Recovery Training

by
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Chapter 1: The Principle of Recovery

Background reading and references

Article 1:
Calder, A. 1990, Restoration and Regeneration as Essential Components within Training Programs.
Article 2:
Rushall, B.S. and Pyke, F.S. 1990, The Principle of Recovery.
Article 3:
Maughan, RJ. 1994, Fluid and Electrolyte Loss and Replacement in Exercise.
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Rehrer, NJ. 1994, Fluid and Electrolyte Requirements in Running and Cycling.
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Article 8:
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Article 9:
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Article 10:
Smith, C. 1994, Fluid Balance in Weight-classified Sports.

Background

Recovery is a general term used to describe the adaptations to workloads after an athlete has been exposed to training or competition. For a healthy, functioning athlete the term refers to a positive response to training stimuli leading to adaptation to those stressors. Such adaptation can be physical or psychological in nature and the recovery processes involved are often referred to as **restoration** and **regeneration** (Calder 1990). Failure to recover from training and competition invariably leads to maladaptation.

Failure to adapt to training stressors, either physical or psychological, can lead to detrimental conditions common to many athletes such as **overtraining**, **overuse** or **burnout**. These require specialist intervention by clinical practitioners from sports medicine and sport psychology. This type of recovery is called **rehabilitation** and lies outside the scope of this article.

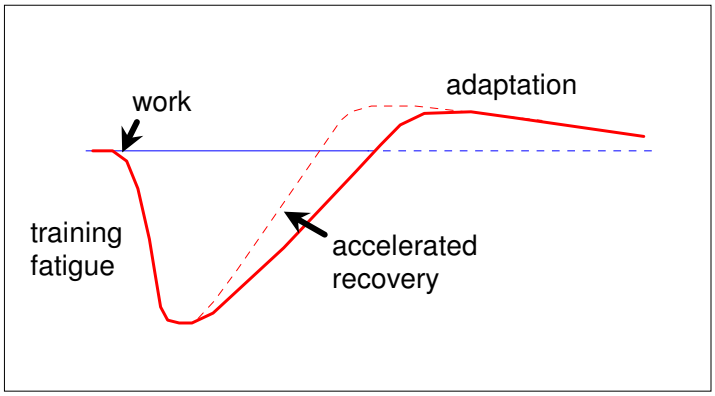
Until recent times talent was the sole prescription for success in sport, but today, to be **the best**, athletes need to work harder, pushing themselves to greater physical and mental extremes, and be able to adapt to such rigorous work. Training hard and training smart are not always synonymous. For many athletes the question becomes 'How can I train hard without getting injured or sick?' The answer is simple. To be able to perform at their best without experiencing these setbacks, each athlete needs to follow the formula for success:

Work Hard + Recover Well = Best Performance

Many athletes work hard but often ignore recovery training activities except when they are ill or injured, yet these practices are an essential ingredient for a balanced training program. Indeed, the principle of **recovery** is one of the basic principles of training (Rushall & Pyke 1990), but it is the one most frequently forgotten by athletes and coaches.

The principle of recovery

Work alone is not enough to produce the best results; an athlete also needs time to adapt to training. The principle of **recovery** refers to that part of training where the benefits of the work undertaken are maximised through practices which reduce residual fatigue and enable the athlete to cope with workloads more effectively. This enhances the athlete's capacity to undertake more work, as well as their capacity to work more efficiently, which in turn encourages better adaptation to training.



Recovery techniques aim to reduce residual fatigue from training

Training sessions are designed to bring about improvements in athletic performance. This is achieved in part through progressively overloading the body systems and fuel stores that underpin each of the five 'S's of training:

- **S**tamina
- **S**trength
- **S**peed
- **S**uppleness, and
- **S**kill.

Underlying this progressive overload principle is the understanding that in order to develop a particular capacity or system, that capacity must first be challenged or stressed. This stress is provided by the training load that represents the stimulus for change to occur. The work undertaken results in a degree of fatigue or depletion of the physical or psychological systems involved. Adaptation to training is accelerated when residual fatigue is reduced as soon as possible after training and the challenged functions are restored quickly to normal operational levels.

Overtraining, overuse and burnout

If positive adaptation to training results in improved performances, then it is also important to recognise that negative adaptation can also occur. Essentially the wide range of **overtraining** signs and symptoms is a reflection of the extensive influence of the athlete's immune system when it is unable to cope with excessive stress. **Overuse** problems are an indication of biomechanical problems due to excessive or inefficient mechanical loading, and **burnout** occurs when athletes are so psychologically drained they lack motivation and sometimes lose all interest in their sport.
The onset of these conditions is diverse and varied. No two athletes will respond to training loads in the same way because adaptation rates vary from one individual to another. Consequently it is not always appropriate to prescribe the same workloads for all athletes but **it is absolutely essential** to monitor their responses to training so that workloads can be varied to suit each individual's adaptive capabilities (see Chapter 2).

Rest: passive and active rest

Passive rest

Sleep is the most important form of passive rest. A good night's sleep of seven to nine hours provides invaluable adaptation time for athletes to adjust to the physical and emotional stressors they experience during the day. Other forms of passive rest involve techniques that help the mind to **switch-off** from all the surrounding stimuli. Getting to sleep can sometimes be difficult because of the excitement of the day's events so it is important that athletes develop habits to promote a good night's sleep.

Meditation, flotation or reading are also examples of passive rest. Some of these are readily accessible to all athletes but a few are less accessible because they require specialist training or they are quite expensive (see Chapter 4).

Active rest

Rest periods vary depending on the volume and intensity of the work set, the energy systems being trained and the fuel stores used. The table below provides some suggestions for the duration of recovery time for specific biochemical systems and processes.

