a Swim Down pool is not available) will also remove lactate more effectively than passive recovery. Activities such as walking, stretching and arm-swinging, hot showers and other land based movement should be used when Swim Downs are not available.

Blood lactate will tend to increase for some minutes (usually 3-7) after a race, followed by a rapid removal phase (e.g. for approximately 200-400m) and then a slower more constant removal phase. A good guide to the expected rate of removal if you do not have lactate testing available is to estimate the maximal value, perhaps from previous lactate tests; initially swim 200m steady and then each further 400m should represent a drop of approx 50% of the previous value. The following table shows this relationship. Generally, the higher the maximal lactate value, the longer the length of the Warm Down.

Max Value	600m	1000m	1400m	1800m	2000m
8.0 mM	4.0	2.0	1.0		
10.0 mM	5.0	2.5	1.25		
12.0 mM	6.0	3.0	1.5		
14.0 mM	7.0	3.5	1.75	>1.0	
16.0 mM	8.0	4.0	2.0	1.0	
18.0 mM	9.0	4.5	2.25	1.1	?
20.0 mM	10.0	5.0	2.5	1.25	?

- All values in millimoles per litre (mM)

One of the consequences of maximal swimming or racing that is often forgotten in the recovery process is the replacement of fuel sources. Swimming at this intensity producing high lactate values will deplete muscle glycogen significantly. It is important that the refuelling process starts immediately in order to ensure adequate muscle glycogen replenishment and not compromise subsequent performances. A carbohydrate solution (usually up to a maximum of 8%) should be used in drinks bottles and regular drinking throughout the Warm Down is recommended.

Summary

Swimmers should always use Swim Downs to enhance recovery. If a second pool is not available, other forms of land exercise in conjunction with a hot shower can be used. Individual adjustments can be made depending on the nature of the event, the type of swimmer and the intensity of the repetition. All Swim Down's should be performed with excellent technique.

Further Reading

- Bogdanis, G. *et al.* (1995). Recovery of power output and muscle metabolites following 30 s of maximal sprint cycling in man. *Journal of Physiology,* **482:** 467-480.
- Cazorla G. *et al.* (1983). The influence of active recovery on blood lactate disappearance after supramaximal swimming. *Swimming Science IV.* Human Kinetics, USA
- Maglischo E.W. (2003). *Swimming fastest.* Human Kinetics, USA

Many coaches and swimmers will develop their own Swim Down protocol to suit their swimmer and the type of recovery required. If swimmers and coaches do not have a set protocol, the one below incorporates most of the key issues suggested in this Fact Sheet.

Swim Down Protocol

1. Swimmers should attempt to keep moving as soon as they have completed a race, this includes moving the arms and legs in the water, and stretching and moving arms and legs out of the water on the way to the Warm Down pool.

2. Remove leg suits before the Swim Down when time permits. Report to the Swim Down pool within 3 min of the end of a race *with a full drinks bottle and food*. Replacing fluid and glycogen replenishment should be major objectives during and after the Swim Down.

	Repetitions	**Comments**	**Distance**
3.	200m	Easy, own pace with unrestricted breathing if possible	200m
4.	4 x 100m + 30s rest	Alternate FC and BC at a steady pace with good technique	600m
5.	8 x 50m + 20s rest	Use 3 strokes (no Fly) and focus on kicking the legs	1000m
6.	4 x 100m + 30s rest	Alternate FC and BC and swim at approx 50-60 BBM (adjust for individuals)	1400m
7.	Take HR or Lactate	If below 100 BPM or <2 mM SD complete If above 100 BPM or >2 mM continue SD	
8.	4 x 100m + 30s rest	Alternate FC and BC and swim at approx 50-60 BBM (adjust for individuals)	1800m
9.	Take HR or Lactate	If below 100 BPM or <2 mM SD complete If above 100 BPM or >2 mM continue SD	

- BPM = beats per minute
- SD = Swim Down

Guidelines:

- Coaches should not usually hold discussions with the swimmer until after the Swim Down has been completed. A few brief points on the way to the Warm Down pool will provide the swimmer with some initial information without delaying the recovery process.