Sports injuries

Everything you need to know as an athlete to prevent or heal injuries

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Table of contents

INTRODUCTION

Knowing and understanding your own body is crucial for every athlete. It helps you to develop and perform to the maximum, and to fully enjoy the sporting experience. The athlete himself is the one at the wheel. Nobody is better placed to feel and judge his body than the person himself or herself. He or she is the only one who experiences the symptoms, who feels the pain or discomfort.

So, it is the athlete who is in pole position.

The best possible care-provider for your body is indeed yourself. Acquiring adequate and correct knowledge will obviously help in this. Gaining this knowledge, however, is not as evident as it may seem today, with an excess of often unreliable internet information, often driven by commercial or other interests. This book tries to offer a solution.

It is written on the basis of a long medical career in following and treating athletes of all levels, from the amateur jogger to the Olympic top athlete who is the very best in his or her discipline. The basic principles are the same for both, by the way. This is logical, because these principles are based on the same biological laws and processes that characterise human physical functioning.

How do you become stronger and faster?
How do you avoid injury despite hard training and intense competition?
How do you come back after injury, stronger and better than before?
What injury did you exactly sustain, what are the consequences, and what can you, your coach, physiotherapist or doctor do to remedy the problem?

Instead of getting drowned and lost in the chaos of doubtful mass-information on the internet, this book will provide the reader with practical and concrete answers to these questions.

It offers a handle on what is so often asked by sportsmen and women: what is wrong and what can be done about it? It provides the athlete and his or her environment with a reliable source of information on the way to self-diagnosis and the best approach. As such, this book will be of benefit to anyone involved in sports; the athlete himself or herself, the coach, trainer, parent, physiotherapist, doctor, or anyone caring.

Chapter 1: How to stay injury-free?

Getting injured is the last thing you want as an athlete. Not only because of the pain and discomfort, but even more so because of the consequences for your sports participation. Standing on the side-lines for days, weeks, months, while your fellow athletes continue to train, have fun, improve, compete and perform. Having to miss all of this, that is often an even greater source of frustration.

In addition, there is this perception of powerlessness and useless loss of time, combined with the uncertainty of full recovery without losing speed, explosiveness, flexibility, strength or agility. Not getting injured is therefore an obvious advice. Many athletes however believe that getting injured is inevitably associated with sports participation, especially at the elite-level, and of course that is in a way true.

But still, some athletes seem to be injured almost constantly, while others hardly get any injuries at all. No wonder that the latter are usually also the more successful athletes. To win prizes, one indeed needs to be present in the arena. You don't win medals in the physiotherapy room. Avoiding injury is therefore essential. I mean with that: avoiding injury is an essential part of what competitive sports is all about: winning or losing.

But there is good news. The days when an injury was exclusively attributed to bad luck, coincidence or bad fate, are long gone. Our knowledge in sports medicine has evolved tremendously over the last two decades, with many of the risk factors towards injury now being well recognised and known, which obviously is extremely helpful in maximally preventing athletes from injury. And that certainly does not mean that athletes should train or exercise less intensively.

On the contrary, training hard, even very hard, is not a problem. Al least, if you apply a few principles correctly. We describe the most important ones below. If you follow them, your risk of getting injured will be minimal.

1.1. Be progressive in your build-up: never increase the load by more than 10% per week.

The most common mistake: increasing too fast. With the consequence of getting injured. Becoming stronger and better in your sport obviously requires training, and this should be done progressively. The mechanism upon which training is based, is actually very simple. When the human body is stimulated in the right way, it will become stronger. This applies to the whole body, but also to each tissue separately.

Strength, speed, endurance, explosiveness, coordination: all of these will improve when the appropriate loading stimulus is imposed on the body. And this also applies to the individual tissues such as bone, muscle, tendon, ligament and cartilage. The right loading stimulus will strengthen the tissue.

Which loading stimulus is the most appropriate for which tissue, is today well known. We discuss that further in this book. But, there is indeed a big "but": when the loading stimulus is imposed too high in intensity, volume, or frequency, it will act tissue-damaging instead of tissue-strengthening.

