



# MEDICINE

## Matters



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PUBLISHED  
BY UEFA'S FOOTBALL  
DEVELOPMENT  
DIVISION



## EDITORIAL

# Keeping pace with developments

BY DR URS VOGEL

For any reader and football enthusiast, “Medicine Matters” can be a great source of useful and interesting information.



Dr Urs Vogel, Chairman of the UEFA Medical Committee.

Without a doubt, medicine has influenced sport, and sport, in turn, has influenced medicine. This is clearly reflected in the fact that today, sports medicine is a well-established specialised field. Beyond simple healing, an injured athlete needs to be fit to play. Just as skiers' injuries have influenced the procedures and treatment for broken bones, footballers' injuries have had an

impact on medicine, particularly on the technique and treatment for anterior cruciate ligament tears and meniscus injuries. In the past, in the interval between the treatment of player injuries and resumption of play, we began to identify the types of long-term damage that could be expected. Here we are referring primarily to post-traumatic arthroses. In addition to reducing the time required for healing and restoring fitness to play, the methods and materials used today should, as far as possible, prevent iatrogenic damage. We know, of course, that the injury itself and primary damage to the cartilage should be considered the main causes of long-term damage. This fact is forgotten all too often by the injured players. If an injury results in long-term damage, it is nearly always attributed to an error on the part of the doctor. Fortunately, such assumptions are rarely correct. Minimally invasive operations, as they are called today, are now common-

place and largely prevent additional damage, while significantly reducing post-operative recuperation time. Healthy athletes also seek doctors' assistance. Most often, they want to know how to improve their performance capability. As a result, training methods have been studied from a scientific point of view, and it emerges that a balance has to be struck between a player's training capacity, strain endurance and rest requirements. Further study should be conducted on player nutrition, liquid intake, strain, and the amount of rest required. Only a healthy athlete can benefit from optimal preparation and training. Any injury or illness has enormous consequences on whether a player is fit to play, and consequently, it is absolutely imperative to do everything possible to prevent both. Medical specialists have to continuously update the preventative measures that they recommend. Accordingly, specific regulations for each sport also have to be repeatedly revised. Injury patterns and possibilities differ from sport to sport, and they should be researched using sport-specific methods. We can never know enough about specific problems, which is why the constant search





**Standing, left to right:**

Dr Leonard Nokes  
 Dr Mogens Kreutzfeldt  
 Prof. Mehmet Binnet  
 Dr Jacques Liénard  
 Dr Pedro Correia Magro  
 Dr Alfonso Moreno  
 Gonzalez  
 Prof. Paolo Zeppilli

**Sitting, left to right:**

Prof. Stewart Hillis  
 Dr Michel D'Hooghe  
 Dr Urs Vogel  
 Prof. Jan Ekstrand

for new discoveries should be conducted separately for each sport. Football differs from many other types of sport in that it is played throughout the year, and that professional players compete weekly and are therefore perpetually in the public eye. Team sport differs in several ways from individual sport. The medical community's desire to engage additionally in sport-specific research is legitimate. Professor Ekstrand, Vice-Chairman of the Medical Committee, has conducted, in friendly co-operation with the relevant club physicians, a year-long study on the occurrence of injuries in eleven top European clubs. He presents his results in an article in this issue of "Medicine Matters". Future research is planned in the spirit of continuing to gather knowledge about our sport. UEFA will also provide financial support to suitable research projects which make a specific contribution to football. In recent days, the European media have taken up discussion of the evocative question of whether heading the ball can cause damage to the brain and the cervical spine. The medical community has to admit that it has not yet achieved general consensus on this issue. As conscientious

physicians, we have an obligation to discuss the potential for long-term damage. This will be possible only if we pave the way for international research on this topic. These are issues which have a direct impact on the way in which the rules are interpreted. How should an elbow jab to the head be disciplined? Similarly to tackling from behind, which is sanctioned with a red card because of our present knowledge about its increased potential for injury? The publication of "Medicine Matters" is justified by articles on research and new discoveries about proven therapeutic methods. We would like to thank the authors of the very interesting articles printed here for their valued co-operation. The medical knowledge that applies to professional football can be used to benefit the game at grassroots level too. Our sport is constantly changing, and every specialist is called upon to keep pace with developments. We are already looking forward to the EURO 2004 in Portugal. Let's work together to solve any medical problems that can accompany such a major event.

**Dr Urs Vogel**  
 Chairman, UEFA Medical Committee

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### COVER

Medical supervision is essential for players who want to enjoy long professional playing careers, like Jörg Heinrich (SV Borussia Dortmund).

PHOTO: EMPICS



# USE OF DIETARY SUPPLEMENTS:

## RISKS AND REWARDS

BY PROF. RON MAUGHAN

**Many different factors contribute to successful performance in football, and players use nutrition supplements to help sustain intensive training, to improve performance in competition, and to try to stay healthy. Players who take supplements, however, should only do so after carrying out a careful cost-benefit analysis. On one side of the balance are the rewards, and on the other side lie the risks.**



The variety of dietary supplements on offer is vast but not free of risk.

