

A GUIDE TO



INCLUDES DVD

SPORTS AND INJURY MANAGEMENT



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Andy Leaver**

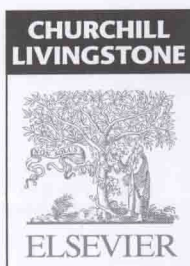
A GUIDE TO SPORTS AND INJURY MANAGEMENT

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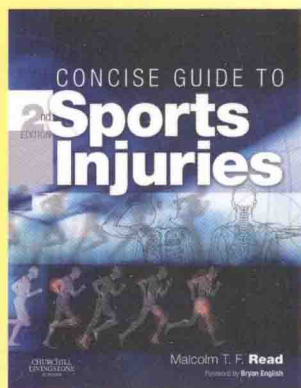
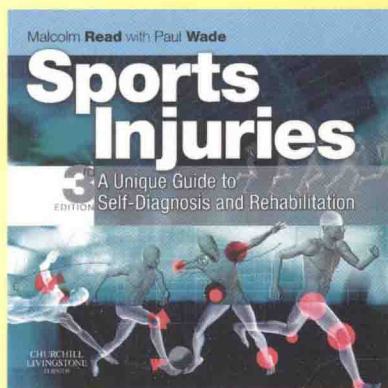
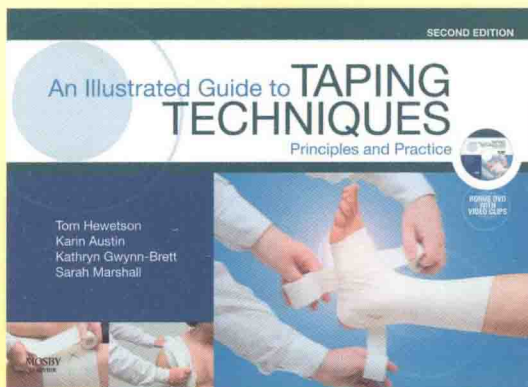
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A GUIDE TO **SPORTS AND INJURY** **MANAGEMENT**

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DVD CONTENTS

The DVD accompanying this text contains:

The Interactive Diagnosis Tool
Video clips
Multiple Choice Questions relating to each chapter in the book

The Interactive Diagnosis Tool

The tool aids diagnosis of common injuries and opens as a colour image of the selected part of the human body (e.g. ankle and foot). The user clicks onto the image to bring on screen a more detailed anatomical drawing of that body area. The user can choose to view the ankle from anterior, inferior, lateral, medial and posterior views.

Within each of these views the user moves the cursor over the image and as trigger points on the image are highlighted the various diagnoses pop up on screen. The diagnoses are split into acute (red), chronic (blue) and referred (green) diagnoses. There are over 200 common injuries diagnoses included in the tool.

COMMON INJURIES

Ankle and foot

Anterior view
Forefoot (anterior view)
Inferior view (sole of foot)
Lateral view
Medial view
Midfoot (anterior view)
Posterior view

Buttock

Posterior view (lumbar spine to mid thigh)

Groin and pelvis

Anterior view
Lateral view
Posterior view

Knee

Anterior view
Lateral view
Medial view

Posterior view
Inferior view
Superior view
Acute

Lower leg

Anterior view
Posterior view

Shoulder

Anterior view
Posterior view

Spine

Cervical – posterior view
Lumbar and sacral – anterior/lateral/
posterior views
Lumbar and sacral – posterior view
Thoracic – posterior view

Thigh

Anterior view
Posterior view

Upper limb

Anterior view
Medial view
Lateral view
Posterior view

Wrist and hand

Anterior view
Posterior view

VIDEO CLIPS

There are video sequences of all the techniques and exercises indicated in the text by the icon. To look at the video for a given technique, click on the relevant item in the contents list on the DVD.