Thus, at some point, a loading stimulus may indeed become destructive or harmful, depending on its intensity or frequency. (Figure 1.1) This process occurs at the microscopic level: training stimulates the cellular mechanisms that make tissue stronger, ensuring that the tissue can better handle the imposed load in the future.

But when that same stimulus is applied too aggressively - before the cellular mechanisms have sufficiently strengthened the tissue - the tissue will fail and become damaged or injured. Tissue adaptation therefore requires a certain amount of time. How much and how long exactly?

That is today relatively well known and also supported by scientific evidence. On average, a 10% load increase per week will hardly lead to an increase in injury risk. When the load is however increased greater than 10% per week, the risk of injury increases exponentially. (Figure 1.2) Training for a week with a load that is 30% higher than the week before, will increase the injury risk from an average of 6% (baseline risk) to 28%, that is by a factor of more than 4.

An example: a long-distance runner trains at an average of 100 km/week. However, the competition is approaching, and he wants to increase his training. The following week he trains at 110 km (+10%). Good; his injury risk remains baseline (about 6%). But if he were to increase his weekly volume to 130 km (+30%), his injury risk would rise to 28%! So, 4.5 times as high.

This rule is uniform and applies to almost all sports disciplines; the number of hours on the court for tennis players, the number of balls they hit, the number of sprints for hockey or soccer players, the number of throws for javelin throwers, and so on. Increasing the load is ok, but no more than 10% per week.

Hence the importance of correct load monitoring, as it is predictive of injury risk. And this applies to the different physiological components that are important to the specific sport; aerobic (endurance) and anaerobic work (shorter (sub)maximal efforts), power efforts, contact and non-contact efforts; all of these are subject to the same principle; if you increase them to an intensity of >10%/week, your injury risk increases exponentially.

For both the amateur and the professional athlete, monitoring of these variables is nowadays perfectly possible through trackers and smart-watches, and continuous load monitoring has therefore become indispensable in (top) sport today. Especially in risk periods where load spikes or load peaks (>10%) may occur, such load monitoring and load adjustments when needed, are crucial.

The traditionally dangerous periods are those in which the athlete or trainer wants to get back on level (too) quickly, such as when resuming after an injury, restarting after a summer or winter break, after an illness, or when new accents are suddenly imposed in training.

Classics are also the "start to sport" programmes, where the athlete loses himself or herself in enthusiasm and ambition, increasing the load too hard and too quickly, and ending up injured after only a few weeks. Again, it is important to note that this does not mean that you cannot train hard; the body is perfectly capable of handling heavy training loads, as long as these are built up progressively.

Figure 1.1: The intensity and frequency of the load determine whether it is tissue-strengthening or tissue-damaging.

Figure 1.2: Injury risk in relation to load increase per week. As soon as the load increases by more than 10% per week, the risk of injury rises sharply.

1.2. Avoid cumulative symptomatology.

Training or competing with a certain symptom such as pain, swelling or a feeling of stiffness need not be a problem in itself. What is problematic, however, is when the same symptom progressively increases over successive training sessions or sports participation. We call this cumulative symptomatology; the symptom becomes each time a little worse. (Figure 1.3)

For example, a distance runner has some pain in the Achilles tendon. At the start of the training, the pain score is 1 (out of 10), at the end of training it is 3/10. After training, he allows the tendon to rest and starts the next training session only when the pain has dropped to 1/10 or lower. In addition, he makes sure that the pain does not increase above 3/10 during this next training.

Perfect; the athlete has read this book and avoids cumulative (i.e. progressively increasing) symptomatology, thus avoiding serious structural damage. If the athlete fails to do this, and for example had resumed training with a pain score of 2/10 or had allowed it to rise to 4/10 during training, and especially if this happens repeatedly, serious structural damage will occur at some point, with the result that the athlete will drop out injured.