Vitamin and mineral supplements are generally perceived as being harmless, and the one-a-day multivitamin tablet is seen as an insurance policy “just in case”. More exotic supplements have become a prominent feature on the shelves of sports nutrition stores in the last decade or two, and some of these have been linked with positive doping results for nandrolone and for other prohibited drugs. Nandrolone is the popular name for the anabolic androgenic steroid more properly known as 19-nortestosterone. This latter name makes it clear that this drug is closely related to the male sex hormone testosterone, which plays a role in building muscle and in aggressive behaviour, both of which might be of benefit to players in training and in competition. Many different androgenic anabolic steroids, including nandrolone and testosterone itself, have been used

by athletes over the years, and FIFA, UEFA and the national bodies have well-established measures in place to detect abuse of these compounds.

Dietary supplements are not evaluated by regulatory agencies in the way that medicines are, and inaccurate labelling of ingredients is known to be a problem. Most supplements will not cause problems, and most companies that manufacture and supply these supplements are anxious to ensure the welfare of their customers. However, there is a very real risk. A paper published in the scientific literature in November 2000 provided some of the first solid evidence of steroid contamination of dietary supplements. This study is of particular interest and importance for two reasons. Firstly, the study was conducted at the IOC-accredited laboratory at the German Sports University in Cologne, so it is fair to assume that the highest standards of care were applied in all aspects of the study. Secondly, the study was published in a peer-reviewed scientific journal where it would have been subjected to rigorous scrutiny by experts before being accepted for publication.



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This study reported the results of analyses carried out on legitimate dietary supplements, none of which declared on the label that they contained steroids, none of which would reasonably be expected to contain prohibited compounds, and none of which gave any warning to athletes that problems might result from their use. They identified nandrolone, testosterone and other steroids in these supplements: when they were fed to healthy volunteers, they gave positive nandrolone urine tests, with urinary concentrations of up to 360 ng/ml (remember, the threshold for a positive test is 2 ng/ml for men and 5 ng/ml for women). The supplements tested were Chrysin, Tribulus Terrestris and Guarana, none of which should give a positive test.

The Cologne laboratory followed this up with a much bigger survey. A total of 634 different product samples were purchased from 13 countries around the world. These were analysed for the presence of steroid hormones and their precursors. 94 supplements (14.8% of the total) were shown to definitely contain prohibited substances,

and for another 10% the analysis was not conclusive, but steroids may have been present. That is close to a 1 in 4 risk! Substantial numbers of positive tests were obtained from products bought in the Netherlands (26%), the USA (19%), the UK (19%) and elsewhere. The names of the supplements have not been published, but they included vitamins and minerals, protein supplements, creatine and many others. Further details of this study can be found on the website of the Cologne lab at: [www.dopinginfo.de](http://www.dopinginfo.de).

The IOC-accredited laboratory in Vienna has repeated the Cologne study, although with a smaller number (57) of supplements. They found that 12 of these (22%) contained prohibited steroids. Unlike the German results, the identities of the companies and the products have been published on the Internet, and can also be found on the Cologne website at the address given above.

Events took a more sinister turn in 2002 when the same laboratory found one of the "hard" anabolic steroids (methandienone) in a supplement that

was bought in England. This drug was present in high amounts, enough to have an anabolic effect, but also enough to produce serious side-effects. The presence of this steroid has been described as a "deliberate and criminal act".

The picture has not changed greatly as a result of this information. The principle of strict liability still applies, so players have to be extremely careful. In a future article, we will look at some of the steps that players can take to protect themselves and at some of the proposed legislation changes that might make the supplement industry more accountable than they are at present.

**Prof. Ron Maughan**  
*Loughborough University,  
England*



# PERFORMANCE DIAGNOSIS FOR CONDITIONING

BY PROF. WILFRIED KINDERMANN

Speed and endurance determine the physical conditioning requirements for football. Match analyses show that, on average, a player covers a distance of 10 km (ranging individually from 7 to 13 km) in a 90-minute football match. About 60-70% of the total distance is covered at a walk or a trot, 20-25% at mid-range intensity, and 10% at a high-intensity run or sprint.

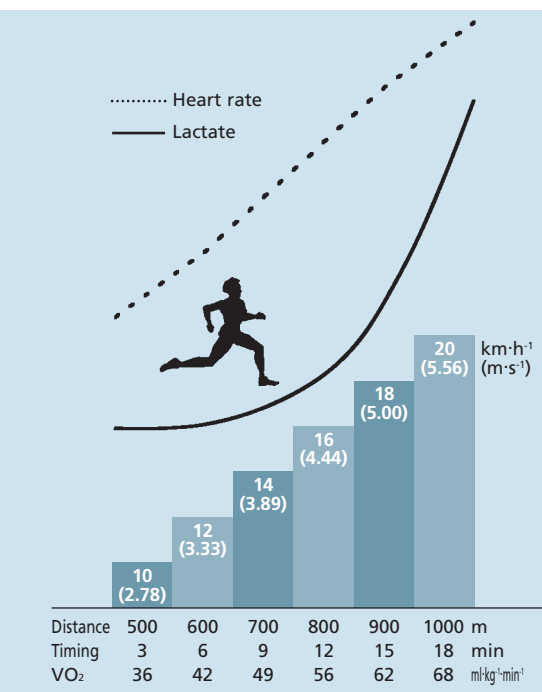
The most frequent sprint distances during a match range from 5 to 20m. Only a few studies consider the differences stemming from the various playing positions. Midfielders run more than others, whereas strikers and outside defenders appear to sprint more often and greater distances.