System	Recovery time
ATP-PC replenishment	2-5 minutes
Removal of lactate	30-60 minutes (active recovery) 60-120 minutes (resting)
Muscle glycogen replenishment	Up to 48 hours

Active rest is much undervalued by athletes. The end of the training session is an ideal time to introduce active recovery activities, although active rest can also be incorporated throughout the session. Recovery activities are selected to fulfil a number of tasks. They can either help recover the physiological state of the athlete, eg light walking or cycle to recover the lactate system, or they can focus on musculoskeletal recovery, eg stretching and exercises to promote a return to postural efficiency through musculoskeletal balancing programs. Also, recovery activities can focus on psychological recovery with the use of visualisation, breathing and meditation as techniques that can be used during a game or match, eg recovery between points in a tennis match, at half time, or after the training session or game.

Cross training can often be used as a form of active rest provided the work intensities are modest (light aerobic) and the exercises undertaken are different to those normally performed in training. Pool work, either walking or swimming (particularly backstroke and side stroke), are excellent modes of active recovery after a game, as is stretching in a warm pool. These techniques are frequently used by many Australian football codes and basketball teams and clubs. (See Appendix 1 for an example of a pool recovery session.)

Rest days are essential. At least one day per week should be a non-training day to allow athletes time for physical and psychological recovery. It is important that athletes have this time to develop interests outside their sport in order to have a balanced lifestyle. The old truism that 'all work and no play makes Jack a dull boy' reflects the need for variety to prevent staleness and boredom. An athlete with one or two interests in addition to their sport can access this stimulation more readily than the athlete who focuses on sport to the exclusion of everything else. Finding the balance between study/work, training, and social and domestic commitments is one of the biggest challenges for high performance athletes. Rest days allow athletes to integrate these demands more readily and maintain a healthy balance in their lives.

Sleeping tips

Things to do:

1. Practise relaxation techniques before going to bed (listen to relaxing music, progressive muscle relaxation, breathing exercises, visualisation)
2. Lie down to sleep ONLY when you are sleepy
3. If you don't fall asleep within 30 minutes after turning out the light, get up and do some relaxation work (see point 1)
4. If you wake up in the night and can't go back to sleep, get up and do some relaxation work (see point 1)
5. Get up at the same time each day

Things to avoid (evening)

1. Caffeine (eg coffee, tea, coke, chocolate)
2. Nicotine
3. Alcohol
4. High protein meals

Reduce thinking and worrying in bed **Learn to *switch-off***

Fluid and fuel for recovery

Preparing for an event or training session and also providing afterward for the replenishment of fluid and fuel stores used in training requires planning. Athletes are responsible for balancing their nutritional intake in accordance with the demands of their training.

The most critical components for recovery relate to fluid and fuel replacement strategies. Monitoring fluid loss so that it is kept to a minimum is essential. Body weight loss of 2% or more during exercise, results in measurable physiological changes which lead to a reduction in aerobic output. Educating athletes to hydrate to keep pace with sweat rates is important and this can be monitored through urine checks and pre and post training weighing (*Coaching Focus* 1994).

Adequate supplies of glycogen in the muscles and in the liver are needed to support the energy demands of an athlete and promote recovery for the next training session. Dietary CHO is the primary source for the body to manufacture glucose.

CHOs are classified in terms of their glycaemic index. This refers to the relative rate of absorption of glucose from a particular food.

When food containing CHO is eaten, the amount of glucose in the blood rises to a peak after about 20-30 minutes. The glycaemic index (GI) of a food is determined by the rate at which CHO is available for glycogen resynthesis in muscles and the liver. Foods are compared to white bread or glucose (both of which have an arbitrary GI of 100) in terms of their rate of CHO digestion and absorption.

The glycaemic index of some foods (from Macdonald, N (1995) Glycaemic Index – an update and overview *Nutrition Issues and Abstracts No. 6 June 1995*)

High (GI >85)	Moderate (GI = 60-85)	Low (GI <60)
white bread	pasta/noodles	apples/pears
wholemeal bread	popcorn	cherries
Nutrigrain	porridge	peaches
cornflakes	potato chips/crisps	apple juice (unsweetened)
Weetbix	Special K	All-bran
potato	white rice (boiled)	baked beans
rockmelon	sweet corn	lentils
raisins	sponge cake	ice cream
bananas	oranges	yoghurt
corn chips	orange juice	fructose
sugar/honey	chocolate	brown rice (boiled)
cordial/sports drinks		milk (all types)
glucose		peanuts

Foods with a high or moderate GI are recommended for rapid replenishment of glycogen stores in the liver and muscle. However, if foods with a high to moderate GI are mixed with foods of low GI, the food with the low GI will lower the rate of absorption of CHO into the blood stream. Consequently athletes need to be educated to have a sandwich, piece of fruit or a sports drink with them to consume after training. There is a window of opportunity immediately after strenuous exercise to replenish muscle fuel stores at a faster rate than by delaying carbohydrate replacements (approx. 30 minutes).

Some protein intake with these carbohydrates is also recommended especially after hard training such as weights, sprinting or tackling, or when impact activities have been undertaken. Protein is especially important for muscle regeneration and the prevention of exercise-related anemia. In particular, athletes involved in anaerobic activities require additional dietary protein to facilitate training adaptation and recovery. The intake of a protein source providing 6-12 g of essential amino acids (equivalent to 10-20 g of protein from a high quality source) may be valuable in a recovery snack since it has been shown to have a substantial effect on net protein synthesis. Also, because insulin plays such a vital role in replenishing glycogen stores after exercise, it's important to focus on how to make it work optimally. Studies show that protein, when combined with carbohydrates, almost doubles the insulin response. This makes it seem logical to include some protein along with your complex carbohydrates. A ratio of 4:1 is a good recommendation; any more is believed to interfere with rehydration. It is important to note though, that protein foods should not be consumed at the expense of carbohydrate foods. Focus on high-carbohydrate foods and meal choices first. Meals need to be balanced nutritionally. The total diet composition over the long-term should be close to 60-70% carbohydrates, 15-20% protein, and 15-20% fats.