Assessment of the ankle joint

Ankle dorsiflexion
Ankle eversion
Ankle inversion
Ankle plantar flexion
Anterior drawer test for the anterior
talo-fibular ligament
Posterior impingement test
Syndesmosis test

Assessment of the knee joint

Anterior drawer test for the anterior cruciate ligament (ACL)
Dial test for the posterolateral corner
Lachman's test for the ACL
McMurray's test for the meniscii
Patello-femoral joint glides
Posterior drawer test for posterior cruciate ligament (PCL)
Posterior sag test for the PCL
Valgus stress test for the medial collateral knee ligament (MCL)
Varus stress test for the lateral collateral knee ligament (LCL)

Assessment of the hip joint

Hip flexion
Hip medial and lateral rotation
Ober's test
Quadrant test
Test for impingement of the anterior capsule of the hip
Thomas test

Lumbar spine assessment and lower limb nerve provocation tests

Lumbar flexion and extension
Slump test
Straight leg raise

Assessment of the sacroiliac joint (SIJ)

SIJ kinetic test – forward flexion
Stork test

Assessment of the elbow joint

Valgus stress test for the medial collateral elbow ligament (MCL)
Varus stress test for the lateral collateral elbow ligament (LCL)

Assessment of the shoulder joint

Apprehension and relocation tests
Empty and full can tests
Hawkins Kennedy test

Neers test
O'Briens test
Resisted empty and full can tests
Scapulohumeral rhythm
Sulcus test
The 'Scarf' acromioclavicular joint test

Upper limb nerve provocation tests

Upper limb tension test (ULTT 1) – median nerve bias
Upper limb tension test (ULTT 2) – radial nerve bias
Upper limb tension test (ULTT 3) – ulnar nerve bias

Assessment of lower limb stability and muscular control

One-legged squat

Warm-up stretching programmes

Dynamic stretching warm-up
Static stretch warm-up

Proprioception/balance exercises

BOSU hops
Single-leg BOSU balance
Single-leg BOSU squats

Weight training examples

Bench press
Squat

Rehabilitation exercises

Eccentric Achilles tendon exercises
Eccentric patella tendon exercises
Knee drives
Nordic hamstring exercises

Core stability exercises

Floor core exercises
Gym ball core exercises

Other

30-second neurological examination
Application of a cervical collar

Preface

As a training sports physician I felt there was a lack of teaching material that was both practical and which suited my way of visual learning. I was desperate to find a book or DVD that took me through symptoms, signs, investigation and management combined with a list of possible differential diagnoses that was visual and reflected how we manage patients in the clinic. I was pleased to find that after working together with Andy at London Irish Rugby Club he had a similar train of thought. We therefore hatched the idea of developing a book and DVD that was very practical, visual, and, most importantly, gave information from both a physician's and physiotherapist's perspective. The project has taken several years to develop and the final product will hopefully be of value to sports physicians, physiotherapists, osteopaths, chiropractors, sports masseurs and all those training in these fields as well as keen athletes.

Mike Bundy
London, 2009

Having worked as a physiotherapist in sport for a number of years, it has become very apparent that there are a vast number of clinical signs, tests, techniques and exercises that clinicians have to remember. While there are a number of other textbooks available, I have yet to find one that has taken me through the assessment techniques to the clinical findings and then to the rehabilitation techniques to treat the injury in an easy-to-follow and visual manner. Having worked with Mike for a number of years, we felt that we could produce a book which would provide clinicians with all the necessary information to accurately assess, diagnose and rehabilitate a wide variety of commonly occurring sports injuries in a new and exciting format. In doing so, we have incorporated photographs into the book and videoclips onto the interactive DVD to highlight a number of the important tests and exercises. We hope that all the clinicians who read this will find it very useful.

Andy Leaver
London, 2009

Acknowledgements

We would very much like to thank Chris West and Hannah Bundy for agreeing to be in the photographs and would also like to thank Sarah Mitchell, Sarah Bundy and Phil Leaver for all their help in taking the photographs and video clips.

M.B.
A.L.