We prefer a system of performance diagnosis that evaluates the individual components of conditioning in isolation, i.e. independently of ball-specific situations. This enables us to pinpoint deficiencies in the basic elements of physical conditioning and to minimise them through suitable training methods, which often include non-sport-specific training. Running training without a ball is certainly not inappropriate to football if you consider that only 150 to 200m are run with the ball during a match.

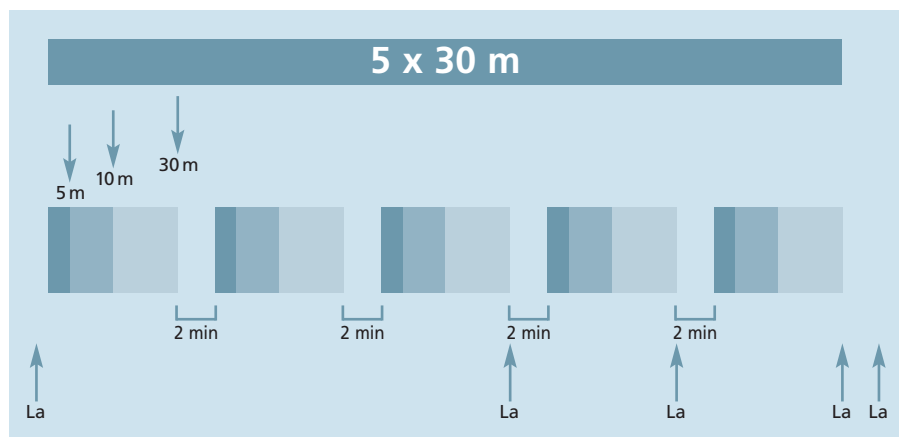
simultaneously. It also ensures standardised testing conditions. The test consists of a step test and a sprint test. It takes about 3 or 4 hours, at most, to test a team of 20 players.

The step test (Figure 1) uses the lactate performance curve to determine the individual anaerobic threshold (IAT) as an indicator of endurance performance capability. The heart rate is also measured using a wireless system. The lactate concentration is at the IAT between 2 and 3 mmol/l, on average, with a corresponding heart rate of 165 to 170 beats per minute. The anaerobic threshold, which is often calculated as 4 mmol/l, overestimates most players' endurance. The maximum

In football, performance diagnosis is conducted only in the form of a field test in an athletics hall or on a sports field. This makes it possible to limit the time requirements, since several players can be tested



**Figure 1:** Lactate and heart rate results in a step test for endurance performance. The x-axis shows the distance run and oxygen intake for each level of intensity. The time under stress is shown as a progression.



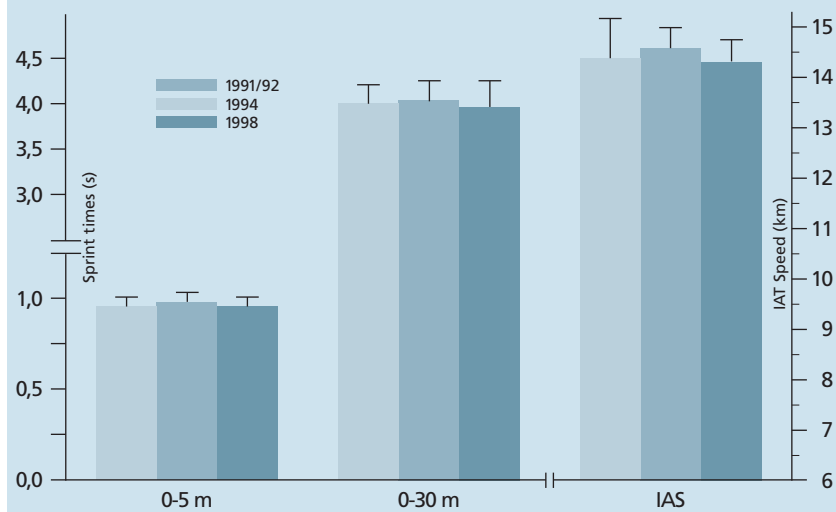
**Figure 2:** Sprint test for speed capability (La = lactate).



oxygen intake ( $VO_{2max}$ ) can be calculated from the maximum running speed (Figure 1). Additional spirometry contributes no additional information relevant to performance diagnosis and would serve only to increase outlay. Before the step test, a 5 x 30m sprint test is conducted (Figure 2). The rest period between the sprint and step tests lasts around 30 minutes. In addition to the time measured at 30m, which indicates basic speed, the intermediate times at 5 and 10m are also measured electrically as indicators of starting speed and acceleration capability. The lactate concentration value is dependent on various factors and can indicate, inter alia, delayed recovery capability.