Minerals and trace elements are important for muscle regeneration. However, extra intake of these by taking synthetic supplements may not be as effective as increased dietary sources due to the reactivity of some elements and metals with other foodstuffs in the gut. Professional nutritional advice is necessary for those athletes who experience considerable muscle damage, or those who are continuously fatigued. Iron deficiencies or problems with absorption are not uncommon in athletes of both genders. If an athlete is consistently tired, the following checklist may help to eliminate possible causes and direct the athlete to seek professional help if fatigue persists.

Fatigue fighters checklist

After each training session

Drink & eat
Walk/move (at least 5 minutes)
Stretch
Hot/cold shower

Evening/end of day

Hot/cold shower/spa/sauna
Stretch & self-massage (especially legs)
Practise relaxation 10-15 minutes before bed
(music, progressive muscle relaxation, visualisation, breathing exercises)

♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦

Note:

1. Monitor how you feel each day
   Get up at the same time each day
   Record how you feel


Great


OK


Tired/stuffed

2. You need at least four hours between training sessions
3. If the *fatigue fighters* don't work, seek help from a specialist

Chapter 2: Monitoring Adaptive Responses

Background readings and references

Article 11:
Mackinnon, L.T. and Hooper, S.L. 1994, Training Logs: an effective method of monitoring overtraining and tapering**,** *Sports Coach*, 17 (3) pp 10-12. Australian Coaching Council, Australian Sports Commission, Canberra.

Article 12:
Sayers, M. 1994, Neuromuscular fatigue and recovery: a brief review, In *Proceedings of the Australian Coaching Council's Coaching Conference*, Canberra.

Article 13:
Pyne, D. 1994, Physiological Basis of Fatigue, In*, Proceedings of the Australian Coaching Council's Coaching Conference*, Canberra.

Article 14:
Hooper, S.L. 1995, Monitoring Overtraining in Athletes: Recommendations. *Sports Medicine*, 20: 321-7.

Monitoring training responses

The coach's view

Workloads need to be adjusted to the adaptation rates exhibited by each individual and the wise coach will gauge this by monitoring the athlete regularly. Observed coaching cues or signs that indicate how an athlete is coping with training should be recorded in a coaching logbook in conjunction with the prescribed training program. The coach's observations should include both sport specific and generic cues. As the coach improves with experience the more astute he or she becomes at recognising these signs.

A coach's observations of an athlete's adaptation to training

Coaching observations	Signs and symptoms of non-adaptation
Direct communication	Athlete tells me he/she has: • heavy legs • doesn't feel good • his/her legs are sore • feels tired
Body language	Facial expression and colour The look in his/her eyes Bending over to recover after an effort Bad technique compared to normal
Physiological	Increase in resting heart rate Loss of body weight Loss of appetite
Psychological	Low motivation Low concentration Aggressiveness No self-confidence
Others	Poor eating habits Poor sleep patterns

An example from Guy Thibault (1993) Canadian speed skating coach

Monitoring training responses

The athlete's view

All athletes should keep a daily training diary or logbook so that they can monitor their responses to training. **A training diary or logbook is one of the most important tools for every athlete** as it enables them to learn how to recognise when they are coping with training and when they are not. Learning to **listen to** and **recognise** their body's signs and cues is undoubtedly one of the most critical skills an athlete can acquire. Recordings of the quality of sleep, morning resting heart rate and morning body weight, and a daily rating of energy levels are four essential markers that should be recorded daily by athletes. An example of a recording sheet for monitoring these variables is provided in Appendix 2.

One of the first signs of overtraining is consistently poor sleep. Also, a markedly elevated resting heart rate recorded first thing in the morning is an indication that any training undertaken should be modified. Body weight is best recorded each morning before eating and after going to the toilet. This is **not** a measure of fat stores but more likely to be an indication of hydration levels. Rapid weight loss or rapid weight gain is not advisable, and unexplained weight loss may be indicative of overstress. Feeling tired after training is a normal response but feeling constantly fatigued is a sign that the body is still adapting to its stressors.

These four variables take two minutes a day to record and may be the first indication of maladaptation or non-adaptation to training recognised by an athlete. A few days rest is usually enough for these variables to return to normal. If they do not normalise in this time the athlete should seek medical advice.

An athlete's observations — warning of non-adaptive responses

- sudden drop in body weight (more than 3%).
- sudden increase in morning Heart Rate of >6bpm
- inability to respond to relaxation or meditation techniques
- sleep disturbances (plus or minus 2 hrs for more than 2 days)
- low quality sleep for more than 2 days
- feeling constantly tired

From Tim Frick (1993) Canadian wheelchair basketball coach

Monitoring training responses

The recalcitrant athlete

The frustration for many coaches is the lack of consistency with which these variables are recorded by many athletes. Some athletes choose to ignore recordings of any kind so they do not keep any records, diary or training log, despite knowing how valuable this information can be. The coach will need to find an alternative for athletes who are reluctant to keep daily records no matter how important this process is for the athlete's training and health. A simple and quick self-assessment method is the smiley faces diagram. The variables assessed can be changed to suit different circumstances but the outcome is essentially the same. How you feel is often the best indication of how you are coping.