Increasing, cumulative symptomatology is, in other words, a warning of structural damage that will inevitably occur sooner or later, and that will inevitably put the athlete out of action for a long time to allow the affected tissue to heal or recover structurally.

A basic rule in avoiding injury is therefore to start the next training session only when the symptom or discomfort (pain, swelling or stiffness) has returned to the level it was at the start of the previous session. (Figure 1.4) In other words, do not start the next training session until you have fully recovered from the previous one.

Figure 1.3: Cumulative symptomatology (pain, swelling, stiffness) is the precursor of structural damage and should be avoided.

Figure 1.4: Cumulative symptomatology is avoided if the next training session is only started when the symptoms have subsided to the level at the start of the previous training session.

1.3. Alternate impact-loading with non-impact training.

Broadly speaking, training loads can be divided into impact and non-impact loads. By impact load we mean repetitive shock load; running and jumping. Cycling and swimming are non-impact loads; the body does not have to absorb any shocks. The differentiation between the two types of load is important, because there is a fundamental difference in the tissue structures that endure them. For impact loads, these are the bone and cartilage.

Prolonged impact loading can therefore overload (and damage) bone and cartilage, whereas this hardly happens with cycling and swimming. Cycling and swimming are therefore considered as friendly activities for cartilage and bone, so they are called cartilage- and bone-friendly sports.

As soon as symptoms of cartilage or bone overload start to appear, it is therefore wise to replace impact training with non-impact sessions, and it is even better to incorporate these somehow as a preventive measure before bone or cartilage overload occurs. Good trainers know this, and they can often sense from experience when impact-overload begins to occur.

Often, the athlete will signal some incipient discomfort at the knee, ankle, hip or lower back, or will start to experience signs of periostitis or shin splints (see below), which then is the signal to introduce non-impact training that is functional in the athlete's programme (e.g. cross trainer, ElliptiGO®, rowing bench, etc.).

1.4. Ensure sufficient basic strength, postural control, and dynamic control.

Staying injury-free also means that the athlete must have sufficient strength, flexibility, motor control and coordination to perform in a technically correct manner as well as to overcome the dangers inherent in sport. For example, avoiding a tackle, responding to an opponent's attack, avoiding a sudden obstacle in the course, and so on.

Optimal control over one's own body is therefore a basic requirement, both in static posture (postural control) and in movement (dynamic control). And that is far from easy; even the best athletes rarely exhibit optimal postural and dynamic control, so it is no wonder that even top athletes work on stability, coordination and flexibility on a daily basis. There are different ways of evaluating static and dynamic body control, but the principles are always the same.

The FMS score (“Functional Movement Screening”) is the most commonly used. In elite athletes it is sometimes analysed several times per season. Correct postural control requires a symmetrical stance of the body, with correct position of pelvis and shoulders (the "girdles"), and correct posture of the axial skeleton (pelvis, back, neck and head) in the three spatial dimensions (frontal, lateral and axial). Optimal dynamic body control is the next step.

This requires a stable posture of the trunk (core stability) during the movement, which allows the limbs to perform the sport-specific tasks with maximum efficiency, minimum loss of energy and minimum risk of injury. Coordination, flexibility and muscular strength are the additional elements of importance in this dual objective; (1) maximum movement efficiency (and thus performance), with (2) minimum risk of injury.
In addition, muscle strength must be balanced for agonists* and antagonists**. It is therefore essential to strive for the optimal strength ratios between the muscle groups (Table 1.1).

Table 1.1: Reference values for the ideal agonist-antagonist ratios of the main muscle groups.