The sports medicine performance diagnosis for football players also includes the determination of body fat percentage and, if possible given the time constraints, heart size (or heart volume when measured with an echocardiograph). The body fat percentage is calculated by measuring skin fold thickness at specific sites (calliper method).

Table 1 contains recommended values for the parameters defined in the above tests. It is acceptable to diverge from these recommended values when taking into consideration an individual player's position and tactical duties. In terms of speed and endurance, footballers cannot be compared with sprinters or long distance runners. Players with high endurance are often weak sprinters, and good sprinters



**Figure 3:** Long-term study on speed capabilities (0 to 5m; 0 to 30m) and endurance (IAS) in 62 top German football players (average values ± standard deviation).

often have low endurance. A football player in good condition should have a suitable mixture of speed and endurance. Strong players are usually faster than weaker ones. Teams in the lower divisions attempt to use endurance to compensate for deficiencies in speed and skill. As a rule, it is easier to train endurance in fast and agile players than it is to increase speed in high-endurance players. This aspect should also be considered when selecting football talent. Rather than focusing primarily on endurance, we should promote youth players who demonstrate speed and good technique. Systematic training can significantly improve endurance, even in adult players.

The internationally published literature lacks systematic, long-term studies that would make it possible to assess the developments in conditioning requirements and capabilities in top football. In German top football throughout the 1990s,

the conditional performance capability, which was evaluated in a retrospective long-term study, remained unchanged (Figure 3).

Given that the busy football calendar puts pressure on training and recovery times, it seems hardly possible to increase the current level of physical conditioning. On the other hand, however, important minimum levels of conditioning must be maintained. In order to do so, we have to make optimal use of the preparation period, refresh player conditioning in one-match weeks, and give players with busy match schedules a timely break to recover and rebuild their conditioning. From a medical point of view, we should lend full support to the decision to eliminate the UEFA Champions League second round, which until now has been played out in the group system. This means that four two-match weeks will be cancelled and can be used for recovery and training. This reduction in the number of matches can do nothing but good for the quality of football and player health.

**Prof. Wilfried Kindermann**  
 Director of the Institute for Sport and Preventive Medicine at the University of Saarland, Saarbrücken

Endurance IAS (km.h <sup>-1</sup> ) [m.s <sup>-1</sup> ]	VO <sub>2</sub> max (ml.kg <sup>-1</sup> .min <sup>-1</sup> )	Basic Speed 30m (s)	Starting Speed 5m (s)	Heart Size HV (ml.kg <sup>-1</sup> )	Body Fat % (%)
> 14.4 [4.00]	> 60	< 4.00	< 0.98	> 13.0	< 11.0

**Table 1:** Recommended conditioning, physiological and anthropometric values for high-performance footballers.



Football injuries are an occupational hazard for players, coaches and clubs. A recent study demonstrated that the overall level of injury to professional players is approximately 1,000 times higher than for high-risk industrial occupations! A research group at The Football Association in England evaluated injury risk and pattern in professional English football. The results showed that each injury caused, on average, absence from four matches, and that each week about 10% of a squad was unable to train due to injury. The financial loss attributable to the absence of injured players during the 1999/2000 season in the English football leagues (92 clubs) was calculated at approximately 125 million euros – an average of 1.4 million euros per team.

# The football calendar and the

BY PROF. JAN EKSTRAND

Clearly, the figure is colossal, and UEFA is keen to reduce the incidence of injury and increase safety in football. On the initiative of UEFA President Lennart Johansson, a study was therefore initiated to assess whether the difference in the number of league matches in European countries was reflected in different injury risks.



Prof. Jan Ekstrand  
Vice-Chairman  
of the UEFA Medical Committee,  
Professor of Sports,  
Linköping University,  
Sweden

## The aims of the study were:

- To design and test a method of data collection by using a precise definition of injury and close surveillance of players. If the test was successful, the concept could be used for further studies with more teams and more countries, thus providing a basis for evaluation of the injury risk in football and changes over time. Such a database could be used for analysis of injury mechanisms and suggestions for preventive measures.
- To analyse the exposure to football in different countries (number of matches, training sessions, training/match ratio, etc.).
- To analyse the injury patterns in different teams and compare differences between countries.
- To evaluate the risk of injury while considering the exposure factor (injuries expressed per 1,000 hours of exposure).
- To evaluate the correlation between training/match ratio and injuries and to analyse differences between countries.

In order to avoid bias in data collection and to facilitate comparisons with other studies, great effort was put into standardising the study details, such as the definition of injury, when a player is rehabilitated after an injury, as the elements of a training session, etc.

A pilot study was done in Denmark and Sweden in order to test the protocols for data collection. The results of the pilot study were used as a basis for comparison with the UEFA study. Fourteen European clubs were then selected to take part in the study. One team did not participate and two others were excluded due to insufficient data. The following eleven teams participated fully in the study:

- Arsenal FC (England)
- Manchester United FC (England)
- Paris Saint-Germain (France)
- Stade Rennais (France)
- RC Lens (France)
- AC Milan (Italy)
- Juventus (Italy)
- Internazionale FC (Italy)
- AFC Ajax (Netherlands)
- PSV Eindhoven (Netherlands)
- Real Madrid CF (Spain)





# physical well-being of players

The study ran for one football season (July 2001 to June 2002). All contracted players in the selected clubs' A-team were invited to participate in the study. Players with injuries at the start of the study were included but this initial injury was not included in the injury statistics.