Coaches of team sports often experience more difficulty than coaches of other sports, with athletes being more reluctant to record their training responses. In an effort to overcome this problem basketball coaches at the Australian Institute of Sport have recently combined monitoring training responses with time management and planning strategies for their athletes. Every Friday each athlete receives a printed copy of the following weeks training times and sports commitments. On the reverse side of this page is a daily response sheet identifying nine variables which each athlete must ranks on a scale of 1 (*excellent)* to 5 (*awful).* (See Appendix 3 for a copy.) This daily monitoring process takes the athlete less than one minute to complete and links the athlete's responses closely to training loads and other life commitments such as study, work, domestic life and social roles.

The table below provides a quick and easy way to assess recovery, pre and post training. It can provide some useful subjective information from athletes who fail to complete a training diary or self-monitoring sheet. To complete this work task ask your athletes to tick the column which best represents how they feel both before and after training.

			
Physically Before training After training			
Psychologically Before training After training			
Performance Before training After training			

Chapter 3: Physical Recovery Techniques

Body Management Skills

Background reading and references

Article 15:
Calder, A. 1990, Sports Massage, *State of the Art Review No 24*, National Sports Research Centre, Australian Sports Commission, Canberra.

Introduction

There are many different physical activities and therapies that assist with recovery. Some of those most commonly used include:

- active and passive rest (see Chapter 1)
- cross training (a form of active rest – see Chapter 1)
- stretching
- hydrotherapies
- sports massage
- acupressure and acupuncture

Stretching

Stretching refers to tissue elongation, ie extending a material or substance from its resting length. This occurs as a continuum, so stretches can range from a minimal length to a maximum length. Stretching is an essential action for movement in skeletal muscles and it is often referred to as the way to improve flexibility.
Flexibility refers to the range of movement (ROM) possible around a joint. This varies enormously from one individual to the next.

What tissues are elongated?

(a) Muscle: Skeletal muscle has properties similar to a rubber band, ie it has elastic properties that enable it to lengthen and return to a resting state. The length of a muscle cannot be increased by nervous impulse, therefore an external force must be applied. Such external forces can include gravity, momentum, an antagonist (opposite) muscle group contracting, or applying an external force such as a weight, or using a partner or assistant.

(b) Connective tissue: This refers particularly to *fascia*. That is, the substance which covers each muscle fibre and forms the compartment which surrounds each muscle. *Fascia,* particularly that forming the muscle compartment, can provide a great degree of resistance to stretching. It has visco-elastic properties similar to the properties of both plasticine and rubber. Like plasticine, the viscous components when stretched will remain in the new position. The elastic components, like a stretched rubber band, will return to a resting length after stretching. It is therefore possible for *fascia,* with its plastic component, to change its length permanently – a vital consideration for long-held stretches.

(c) Ligaments and tendons: Tendons are often inadvertently stretched when muscles are used or stretched. However, the deliberate stretching of both these tissues is a clinical role and best left to medical specialists to perform.

(d) Specialised nerve endings:

(1) ***Muscle spindles*** *(the stretch reflex)* – these are located within muscles and they detect the rate and length of stretch on a muscle. If the stretch is too fast or too far these nerve endings stimulate the muscle to contract to protect itself from overstretching.

(2) ***Golgi tendon organs*** *(inverse stretch reflex)* – these nerve endings are located in tendons and they are slower to respond to increased stretch or tension in the muscle. This is also a protective mechanism. When a great degree of tension is experienced, either through contracting or stretching the muscle, the *golgi tendon* causes the muscle to relax to avoid possible rupturing.

Why do we stretch?

(a) to improve performance

(b) to increase the range of movement around a joint

(c) to enable the full development of an opposing muscle group

(d) to increase the ability to absorb shock

(e) to improve posture

(f) to decrease muscle tension or improve muscle relaxation. This leads to improved blood flow through the muscles and when performed as part of the cool-down it can be an effective way of helping muscles to recover from the previous activity.

How do we stretch?

There are two basically different approaches to stretching – one uses techniques which involve **moving**, the other uses held or **static** techniques.

(a) **Moving and dynamic stretches:** any movement involves synchronised muscle contraction and stretching. Movement patterns can progress from gentle, small **ranges of movement** (ROM) to full and dynamic ROM actions. The benefits of this type of stretching include not only increasing muscle temperatures to improve flexibility but also the **switching-on** of motor programs specific for the sport or activity.

Ballistic actions are a part of many sporting movements, such as kicking, sprinting, hitting, jumping and throwing. The word ballistic means explosive and most athletes will need to train to be explosive for their sports. Any essential explosive sporting actions should be incorporated in the latter stages of a warm-up in order to prepare the athlete fully before the game or training session begins.

Bounce stretching: whereas ballistic stretching refers to a single movement, bounce stretching refers to repeated rapid stretches. These can also involve small ROM or full-range ROM around a joint. However, taking a muscle to its full ROM or endpoint of ROM and bouncing at this stage is dangerous. This action stimulates the stretch reflex (muscle spindles) to be continually activated and as a consequence the muscle is being mechanically stretched while trying to contract and shorten. Unless this action is a requirement of a sport, this technique is not recommended as it predisposes the stretched muscle to tearing.

(b) **Static, slow or held stretches:** research to date shows no difference in the improvement in ROM between stretches held for 10-120 seconds. Stretches held for three minutes or more target the viscous properties of the connective tissues while those held for shorter periods of time focus on the elastic properties of muscles and connective tissue. The former can lead to a lengthening in connective tissues resulting in long-term change while the latter aim to return the muscle to its resting length and have a short-term goal.