Contents

The DVD accompanying this text includes video sequences of all the techniques and exercises indicated in the text by the icon. To look at the video for a given technique, click on the relevant icon in the contents list on the DVD. The DVD is designed to be used in conjunction with the text and not as a stand-alone product.

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Chapter

1

Training and conditioning

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The conditioning of athletes is an area which has become very popular and that has made significant advances in recent years. It is an ever-changing discipline because there has been a much greater emphasis placed on athletes being at the peak of physical condition for their sporting event, whether this be by having a greater cardiovascular capacity or being 'fitter' or by being stronger. This has led to strength and conditioning coaches being widely employed in most sporting disciplines to devise training programmes to ensure that the athletes are at the peak of their physical condition so that they are able to compete at the best of their ability in their competitions or matches.

It is, however, an ever-changing area with new and different concepts being devised all the time in an attempt to push the boundaries of physical performance and give the athlete an edge over their competitors. This is achieved by the strength and conditioning staff analysing the specific demands of each individual competitor. The physical demands obviously differ between sports but they can also differ between team mates who play in different positions on the same team. For example, the strength and conditioning programme for a prop in rugby will be quite different to that of a winger on the same team because of the different physical demands placed on each of them in the game. Therefore, it is very important to remember that the programmes need to be tailored to the individual and should be sport-specific for the greatest benefits to occur. For example, a cyclist needs to cycle and sports which are running-based, such as football and rugby, need their athletes to run and so on.

This chapter will discuss some of the different training techniques that are being employed and give some examples of useful sessions for some athletes.

AEROBIC TRAINING

Aerobic training is simply where oxygen is present and is used to generate energy when the glycogen stores in the muscles are broken down to produce glucose and hence allow muscle contractions to continue. It is the most common type of training and that done by members of the public who are trying to 'keep fit'. This is because it has been shown to have numerous health benefits:

- It improves the efficiency and strength of the cardiac (heart) muscle itself. This causes hypertrophy or enlargement of the heart, which leads to increased pumping efficiency and consequently a reduction in the resting heart rate.
- It strengthens the respiratory muscles which facilitate the flow of air into and out of the lungs.
- It increases the number of red blood cells to which oxygen binds and hence aids its transportation around the body and to the muscles.
- It improves the efficiency of circulation which helps reduce blood pressure.
- It can help in reducing stress as the exercise triggers a hormonal release which is involved in controlling anxiety and alertness levels.

These factors have been shown to help reduce the risk of cardiovascular disease and hence produce significant health benefits. Consequently, aerobic exercise in a variety of forms has grown in popularity in the non-elite sporting population to maintain health and keep fit.

Training zone

The training zone is the heart rate that needs to be achieved by an athlete for the benefits to the cardiovascular system to be achieved. The individual needs

their heart rate to be between 65% and 85% of the maximal heart rate for between 20 and 40 min for a cardiovascular benefit. This needs to occur regularly for these benefits to be maintained and improved further. This should be at least three times per week in the non-elite population.

Maximum heart rate

There are a number of ways to calculate a person's maximum heart rate for training purposes. The simplest way to calculate it and to easily recommend to athletes is as follows:

$$220 - \text{age} = \text{Maximum heart rate (beats/min)}$$

For a 30-year-old, the training zone is as follows:

$$220 - 30 = 190 \text{ (max heart rate in beats/min)}$$

$$190 \times 65\% = 123 \text{ beats/min}$$

$$190 \times 85\% = 161 \text{ beats/min}$$

Therefore this athlete needs to keep their heart rate between 123 and 161 beats/min for the duration of the exercise of at least 20 min for a training effect to be achieved.

Aerobic testing

As the conditioning demands on athletes have changed, coaches and conditioners have continued to search for ways to objectively measure fitness so that they can ascertain how an athlete is performing, but also to monitor the effectiveness of their training programmes. If athletes have baseline fitness tests conducted and then they are re-tested, improvements in cardiovascular fitness can be measured.