The clubs were provided with attendance record forms, which they filled in with data on the players' attendance at training sessions and matches. The exposure time was registered in minutes for each player. The attendance records included all practice sessions and matches for the A-team. Only the sessions with physical activity were recorded. If a squad member participated in other training sessions and matches (e.g. B-team, youth matches, national teams), this information was also included.

Absences from training sessions and matches due to injury was reported on the attendance record. An injury was defined as one that occurred during scheduled matches or training sessions and caused the player to miss the next match or training session.

All injuries were recorded on a special form. To simplify and

accelerate the procedure, the information recorded was restricted to injury type, localisation and severity, as well as whether the injury was a repeat injury or whether it was caused by foul play.

## The severity of injuries were defined as:

- slight (absence less than three days)
- minor (absence less than one week)
- moderate (absence more than one week but less than one month)
- major (absence more than one month).

A player was considered injured if he could not fully participate in all parts of a collective training session. He was considered fully

rehabilitated when he had full clearance from the club's medical team.

The overall exposure to football during the full season for the eleven teams was 70,000 hours (58,000 training hours and 12,000 match hours).

Each team had an average of 280 activities (training sessions and matches) during the season. The number of matches, however, differed in the various countries. Real Madrid played 76 matches, whereas the French teams played an average of 49 matches, and the Swedish teams (from the pilot study) 41 matches.

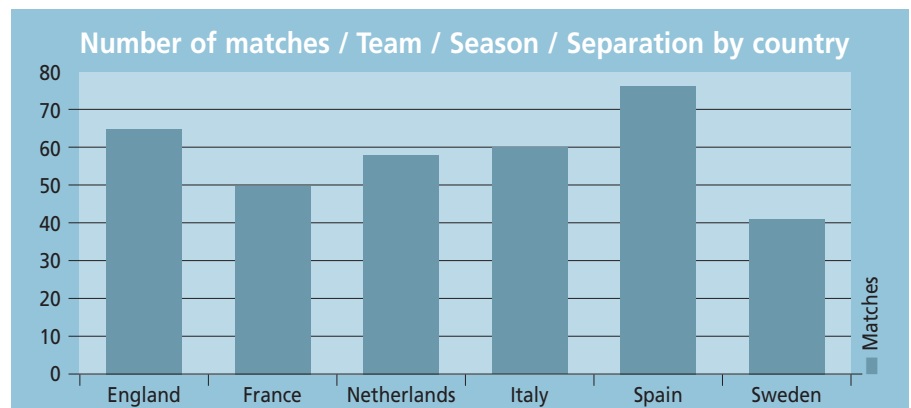


Figure 1



The teams that played more matches obviously had less time to devote to training sessions. The exposure to training sessions and matches for individual players are presented below:

Exposure / Player / Season		
Mean / Standard deviations / Ranges		
	UEFA (266 players)	Sweden (310 players)
Number of training sessions	174 / 53 / 0-266	184 / 50 / 0-270
Hours of training exposure	219 / 66 / 0-327	264 / 73 / 0-370
Number of matches	36 / 16 / 0-69	29 / 11 / 0-50
Hours of match exposure	43 / 22 / 0-93	37 / 15 / 0-67
Hours of total exposure (training + matches)	261 / 80 / 0-376	301 / 84 / 0-421

Table 1

## Conclusions

The study demonstrates that there are indeed considerable differences in the number of matches played in the various leagues throughout Europe.

Given the numerous matches played by top European teams, there is a real risk of overplaying. Too many matches can lead to mental burnout – players are no longer able to gear themselves up for matches and training sessions. Their power of concentration deteriorates, which can affect their co-ordination, which in turn means the player performs less well and is more prone to injury. It appears that the major stress factor is not the 90 minutes of the match itself but rather the mental preparation for matches, travel and possible adaptation to changes of time and climate. The Medical Committee has often expressed its concern with the demands being placed on football players today, and the translation of these physical and mental demands into injury syndromes. A reduction in exposure time would naturally reduce the risk of injury; in an ideal world and from a purely medical perspective, it would appear that one match per week would be the optimum

to preserve the mental and physical health of players.

Many big clubs have large squads of skilful players, allowing them to rotate players and avoid overplaying. However, many of the big stars are always in demand (e.g. Roberto Carlos of Real Madrid and Brazil). In some cases rotation may be unintentional – injuries or a decrease in performance can cause a normal rotation in the selection of the A-team players. Such clubs can still perform well, and are not necessarily affected if a number of players are injured, because they have a large resource of players to choose from.

However, at the end of the league season and the final rounds of the UEFA Champions League and UEFA Cup, teams want to perform at their best. They may play with all their star players even if there is a risk of mental exhaustion and injury. For example, during the last two months of league seasons, the six players who played the most matches in the English and Spanish teams played an average of six matches per month. As a comparison, the six players who played the most matches in the French teams only played three matches during the same period.