Static stretches held for 6-10 seconds are more time efficient for most recovery training sessions. This allows sufficient time for the golgi tendon organs to effect a relaxation response (inverse stretch reflex). This inverse stretch reflex occurs when a muscle is stretched to the point where tension is felt and this is held for about 6-10 seconds. After this time the inverse stretch reflex causes the muscle to relax and the tension eases. It is then possible to move a little further into the stretch. Passive *assisted* stretches can also be added to this category. Long-held stretches (30-180 seconds) target the plastic components in connective tissue and are ideal for increasing the ROM. These techniques result in some muscle fatigue.

The **contract-relax with antagonist contraction** (CRAC) stretch involves gently contracting the muscle to be stretched through a small ROM, then moving the joint in the opposite direction to a held stretch position. The antagonist (opposite) muscle group then contracts and through reciprocal inhibition increases the stretch on the stretched muscle. This technique is more time consuming than a 10 second static stretch but it has the added advantage of providing strengthening at the end of the ROM.

Stretching techniques for recovery

Post training or game, the most appropriate techniques are for short lightly held static stretches of about 6-10 seconds duration. Stretches should be performed in a warm environment and can be continued in the shower or bath. An example of a post game recovery session in a pool is provided in Appendix 1. The session is relatively short and involves both active and passive stretching in a weight supported environment.

This type of stretching facilitates recovery of the athlete's normal resting muscle length. To improve flexibility for tight or problem areas, separate sessions focusing on developmental stretching should be programmed into the training schedule.

Developmental stretching to improve a joint's ROM, or increase resting muscle length, should be undertaken in a warm environment and is ideally performed in the late afternoon or early evening. Such sessions should not be followed by any other form of training as the developmental techniques used leave the muscle in a fatigued state. It is better to rest following these sessions. The techniques are either long held static stretches, partner-assisted stretches, a variety of PNF techniques, or combinations of all of these. A 20 minute flexibility session in a warm hydrotherapy pool or spa is also very productive.

Hydrotherapies

After stretching techniques, hydrotherapies and sports massage are the two most frequently used physical therapies. Water therapies are much under-used and undervalued in Australia. Showers, spas, baths, float tanks and saunas (dry baths) provide ideal environments in which to stretch and perform self-massage.

Guidelines for the use of baths, showers and spas
Spa or bath, with contrast shower or cold plunge pool **Alternate hot (39^{o}C – 40^{o}C) and cold (10^{o}C – 12^{o}C)** spend 3-4 minutes in the hot then spend 30-60 seconds in cold repeat 3 times **Showers:** can be used anytime 30 seconds warm to hot then 30 seconds cold repeat 3 times **Note:** Always take a bottle of water or sports drink

Contrasting hot and cold showers, or using a warm spa with a cold plunge pool or shower, provides an increase in blood flow to the working muscles and accelerates the removal of lactic acid. Recovery of lactates using this protocol occurs at a comparable rate to the recovery of lactic acid through light aerobic activities.

Contrasting hot and cold showers or a warm spa and cold shower also provide neural stimulation because the central nervous system (brain) has to receive and recognise two different types of information – hot and cold. This rapid change from hot to cold stimulates the athlete and helps to increase arousal. Pressure from jets and shower nozzles also enhances muscle relaxation by stimulating light contractions in muscles. Recent research from Finland (Viitasalo et al 1995) has shown that the power output from muscles, after eccentric loading, declines markedly unless the exercised muscles are massaged underwater after training, in which case they show little if any decrease in power. The effects of delayed onset muscle soreness are also minimised this way.

Athletes need to be reminded to drink water before, during and after hydrotherapy treatments as sweating tends to go unnoticed in wet environments. It is also important that the time in the spa, shower or bath is restricted. Treatment times are best limited to two minutes of warm in the shower or three minutes in a warm spa. This should be followed by 10-30 seconds in a cold shower or 30-60 seconds in a plunge pool, alternating from hot to cold three times. There is a tendency for athletes to linger too long in a warm environment and this can offset the benefits of the treatment and in extreme cases be quite detrimental because it can lead to dehydration and neural fatigue. When used correctly, hydrotherapies should leave athletes feeling relaxed but mentally alert, not sleepy and lethargic.

Sports massage

Sports massage has two major physiological benefits. First, some techniques can increase blood flow, and in doing so enhance the delivery of oxygen and nutrients to tired muscles and facilitate the removal of metabolic by-products such as lactic acid. Secondly, the warming and stretching of soft tissues provides temporary flexibility gains. There are also psychological benefits: as tired and tight muscles relax there is a corresponding improvement in mood states. Athletes feel less fatigued and more relaxed.

Perhaps the greatest benefit from a sports massage is the 'feedback' athletes gain as they become more aware of how training loads are affecting their muscles and realising, often for the first time, which muscles and body parts they have stressed. **Tuning-in** to the way the body has been worked helps the athlete identify and manage these stressed and fatigued areas.

Sports massage has gained wide acceptance in Australia over the past fifteen years. There are now many well-qualified professionals available. If the cost of these services is prohibitive then self-massage techniques are free and easy to administer, particularly for the lower legs, chest, neck, shoulders and forearms. In particular, lower leg massages are an effective way to minimise compartment problems such as **shin splints**, or repetitive strain problems. The techniques take a few minutes to perform and can be done in a relaxing atmosphere while watching television or in the shower or bath.

Sports massage

There are five basic terms describing massage technique: vibration (shaking), tapotement (percussion), petrisage (kneading), effluerage (stroking) and friction (small range intensive stroking).

Sports massage uses different combinations of these techniques and is regarded as one of the most effective means of recovery. Treatments are administered during all phases of training.