VO₂ max testing

VO₂ max testing is the gold standard or most accurate test of aerobic or cardiovascular fitness. Its definition is the athlete's maximum capacity to utilise oxygen in a graded exercise test. The testing procedure is not readily available as it requires the athlete's ventilation to be measured very accurately with the concentrations of oxygen and carbon dioxide of inspired and expired air being measured while the athlete performs the graded exercise test on a treadmill or static bike. An athlete's VO₂ max is reached when their oxygen uptake remains constant even though the intensity of the exercise test increases. It is measured in litres/minute (L/min) or millilitres/minute per kilogram (mL/min/kg) of body weight. A score for an elite athlete who participates in an aerobic event such as a rower, long distance runner or cyclist should reach approximately 75 mL/min/kg.

Bleep test

The VO₂ max test is not possible for the majority of athletes, so other tests have been devised to give an objective measure of cardiovascular fitness. The bleep test is perhaps the most common test. It is simply a running-based test which comprises a 20 m shuttle where the athlete has to complete the shuttle inside timed bleeps on a pre-recorded audio tape or CD with the bleeps gradually becoming quicker, thus increasing the intensity of the test. The athlete achieves their score by the level of the test they reach and the number of shuttles in that level. The test goes to Level 21, but an elite athlete should be able to reach at least Level 14 on the test.

TYPES OF AEROBIC TRAINING

Conditioning staff are always looking at developing different training sessions to give the athletes the greatest training benefits. As discussed earlier, it can be in its simplest form maintaining the athlete's heart rate within their training zone for the duration of the session. This is not as effective for elite athletes who need their cardiovascular system to be stressed more vigorously to gain the greatest benefits; therefore other examples will be discussed.

Interval training

Interval training involves the athlete working at near full exertion, i.e. approximately 90% of their maximal heart rate for a period of time, and then interspersed with a rest period of much lower intensity exercise or relative rest. The session is most beneficial when the work to rest ratio is approximately 1:1; that is the time of effort is similar to the rest period. As the session progresses, the athlete's recovery will not be complete and their heart rate will not return to its normal resting level. The rest period is often simply a walk back recovery to the starting position or can be a very low intensity continuation of the same exercise. The sessions should be made relevant to the athlete and the demands of their specific event, i.e. running for running-based sports and a rowing session for rowers, etc.

Examples are as follows:

- Running
 - 10×400 m with 1 min recovery between each repetition
 - 12×200 m with 30 s recovery.
- Rowing
 - 6×500 m ergo with 2 min recovery between reps.
- A pyramid session for ergo or bike
 - 10 s on, 10 s off
 - 20 s on, 20 s off
 - 30 s on, 30 s off
 - 40 s on, 40 s off
 - 50 s on, 50 s off
 - 60 s on, 60 s off
 - 50 s on, 50 s off
 - 40 s on, 40 s off
 - 30 s on, 30 s off
 - 20 s on, 20 s off
 - 10 s on, 10 s off

There should be a 2-min rest between sets and repeat three sets. The 'on' period should be with high levels of resistance and at near maximal effort, with the 'off' period at low resistance but continuing the exercise.

Fartlek training

Fartlek training is similar to interval training in that there are periods of high intensity training interspersed with low intensity periods. It is continuous training and therefore is often used by long distance runners as a training method. The session can last for up to 45 min and can, in fact, include anaerobic bursts if it is required in the athlete's event.

An example of a Fartlek session might be:

- 5 mile run at normal speed
- 8×90 s bursts of increased intensity at 800 m pace with 2–3 min between each increased intensity burst.

Conditioning games

These have become popular training methods in team sports where the athletes play small sided games which are relevant to their sport. The aim is for the athlete to maintain their heart rate at between 75% and 90% of their heart rate maximum for the duration of the game. By keeping the number of team members fairly small, it ensures that all the athletes work maximally for the duration of the game and it is difficult for them not to join in the game and rest.

A good example would be a 3-a-side game of football for 5×5 min periods, or 2-on-2 basketball for 5×3 min periods.