Under normal circumstances, players may be able to cope with such an intensive programme because they know that a period of rest is following. But every four years this rest period is replaced by another series of intense matches due to the World Cup. In 2002, the first World Cup matches were played only two weeks after the UEFA Champions League final, which could explain why a number of European players underperformed in Japan and Korea.

## Overall conclusion

Clearly, a congested match calendar may leave football players fatigued at the end of a season, which could affect their well-being and result in injury and/or under-performance. However, this study only involved a total of eleven teams from five nations; in order to obtain a clearer picture of the overall situation in Europe, the study would need to be expanded to include more teams and countries.

UEFA is nonetheless concerned by the number of injuries that occur during a football season, and has already acted by changing the format of the 2003/04 UEFA Champions League. The number of match days has now been reduced by four; this takes into consideration the physical welfare of players and could result in fewer injuries.

UEFA will undertake further studies on injuries in the future.

*For a complete version of the study results and conclusions, please contact the Football Development Division.*

# NECK PAIN IN FOOTBALL

BY PROF. DAVID SUTHERLAND MUCKLE

Pain in the cervical spine was first brought to my attention many years ago by a former Newcastle United Cup-winning centre-half who complained bitterly in later life. He blamed heading the heavy leather ball when he played in the 1950s.

There is no doubt that the repeated head to ball contact of a forward or a defender, especially a centre-back, can inflict a repetitive trauma to the neck.

Although in my experience such a problem is not common, a proportion of footballers do develop chronic neck pain, sometimes towards the end of their careers, sometimes later.

## Acute on chronic cervical pain

The study of cervical pain is hampered by the fact that even at the age of 30 years, some 30% of the population may show disc changes on a MRI scan.

These changes are usually one of disc desiccation and generally indicate a familial or genetic degenerative change in the cervical discs which often becomes manifest by the age of 45-50 years; so that eventually about two-thirds of the population suffer neck pain at some stage in their lives.

In football, an acute attack may be precipitated around these early degenerative disc changes. An intermittent dull ache suddenly becomes very painful after a minor injury.

However, pain in the neck has several pathologies and presentations.

## Headache

Anyone familiar with whiplash injuries to the neck knows that patients regularly suffer from a headache beginning in the occipital area and spreading to the frontal area. It can be a tension ache or a band-like pain. It may often be associated with neck stiffness and pain, and be at its worst when pain is at its height.

The headache occurs through the greater occipital nerve (C1/2) and there is generally tenderness at the superior nuchal line in the occipital area. Here the nerve passes through

the thickened fascia of the scalp. On rare occasions, such can be the chronicity of the headache and the nuchal tenderness that a local long acting steroid (such as depomedrone) in a local anaesthetic is required. Rarely, a release of the trapped nerve as it emerges through the fascia can be undertaken.

Some players develop a variant, namely a migraine headache, generally without the full-blown visual upset and nausea. Its aetiology is not fully understood. Upper cervical pain may radiate to the face and the temporo-mandibular joint area. Dizziness and dysphagia are sometimes found.

## World Conference on Doping in Sport

The World Conference on Doping in Sport was organised in Copenhagen from 3 to 5 March 2003 by the World Anti-Doping Agency, WADA, in co-operation with Denmark's Ministry of Culture, and the National Olympic Committee and Sports Confederation of Denmark.

This was the largest conference on doping ever hosted, with over 1,000 delegates from governments and international sports federations worldwide in attendance. The aim of the conference was to adopt the new Anti-Doping Code (ADC) which WADA drew up and hopes to implement in time for the Olympic Games in Athens next year.

Football, represented by FIFA, does not agree with the compulsory two-year ban laid down in the Code for a first doping offence, and is in favour of managing doping cases on an individual basis. WADA and FIFA have set up a working group in order to examine this issue further.

*For further information, consult the WADA website at [www.wada-ama.org](http://www.wada-ama.org)*



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A short course of anti-inflammatory agents with physiotherapy to the upper neck is beneficial for the occipital headache. Headaches following a clash of heads, common in football, may have their basis as cervical referred pain if there is a soft-tissue injury in the upper cervical spine, although the underlying pathology (when there has been head trauma) is usually within the brain.

**Neck pain** can vary from a dull ache to a sharp pain on movement. The movement that aggravates the pain is usually rotation with lateral flexion. The apex of the cervical curve is at C5/6 and this is the level that takes the brunt of the flexion/extension/rotation forces during heading or with a fall.

#### **Soft tissue injuries**

Even at speeds as low as 32km/h (20miles/h) the neck is subjected to a peak 12g of force, with an elastic recoil in the soft tissues. Short sprints in soccer can reach such speeds and be exceeded as players collide. Flexion/extension in the upper two levels (C1 and C2) is approximately 50 degrees, with about 9 degrees at each of the remaining 5 levels; movements exceeding these values can injure the neck.