- **Within training sessions:** short massages can be given during work sessions to help accommodate high training loads and to increase the athlete's training potential.
- **Preparatory massage:** massage as part of a warm-up* phase can be given 15-20 minutes before competition. Techniques can be varied so that the massage can either relax an overstimulated athlete or arouse an apathetic one. Sometimes the massage is localised to an injured area in an effort to prepare it before activity.
- **Restorative massage:** is given in the post loading part of a training session or competition. The techniques used aim to reduce muscle tension and fatigue and lower stress levels. The length and number of massage treatments varies depending on the type of activity (eg concentric or eccentric loading), the intensity of the activity and the state of the individual athlete. Elite performers need at least two full body massages per week.
- **Injury prevention:** massage as a means to enhance muscle relaxation after activity and return muscles to their 'normal' resting state. Two days post exercise is often ideal for a massage to be given to identify any stressed or injured areas which the athlete will need to manage carefully to minimise any future problems with these stressed parts.
- **Note**: Massage is an adjunct only within the warm-up phase. It should **never** replace an active warm-up.

Acupuncture and acupressure

Acupressure is often performed as an adjunct to sports massage but acupuncture requires more extensive qualifications and consequently it is less accessible and more expensive. Both techniques focus on balancing energy fields via specific points located on fourteen meridians that pass through the body. Acupuncture points have a lower cutaneous electrical resistance than adjacent areas and these can be measured and evaluated.
Stimulation of specific points is claimed to influence a wide variety of conditions including oxygen uptake, respiration and the immune system. Unfortunately, few reliable scientific studies have been conducted, but a recent reputable study from China has demonstrated that muscles relax more after acupuncture than muscles which receive no acupuncture treatments. Relaxed muscles would have a positive contribution to the aforementioned conditions.

Chapter 4: Psychological Recovery Techniques

Background reading and references

Loehr, J (1992) *The New Toughness Training for Sports.* Dutton: USA (not included in this study pack)

Psychological skills for recovery

This aspect of sport psychology is sometimes referred to as **mental toughness training or psycho-regulatory training** (PRT). All athletes can benefit from learning to use a few simple psychological skills to control emotions and mood states. In particular, improving self-awareness and motivation and decreasing reactions to stress are essential life skills. Recognition of the complex interaction and strong relationship between physical and mental states is important for recovery training. This is evident when muscle relaxation is observed in conjunction with lowered heart rate and blood pressure, and improved mood states.
Skills associated with developing mental toughness or emotional control involve a variety of relaxation strategies including: meditation, autogenic training, breathing exercises, music, relaxation massage and other techniques.

Meditation

Although passive rest is an important component of recovery practices, the time spent during passive rest can be used to include one of several relaxation and/or focusing techniques. Meditation trains the athlete to relax by controlling the parasympathetic (calming) nervous system through reducing **noise** or stimulation to the brain. By controlling this system the athlete can lower blood pressure, lower heart rate, slow down breathing rates, relax muscles and calm the sympathetic (excitatory) nervous system. This technique is useful for controlling stresses from training or competition particularly if the athlete is over-aroused. Meditation skills, like sport specific skills, take some time and practice to acquire and they are most readily learned by younger athletes who have fewer inhibitions and less **noise** to interfere with acquiring the skill.

Progressive muscle relaxation

Progressive muscle relaxation (PMR) can be done at the end of training or before going to bed. The technique involves tightening specific muscle groups, holding them firm for five seconds, and then relaxing. The regimen usually works by starting at either the feet or the head and neck, and working through muscle groups to the other end of the body. This process enables the athlete to identify the sensations of muscle tension and muscle relaxation in specific body parts. This increased awareness helps the athlete to recognise and then reduce muscle tension when it occurs. Like any sporting skill PMR needs to be practised regularly for best effects to be gained.

Autogenic training

Autogenic training has similarities with PMR. It is a self-induced technique where the athlete focuses on producing sensations in specific muscle groups. The two sensations most commonly used to promote relaxation are warmth and heaviness. Warm sensations indicate a relaxed state and are a useful focus after stressful situations.

Imagery and visualisation

All athletes have an imagination which can be developed to contribute to their training potential. Imagery relaxation, and visualisation, involve using the imagination to create a vivid scene. Four senses are used to generate the image: sight, smell, sound and touch. The image created by the athlete should evoke feelings of comfort and relaxation. Escaping to a relaxing place at the end of each day just before going to bed is a useful way of practising the technique and switching-off before going to sleep. Other images can be created and rehearsed to practise focusing on positives and game strategies.

Breathing exercises

Breathing exercises are used frequently in the martial arts. Learning breathing techniques and focusing on relaxing tense muscles leads to a more efficient physical state. Exhaling while applying static stretches also helps to produce a relaxation response in the body.

Athletes need to be instructed carefully in the art of performing this technique. Breathing in through the nose and expanding the rib cage laterally (at the sides) rather than distending the abdomen in front is a more effective technique and helps the athlete to maintain good posture during this procedure. Breathing out should also be done through the nose.

REST (restricted environment stimulation therapy) and flotation

Other psychological techniques revolve around the concept of REST (restricted environment stimulation therapy), sometimes called sensory deprivation or sensory minimisation techniques. Some of these skills are as simple as closing the eyes to reduce stimulation while other techniques require training (meditation) or specialised equipment (flotation). Reducing the amount of stimulation to the brain enables the athlete to focus more effectively on relaxing and becoming emotionally calm.

Flotation tanks provide an environment with minimal stimulation by reproducing weightlessness, with no sight and no sound (unless the athlete relaxes to music or listens to an affirmation tape). This technique takes two or three trials for most athletes to feel comfortable using so that they can relax completely, but it is remarkably effective for reducing stress and burnout, particularly in overstressed coaches. Not all athletes enjoy the enclosed feeling in the float tank and a few dislike the salty conditions of the water. Some wear swim goggles to protect their eyes.