Heart rate monitors

A recent product which has led to further monitoring has been heart rate monitors which are worn by athletes during their sessions and actually record their heart rate throughout a training session.

In this way, their effort levels can be monitored and conditioners and coaches can ensure that their athletes are maintaining their heart rate at the desired levels of towards 85% of the heart rate max for the whole session. It is an accurate way of observing heart rates through a session but also the rate of recovery, which is another good indicator of cardiovascular fitness as this occurs faster in fitter individuals.

ANAEROBIC TRAINING

Anaerobic training is training or exercise where the athlete triggers the metabolism of the glycogen without oxygen present. It occurs in intense exercise which lasts for less than 2 min and is effective in building muscle mass and power. It does, however, lead to the production of waste products such as lactic acid, which is detrimental to muscle function, and therefore, this type of exercise cannot last for longer than 2 min because of the lactic acid build up.

The point where lactic acid builds up in the muscle and circulatory system is termed the *lactic threshold* or *anaerobic threshold* and occurs when the lactic acid is produced more quickly than it can be removed or metabolised. When the lactic threshold is reached, the athlete is unable to continue to perform at the same level and this is often described as 'hitting the wall'. It is, however, possible to train and increase this threshold so that the athlete can perform for longer at the same or greater intensity before the threshold is reached.

For this training effect to occur, the athlete must work maximally and to fatigue. Their recovery period means that as the session progresses, it is just insufficient for the athletes to meet their targets. As long as the athletes continue to put in maximal effort, they will achieve a training effect and improve their lactic threshold. For this to occur, the work to rest ratio needs to be approximately 1:2–4, with the total work time being between 4 and 8 min.

Examples of such sessions are as follows:

- 10×200 m (aim to complete within 30 s) with 90 s recovery
- 5×400 m with 5 min rest
- 10×60 m sprints with 60 s recovery.

Therefore, any event or sport where the athlete is required to work to maximum intensity for periods of up to 2 min needs to include this form of training in their programmes.

STRENGTH TRAINING

Strength training is where different forms of resistance are used to build strength, size and endurance of muscles. It is important for athletes to include strength training in their training programmes, as significant benefits to their function can be achieved, including improved joint function and reduced injury risk given to them by the increased size and strength of the muscles acting over the joints. Weight training is the commonest form of strength training and the principles underpinning it will be discussed further here.

Principles of training

There are different forms of strength training which give rise to different results and improvements in the athlete's performance. It is the differences in the number of repetitions, sets, speed of exercise, weightlift or force required and tempo which cause slightly different adaptations to the muscles and differentiate between the different forms of strength training.

Specificity

It is vital that the exercises which are integrated into each athlete's programme are specific to their individual needs to improve performance in their event. There are now hundreds of exercises that can be tried in the gym which all train the muscles in a slightly different range or different movement pattern.

The strength and conditioning trainers must analyse the movements that occur in the athlete's event and try to replicate these movements in the gym. For example, the squat exercise is very useful when athletes require a sprint or explosive start to running or if jumping is required in their sport.

Also, it has been shown that when training the muscle, the gains are often task- or movement-specific. For example, when strengthening the quadriceps, squat training shows improvements in this form of closed chain knee extension, specifically the squat, but there is no carry over or improvement in open chain knee extension strength. Therefore, it is not just as simple as doing an exercise which uses the muscle group but, importantly, it should be movement- and event-specific for each individual.

Also, not every athlete will require every type of weight training in their programme because the demand of each sport is slightly different. For example, a sprinter will not require endurance training as it is not part of their sport, but of paramount importance is making improvements in power and strength. Likewise, a marathon runner will not need power training and should concentrate on endurance and strength sessions instead.

Strength

For specific strength to be gained the exercise programme must have the following components:

- The weight must be between 75% and 95% of their 1-repetition maximum (1RM) weight
- There should be between 2 and 5 repetitions (reps) in each set of exercises