Minor tears in both the short and the long muscle of the neck are found and can give rise to short-term discomfort/pain like any other muscle sprain. The pain is more troublesome when there has been a small haemorrhage into the facet joint or damage to the capsule. The neck is a rapid response unit to impending head and face trauma (especially to the eyes) and will with a sudden reflex move the head away before the player is conscious of the problem. (No boxer consciously thinks about the oncoming blow!) To do this function requires a major proprioception and motor nerve linkage from the soft tissues to the cord, medulla and cerebellum; then on to the mid-brain and cerebrum. This vast network of nerve endings and connections makes the neck particularly painful after injury. Tenderness is usually located in the mid- to lower cervical spine.

A plain x-ray generally reveals no abnormality and the use of a MRI scan is important in the investigation of neck pain that does not settle after 2-3 weeks, or earlier if the pain is severe.

In the more symptomatic cases the **cervical disc** on a scan may show **desiccation** (or loss of hydration). Several levels of such disc changes (i.e. early degeneration) would point to a familial or genetic background, but the underlying problem is being made symptomatic by the sport. Incidentally, weight training can cause neck ache if the technique is faulty or the weights too heavy in players with early degenerative changes in the discs.

Analgesia, anti-inflammatory medication and regular physiotherapy are beneficial. If the central positions cause repeated flare-ups after heading, then a change of position may be forced on the player.

The pain from a C5/6 disc can be referred to the posterior aspect of the shoulder through the supra-scapular nerve. This nerve has an unfortunate course beneath the small fibrous band of the scapular notch. So when the shoulder muscles tighten, thus fixing the scapula as the neck is thrust forward, this nerve is caught against the retaining fibrous band. Such can be the localised tenderness at the notch that a local steroid in local anaesthetic may be needed.

Referred pain along C5/6 is most obvious when a **degenerative disc** has collapsed and a **small herniation** touches the nerve root. Then shoulder pain (around the deltoid area) can be felt and on occasions a pericapsulitis (frozen shoulder) occurs. In a study of 51 arthroscopies of the shoulder carried out in the mid-1980s, I observed a band of erythema in the synovium across the front of the shoulder joint (C5/6 innervation) with, in long-standing cases, some thickening of the capsule. The restriction of external rotation due to either pain or thickening is important. With abduction of the shoulder beyond 85-90 degrees, the humerus must externally rotate. A failure to do so limits abduction, a feature of a pericapsulitis. Physiotherapy must be directed to the neck as well as the shoulder.

Other areas of referred pain from C5/6 (6<sup>th</sup> nerve root) are the outer aspect of the elbow (sometimes thought to be tennis elbow) and into the hand. With pain referred from the C6/7 level (7<sup>th</sup> nerve root) the upper limb experiences tingling or numbness chiefly on the outer forearm and in the thumb (C6) and middle fingers (C7) that mimics a carpal tunnel syndrome.

A **major disc herniation** causes nerve compression and reflex changes (biceps C5/6; brachioradialis also



C5/6 and triceps (C6/7) indicate a problem that needs detailed investigation with a MRI scan and perhaps nerve conduction studies. A large herniation with neurological changes needs surgical decompression with disc removal and the insertion of a bone graft. It is not advisable to pursue a career in football.

### Acute bone trauma

**Fractures and dislocations** are rare and demand immediate investigation with a CT or MRI scan, the former giving good detail of the bony architecture. Most important is the spinal canal area and the CT scan will show any pressure or impingement by the surrounding bone on the spinal cord. Complex ring fractures of the **atlas** and injuries to the **axis** are beyond the scope of this article, but care must be taken to exclude a congenital abnormality of the dens of the axis that can mimic a fracture.

Pure flexion injuries are expended on the vertebral bodies and usually produce a stable wedge fracture. A clash of heads (commonly seen in head-tackling in American football) can cause a lateral wedge fracture. A burst fracture of a vertebral body is produced by a vertical force. This happens when the player lands heavily on the top of the head.

In soccer a hyperextension injury of the neck can cause small **fractures** of the tips of the **spinous** process but since the spinal canal is not involved they can be treated with analgesics and a period of rest (about 8-12 weeks). It is advisable to assess the facet joints for excessive movement by flexion/extension x-rays to ensure that there has not been some disruption of the facet joints. Major hyperextension forces tear the anterior longitudinal ligament and may also rupture the discs causing major cord damage.



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Flexion with rotation forces tears the posterior ligaments and the flat, small facet joints are dislocated. Hyperextension with rotation can have a similar effect.

**Bilateral dislocations** occur after a clash of heads and a heavy fall onto the neck, with a rotation injury as the side of the head hits the ground at speed. Sometimes only one facet joint is dislocated. This single or **unilateral dislocation** can be missed but the acute spasm to one side or torticollis is diagnostic. The lateral x-ray shows anterior displacement of about 25% width of the vertebral body with unilateral injury. Radiological controlled reduction under a general anaesthetic is needed for both types of dislocation.

After a major fracture or dislocation the decision to stabilise the neck with an internal fixation device or a bone graft does require a curtailment of a football career.

After a unilateral dislocation a period of 4-6 months with graduated physiotherapy is required and the return to playing must be cautious, and radiological stability assessed first.

**In conclusion** — neck injuries encompass a wide variety of pathologies

from a simple muscle pull to a disc herniation, facet dislocation or a burst vertebral body fracture. All may occur with or without upper and lower limb nerve damage.