Music

Music is enjoyed by almost all athletes but as an adjunct to training it is quite under-utilised. Although it is sometimes used in the weights gym to provide a motivational atmosphere conducive to sustaining repetitive workloads, it is equally as effective in evoking a relaxation response if the appropriate music is selected. Most athletes have access to a portable music system such as a walkman or small tape deck. Every athlete should be encouraged to create a bank of tapes they like which generate a range of moods and atmospheres, to produce either a stimulating or calming effect for them. These can be used in training and because they are quite portable they are also an excellent tool in competition or when an athlete is in an unfamiliar environment and is having difficulty relaxing. With practice, an athlete can learn to manipulate mood states to generate either optimal arousal or relaxation.

Apart from flotation and music, all these recovery techniques can be practised daily without the need for any specialised equipment or facilities. An ideal time for rehearsing these skills is immediately before going to bed. Learning how to **switch-off** from the day's events will predispose a good night's sleep.

Emotional recovery

At key times during the year, such as competitions and tournaments, school or university exams and Christmas, athletes are often excessively stressed. If they have lost a game or competition, or performed below their expectations they may benefit from some emotional recovery in their training program. Mood lifting activities can include watching an amusing video or comedy show on TV, reading an escapist or adventure novel, or going to a fun park, zoo or light entertainment centre. A sense of humour and a feeling of mateship, or team support, are invaluable in times of emotional stress. For teams or athletes in extended competitions away from home, and especially overseas, planning such activities as part of the tour is essential.

Chapter 5: Selecting Appropriate Recovery Activities, Planning and Responsibility for Recovery

Background reading and references

Article 16:
Calder, A.1994, Accelerating Adaptation to Training, In *Proceedings of the Australian Coaching Council's Conference*, Australian Sports Commission, Canberra.

Selecting appropriate recovery techniques

Selecting the best recovery techniques will depend on several factors.
First, the athlete and coach will need to recognise what has been fatigued in training in order to recover any residual fatigue from the work done. Is it metabolic fatigue where the fluid and fuel stores need replenishing, is it neural fatigue from explosive powerful exercises or skill training, or is it psychological fatigue? Training sessions often involve combinations of all of these types of fatigue so specific recovery activities can be selected to address these.
Restoring metabolic fatigue can be achieved by restoring fluid and fuel stores and increasing the delivery of these consumables to fatigued muscles (hydrotherapies or light aerobic activities). Neural fatigue can be reduced by using a spa or jostling massage techniques in conjunction with one of the many relaxation techniques. Psychological fatigue can be addressed by relaxing mentally and physically or by choosing a light entertaining activity if emotional recovery is also required.
Second, the use of recovery techniques depends on their availability and the cost and time involved in their delivery or use. Those techniques which can be self-administered and incur no cost are the ones most readily used and accessible to all athletes. Costs increase and techniques become less accessible if specialised equipment is needed or if skilled personnel are required to administer the technique.

Putting it all together: planning recovery training

Off-season/transition/early preparatory phase

This is the most important period for developing recovery training skills. Pre-season screening is essential in order to detect any potential problems which may be exaggerated by training during the season. This is also the time when athletes should start their self-monitoring programs by using a diary or logbook, and begin to learn to **tune-in** to their bodies (see Chapter 2).
Basic time management skills should be introduced so athletes learn how to plan for training, study/work, home life and a balanced social life. Some of the most essential recovery techniques should be introduced and reinforced during this phase. These include appropriate nutrition, stretching (including postural efficiency exercises), hydrotherapy in the shower, self-massage and one or two relaxation techniques. These skills should be reinforced throughout this phase.

Specific preparatory/conditioning/pre-competitive phase

Training loads are often heaviest during these phases so now is an ideal time to make use of cross training to minimise overuse problems. By now, athletes should know how to balance their training sessions in relation to their other priorities such as work or study, and their home and social lives. Self-monitoring through reference to their diary or logbook should be a habit and checked regularly by the coach. The increase in training loads will generate a greater need for more physical recovery techniques especially hydrotherapies, massage and other active recovery activities, including postural correction techniques. Increased workloads also mean that nutrition strategies need to be reinforced to ensure that appropriate and sufficient fuel and fluids are being consumed. Fatigued bodies tend to perform techniques inefficiently and are therefore more predisposed to injury, so adequate nutrition is critical in order to minimise fatigue.
Psychological skills to promote muscle relaxation, such as PMR (progressive muscle relaxation), are also usefully introduced here. Each athlete should practise the relaxation techniques they plan to use during competition and spend time selecting the music they like to use to create a relaxing atmosphere for the times when they will be competing.

Competition phase

By this time all recovery skills should be automated. Athletes should be familiar with a range of self-recording and self-management strategies. They should know how and when to use all the techniques they have practised and be comfortable using these during intense competition There may be a heavier reliance on psychological recovery during this phase because of competition stress. However, if the competition program is planned in advance and athletes know and understand their requirements for this, their stress levels will be lower and they will have more control over their physical and psychological states.
Coaches need to plan carefully to include appropriate recovery training activities around the competition schedule in order to maximise recovery from one game or event to the next. If the competition or tournament involves travelling away from home this includes planning the travelling time and travelling conditions, including arrival time. All major activities need to be forward planned – wake-up times, meal times and food selection, stretching, showering arrangements, post game recovery activities, access to a pool or spa for recovery, massage availability, and planning the **time-out**.