Knee:	Hamstring/Quadriceps (H/Q)	55-60%
Hip:	Flexors/Extensors	65-75%
	Abductors/Adductors	85%
Ankle:	Evertors/Invertors	85-90%
	Dorsiflexors/Plantar flexors	25-30%
Shoulder:	Abductors/Adductors	50%
	Flexors/Extensors	80%
	Exorotators/endorotators	65-70%
Elbow:	Extensors/Flexors	90-100%
Wrist:	Extensors/Flexors	50-60%

** ** Agonists and antagonists are muscles or muscle groups that move the joint in the opposite direction. Depending on the direction of movement, one speaks of the agonist (e.g. the biceps for flexing the elbow, while the triceps is the antagonist), and vice-versa; for the extension of the elbow, the triceps is the agonist, the biceps the antagonist.*

1.5. Consider your morphotype.

The importance of the morphotype in sports has been widely studied. Classically, anthropology distinguishes 3 basic morphotypes: endomorph, mesomorph and ectomorph, and each of these morphotypes is associated with a number of morphological and physiological characteristics that make the person more or less capable of excelling in a particular sport. (Figure 1.5)

Endomorphs are characterised by a round body shape with short, tapered limbs and body mass concentrated around the abdomen. Mesomorphs have a V-shaped body with a muscular appearance, broad shoulders and a relatively narrow waist. Ectomorphs have a lean body appearance with long arms and legs, narrow shoulders and relatively little muscle development. (Table 1.2)

It is therefore not surprising that a certain morphotype suits a specific sports discipline better than another. In the past, it was thought for a while that there was also a correlation between morphotype and certain psychological variables. For example, endomorphs were associated with a gentle and loving nature, whereas mesomorphs were associated with a combative, competitive and assertive attitude, which de facto made them more suitable for competitive sport.

But in the meantime, this view has been modified, and based on larger studies, the conclusion has been reached that this association was wrong or at least not significant. Regarding the association between morphotype and physical characteristics or performance, however, there is no doubt. Numerous sports science studies have demonstrated this for just about every sport, which is quite logical. It is therefore no surprise that morphotyping an important element is in talent detection and development.

Figure 1.5: Endomorp, mesomorph, and ectomorph.

Several methods exist to determine the morphotype of an athlete, but the most widely used is Heath-Carter's method. It uses a formula based on various anthropological measurements including height, weight, skinfold thickness, circumference of the upper and lower limbs, and some length-width ratios of the skeleton. In this way, it is determined for each athlete to what extent he or she exhibits an endomorph, mesomorph, or ectomorph constitution.

The quantification is then from 1 to 7, with the three archetypes being catalogued as 7:1:1 (extreme endomorph), 1:7:1 (extreme mesomorph), or 1:1:7 (extreme ectomorph) respectively. In reality, however, these three archetypes are almost never found, and indeed most of us find ourselves in the spectrum somewhere in between (e.g. 5:3:4). With this method, athletes or individuals can therefore be characterised in an interesting way in terms of body constitution.

Although the individual's morphotype is partly genetically determined, recent research has shown that under the influence of diet, lifestyle and training, an evolution of the morphotype over time can occur. A sedentary lifestyle, for example, will enhance the endomorphic aspects, while physical training will increase the mesomorphic (strength training) or ectomorphic (endurance training) aspects.

For many sports, the morphotype profile of the elite athlete at the top-level is well known. Figure 1.6 shows a graphical summary of the current knowledge on this subject. No wonder, of course, that most elite athletes are situated in the mesomorphic/ectomorphic zones, but individual exceptions are certainly not uncommon.

Figure 1.6: Average morphotype-profiles of elite athletes, by sport:

1. Artistic gymnastics, 2. Athletics discus, 3. Athletics high jump, 4. Athletics hurdles, 5. Athletics long-distance run, 6. Athletics marathon, 7. Athletics speed walking, 8. Athletics sprint, 9. Athletics long jump, 10. Basketball, 11. Boxing, 12. Golf, 13. Judo, 14. Karate, 15. Rowing, 16. Rugby, 17. Fencing, 18. Sumo wrestling, 19. Tennis, 20. Triathlon, 21. Soccer, 22. Volleyball, 23. Cycling (track), 24. Cycling (road), 25. Wrestling, 26. Swimming.

Morphotyping is obviously of interest to coaches and athletes, but also has implications for injury prevention and risk analysis. (Table 1.2) It is well known for example that ectomorph athletes have difficulty gaining muscle mass, whereas endomorph athletes, and especially mesomorph athletes, gain muscle mass quickly. Endomorph athletes, on the other hand, have more difficulty keeping their body weight under control, whereas ectomorph athletes have little or no problem with that.