The attending therapist or physician should always be on guard against the more serious injury and look with concern on any neck trauma until the extent of the injury has been fully evaluated, with a scan needed in many cases. **It is important to always stabilise the neck and handle the player with the utmost care on the field of play and until that moment when the injury is diagnosed in hospital, if a serious injury is suspected.**

A cervical collar and spinal board stretcher are mandatory with suspected serious trauma – often indicated by weakness, numbness and tingling in the arms and legs. Even without these symptoms a player who supports his neck because of a feeling of weakness or looseness has a serious injury until he has been investigated and proved otherwise.

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# The detection of doping substances

BY DR MARTIAL SAUGY

Dr Martial Saugy is the Director of the Swiss Doping Analysis Laboratory in Lausanne, Switzerland. We asked him the following questions regarding doping matters:



Doping tests are a crucial element of the UEFA Fair Play campaign.

**1. ■ The World Anti-Doping Agency, WADA, hosted the largest conference on doping in Copenhagen last March. It is hoped that sports federations and governments worldwide will adopt the new Anti-Doping Code before the Olympic Games in Athens next year. Can WADA hope to become truly operational or is the idea of a world authority on doping simply unfeasible?**

*It does appear unfeasible. In my opinion, WADA should support sporting federations that do not have the appropriate funds and infrastructure to run an anti-doping programme. This is not the case for football, which has been running an efficient doping prevention programme for several years. WADA's aim to become the world authority on doping would entail the creation of a massive database, which would simply be unmanageable in the near future. Further harmonisation and a clearer definition of the limits allowed for doping substances are certainly necessary and WADA has been created by sport bodies to do this job. But we know that sport is multifaceted and that there are differences in different sports. Rather than to create one unique standard for all, the solution could be found in taking into account, from case to case, these differences and specificities.*

**2. ■ Performances in sport have improved drastically over the years, so much so that it is widely believed that athletes cannot compete at the top level without using doping substances. Have we reached the point where the only way to improve athletic performance is to resort to further doping?**

*This is a reflection of our modern society, where the emphasis is on spectacular performance rather than the joy of watching a sporting event. The human body obviously has certain biomechanical limits, which cannot be surpassed. I think the whole concept of sport needs to be reviewed. The public should be encouraged to look forward to an exciting encounter between two teams, rather than a stunning performance or a new world record. Team sports in particular can play a vital role, precisely because individual performances are irrelevant. Furthermore, star football players can have an enormous impact on youths and adolescents – thousands of youngsters adopt the same haircut as David Beckham or Ronaldo. These players could be used as ambassadors to communicate an anti-doping message and to discourage the use of doping. Star players could be used much more to transmit a message for educational purposes, and could provide an opportunity to educate the public in the future.*

**3. ■ In today's society, appearances and performances are extremely important. Individuals and athletes are increasingly willing to use risky or prohibited**



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means, including doping, to improve their performance or appearance. The general public and the press are surprisingly tolerant towards doping, some even see it as “a sign of the times”, i.e. inevitable. Given this context, how can the fight against doping be won?

*This is more of a philosophical question; again, I believe it's about proper education. Football is now a professional activity, and using illegal or immoral means to obtain advancement in any profession should not be encouraged. People should be taught that there are certain rules that cannot be broken, and to behave in a moral way. Doping-free sport should be one of those essential rules – an elementary rule of life.*

**4. ■ Doctors or other medical professionals may provide players with substances that could contain banned substances, and lead to a positive doping test. Should the medical profession be held responsible in positive doping cases or should the player be held entirely responsible?**

*Responsibility should definitely be shared, and the medical profession should be attributed part of the blame in a positive doping case. I believe the player and the*

*medical professional in question should share responsibility.*

**5. ■ In recent years, there has been a marked trend towards “judicialising” in positive doping cases. Lawyers have questioned the professionalism of experts with vast experience such as yourself and claimed that your intention is to ruin athletes’ careers. What can be done to fight against this trend?**

*A more structured and constant exchange of opinions between sports federations and laboratories could be helpful. The easiest place for a lawyer to attack in a doping case is the laboratory. At least four or five times per week I receive calls from lawyers with unbelievable questions on tiny details or basic laboratory procedures, looking for a possible loophole. Answering these questions is almost a full-time occupation. Lots of issues could be resolved if sports federations and laboratories had a unified approach towards these questions typical of lawyers defending athletes in doping cases.*

**6. ■ Various studies have demonstrated that certain food supplements can contain prohibited substances that could lead to a**

**positive doping sample. Is this still a current issue or have manufacturers improved the labelling of their products?**

*This is indeed still a problem – labelling has not improved. Athletes are likely to continue to take food supplements in future with no intention of doping themselves. There is no easy answer, and yet there is a real need to deal with this problem, otherwise lots of time, money and energy will be spent in court cases to prove the innocence of athletes/players.*

**7. ■ What should sports associations such as UEFA do to protect players from doping?**

*I believe a rigorous communications policy is necessary to render football credible and to educate players as well as the general public about doping matters. This is a real challenge, but UEFA certainly has the means to succeed in this task.*



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