It is important to organise appropriate entertainment in order to find a suitable balance between stress and relaxation. A wise coach will also have strategies in place for emotional recovery in the event that athletes or teams are unsuccessful in their performances. Planning ahead for every eventuality minimises problems associated with stress and promotes performances under challenging competition conditions.

Responsibility for recovery training

At the beginning of the training year it is advisable that coaches and athletes should have a clear understanding of their own distinct, but complementary roles and responsibilities for recovery training. Both parties need to be clear about each other's responsibilities and both need to agree to undertake these respectively. This agreement can be in the form of an unwritten contract or a 'gentleman's agreement' but it is essential that both coach and athlete have clearly defined roles and duties for recovery training.

The coach and recovery training

Overall planning of workloads and appropriate **work-to-rest** ratios is the responsibility of the coach. To assess adaptation to the training loads, the coach needs to monitor athletes at the beginning and during each training session for any signs or symptoms of non-adaptation.

To encourage self-monitoring skills the coach will need to familiarise athletes with using a training diary or logbook and check these on a regular basis, eg at least once a week. The coach can encourage the use of self-management skills that athletes will need. This can be done throughout the training year by introducing techniques in the preparatory phase and reinforcing the use of these throughout the year. Also, it is a wise coach who recognises the external demands on athletes, such as exams or work, and tailors training loads to complement these external pressures so athletes are not excessively stressed.

Many coaches will not have all the knowledge or skills required to teach many recovery techniques, so they may have to use other specialists to teach athletes how to perform these skills, eg self-massage. However, the coach has a responsibility to reinforce this educational aspect of the training program by regularly encouraging and reviewing the application of these techniques and activities.

Training programs need to be flexible so coaches have the option to change workloads relative to the adaptive responses of individual athletes. This flexibility also applies to the different requirements placed on athletes by different environments and venues. Careful planning and evaluation of training needs and adaptive responses will ensure that coaches fulfil their responsibilities for recovery training for their athletes.

The athlete and recovery training

Athletes have two major responsibilities. First they need to learn to **listen to their bodies**, and secondly they need to **look after themselves** physically and psychologically. The very least an athlete can do to fulfil these responsibilities is outlined below and in Appendix 6.

If athletes learn the essential skills of self-monitoring and self-management, not only will they optimise their chances of adapting to heavy workloads, they will also develop effective life skills that they can use after they have finished their competitive careers.

Athlete responsibilities for recovery training

Monitoring and management strategies

Daily

- Every morning monitor resting heart rate, body weight and quality of sleep
- Each evening, rate daily energy levels/tiredness for the day
- Eat a balanced diet and plan appropriate meals and post training snacks
- Use shower/spa/bath for stretching, self-massage, and hot & cold contrasts
- Before bed practise relaxation, eg music, visualisation, PMR, breathing exercises

Weekly

- Have at least one rest day a week (can do a light non-training activity, eg golf)
- Plan active rest, eg stretching, postural exercises, cross training
- Organise a massage (professional, partner or parent) and use self-massage at least three times a week

Weekly time management: plan in advance

- Prioritise all weekly commitments (work, study, training, domestic, social events)
- Add a few varied recovery activities around these commitments, eg spa, pool, float, movie, music etc

Partners and/or parents of athletes and their support for recovery

Partners and parents can help to reinforce the responsibilities of the athlete. By encouraging the use of a training log or diary they can help the athlete to **learn to listen** to his or her body. Parents can use the concept of the 'smiley faces' to gauge how their children are responding to training, or school, or life in general. Both partners and parents can play a very useful role by learning and applying massage techniques on their children. A few minutes massaging tight legs, shoulders, or back, before the athlete goes to bed can mean the difference between a heavy stiff body or a more relaxed, recovered body the following morning. Preparing balanced meals with appropriate post training snacks and a drink bottle to include in a kit bag is essential.

Close family members inadvertently monitor their partner or child's responses to stress so they are aware of the signs and cues when the athlete is not coping. Like the coach, partners and parents should also keep watch for excessive stress in the athlete and they should be able to communicate freely and openly with the coach if they suspect that the athlete is having difficulties adapting. The same principles apply to parents and partners as to coaches and athletes, ie plan, monitor and manage carefully to minimise the occurrence of any problems.

Summary

Intense pressure on athletes and coaches to produce bigger and better results has increased the necessity to train hard, but sometimes this is achieved **at all costs**. Athletes and coaches often fall victim to illnesses associated with excessive stress, and occasionally the temptation to cheat in order to succeed is very attractive. Finding a balance in training programs so that best performances can be realised without the athlete or coach breaking down has often been difficult because many coaches and athletes are unaware of the role and benefits of recovery training.
The principle of **recovery** is the most frequently forgotten training component and the most poorly understood of all the training principles. Yet recovery training is as important for an athlete's development as are the improvement of energy systems, strength, flexibility and mental skills training. The benefits from blending recovery training effectively within programs are many and include:

- Athletes learn how to monitor their training responses (**listen to their bodies**) and manage themselves (**look after their bodies and control their emotions**) so they can cope with their workloads and stresses and promote adaptation to training loads.
- A spin-off from successful adaptation is the reduction in injuries, illnesses and burnout often experienced by excessively overstressed athletes and coaches.
- Recovery training methods offer athletes a safe and natural alternative to banned performance-enhancing drugs.
- Through recovery training, athletes and coaches acquire effective life skills in self-awareness, self-management and self-maintenance which they can use even after they have finished their competitive sporting careers.

Responsibility for monitoring adaptation and implementing recovery training is a shared responsibility between the coach, athlete, partners and parents of athletes. If all are committed to working hard and adapting well they can achieve their **best performance**; the winning formula is:

Work Hard	**+**	**Recover Well**	**=**	**Best Performance**