Ectomorphic characteristics are therefore favourable for endurance athletes, long-distance runners (think of the slender Kenyan athletes), and high jumpers. On the other hand, ectomorph athletes are more prone to stress fractures, hormonal disruption, and in the case of female athletes, dysregulation or absence of the menstrual cycle, due to their slender physical constitution. Mesomorphic characteristics are extremely favourable for short and explosive efforts, but these athletes are at a higher risk of muscle tears and tendon injuries because of their increased muscular tension (tonicity).

Finally, endomorphic athletes have a low centre of gravity, which gives them a firm footing and great agility, which is advantageous in a number of combat and contact sports (defenders in rugby and American football). Because of their mass inertia, they are also favoured in throwing sports. Possible derailment of body weight is a disadvantage, as is an increased risk of overload problems in the knee, ankle and hip joints (cartilage), as well as an increased risk of muscle and tendon injuries during more explosive loading.

All these factors are therefore very important when making a sport-specific choice. Once this choice has been made, one can focus on preventive measures to optimise the less favourable aspects of the specific morphotype for the sport that was chosen.

Table 1.2: Morphotype characteristics.

Endomorph:
- round body shape
- mass concentrated around abdomen
- short, tapered arms and legs
- wide upper arms and thighs
- small hands and feet
- smooth soft skin / fine hair
- relatively large head and broad face

> advantage: low centre of gravity and thus stable and manoeuvrable, high inertia
> favourable for: shot put, wrestling, judo, defensive lines American football, rugby
> risk: weight control, joint problems (cartilage), cardiovascular risk, diabetes

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Mesomorph:
- V-shaped body

- muscular
- solid torso
- wide shoulders / narrow waist
- large bones
- thick skin / stiff hair

> advantage: strong, explosive, high speed-strength
> favourable for: explosive sports (sprinting, hockey, soccer (attackers), boxing, karate, judo)
> risk: hypertonicity with muscle and tendon injuries, ligament injuries

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Ectomorph:
- lean body
- long arms and legs
- narrow shoulders
- short upper body
- minimal muscular development, slim (low fat storage)
- thin skin

> advantage: large wingspan, long limb lever, low relative body weight
> favourable for: long-distance runners, high jump, endurance sports
> risk: stress-fractures, overuse injuries, hormonal imbalance

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1.6. Get enough sleep.

Insufficient sleep is detrimental to all of us, but even more so for the athlete. This is because sleep not only ensures the recovery of the body after the effort, but especially because sleep is necessary to convert the effect of training into a stronger body.

During sleep, growth hormone is released under the influence of the training stimulus imposed during the day, which leads to tissue strengthening and tissue repair at the cellular level. Especially the deep phases of sleep are important for this growth hormone production.

Moreover, during sleep, the information processing and storage of the skills that were learned during the day occurs, so that these data are "saved" in our brain. Athletes therefore need to sleep enough, in fact as much as possible, to generate maximum effect from their training, and to allow the damaged or injured tissues to recover. Athletes who sleep less than 8 hours a night, on average, have a 1.7 times higher risk of injury than athletes who sleep more than 8 hours a night.

Unfortunately, however, numerous studies have shown that many athletes neglect this aspect and sleep far too little, whether during training camps, during competition periods, or even throughout the whole year. Sleep monitoring has therefore become an important aspect for many coaches when following their athletes. The standard recommendation for athletes is to have 10 hours of sleep a day. Power naps of 20 to 30 minutes after lunch count towards this total and are even recommended.

Summary

With these tips, you will (almost) never get injured:

- When you build up the training load, do so with a maximum of 10% week.
- Avoid cumulative symptomatology.
- Alternate impact-load with non-impact load.
- Ensure sufficient basic strength, postural control, and dynamic control.
- Consider your morphotype.
- Get enough sleep.