Documento de lectura

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Injury Prevention in football

Injury prevention seemed to be an area consisting of multiple topics.

We believe that working in each of the following areas will (of course) not account for injuries after contact/foul, however, might prevent from non-contact injuries.

Screening for injury history

Player with an injuries in the past player are more likely to injure themselves again (1) at the same site (2, 3) *- see references below.*

Therefore injury history can give insight into player's likelihood of re-injury (and body site) and strength and conditioners can target specific muscles that have been shown problematic in the past and/or to stabilize specific joints, such as the ankle.

Consequently, there are more information on proprioception/balance HERE.

Muscular dysbalances and asymmetries are discussed HERE. A specific section was dedicated to Hamstring/quadriceps ratios HERE.

Strength training

Besides strength training for enhancing performance, it can also have emphasis on injury prevention.

It seems that eccentric muscle contractions showed high muscle activation (4), put high stress on the muscle (5), and therefore also seemed to have the highest preventive effect (6).

Eccentric hamstring exercises were reported effective in preventing hamstring strains (6, 7) and fatigue (8).

A second goal in strength training with an injury prevention emphasis is to work on a) muscle and b) leg asymmetries.

A) Hamstring to Quadriceps strength asymmetries (measured as eccentric hamstring to concentric quadriceps ratio OR concentric hamstring versus concentric quadriceps) were shown to significantly impact injury incidence (7, 9, 10).

A Hamstring to quadriceps ratio of below 0.75 (11) - 0.6 (12) seemed to be "problematic" and

suggested a higher probability of future injury. Also, the speed of movement/testing seemed crucial. Higher velocities seemed to be more prone to show higher ratios (13, 14).

However, considering the true speed of movement during kicking (15, 16)/football testing at higher velocities seemed to make sense. Additionally, preferred versus non-preferred legs should be investigated (13, 17).

Information in youth players in both genders are also present throughout the literature (18), suggesting greater development for quadriceps muscle compared to hamstring for girls after menarche and therefore a higher risk for ACL injury.
As a result, hamstring strengthening should be instituted for girls after menarche (18).

B) Dominant to non-dominant leg muscle strength (10-12) differences but also anatomical/functional leg length differences seemed to impact injury (10) incidence.

Interestingly, experienced players with longer professional training age showed a more balanced use of their lower extremities to cope with previously developed musculoskeletal asymmetries and possibly reduce injury risk (19).

More information on strength training can be found HERE.

Warm-up

The general purpose of the warm-up is to increase blood circulation to the working muscle to meet the increased oxygen demand. As a result, the activity will result in increasing tissue temperature, which helps electrical and chemical reactions in the muscle. Decreased resistance of muscle and joints, increased thermoregulatory strain, faster nerve conduction rate, improved rate of muscle contraction and reaction time, altered force-velocity relationship, increased anaerobic energy provision (20) increases with temperature as well (21).

Generally, three different types of warm-up exists (21):
1) Passive warm-up such as hot showers or heat from the environment (heat pads, sun). This type of warm-up is not necessarily recommended as it increases the blood flow to the skin instead of to the muscle (22). However, physical activity in heat will have an effect on performance.

2) General warm-up consists of jogging, cycling and every other activity in which the major muscle groups are involved. General warm-ups have been proven to have greater impact on short term performance and intermediate (>10 seconds , but <5 minutes) and long term (>5 minutes), if the actual activity is started in a non-fatigue state and if thermoregulatory procedures are still limited (23).

3) Specific warm-up
With regard to a football specific background, specific warm-up consists of different movements with and without the ball that are typical in football. Advantages of specific warm-up are an integration of

skills and its neural activation/responses.

The effect of warm-up procedures on injury rate were seen in female youth football players (24, 25). The warm-up consisted of the F-Marc programm from FIFA (24) or basic components in stretching, strengthening, plyometrics, and change of direction (25).

Teams with a higher compliance to the programm showed a 35% lower risk of injury as well as coaches who incorporated injury prevention programs presented a 46% decrease in injury risk (24).

Interestingly, muscle temperature following a warm-up has been shown to last up to 45 minutes (26).

The second study (25) showed a difference in injury rate for ACL injuries of 3.3 times for the intervention athletes compared to the controls.

More information and videos of warm-ups can be seen HERE.

Cooling down/Recovery

A variety of cool-downs/recovery procedures exist. The available time and purpose will decide over the recovery procedure. We would like to direct you to the specific recovery section on our website.

Monitoring players

Monitoring players can have various forms, but the purpose is more or less the same - to control the prescribed stimulus and avoid overtraining, overuse, and finally chronic fatigue.

The problem in monitoring players is that exercise/training prescription is often based on external factors (duration of exercise, repetitions and frequencies) that are external (factors that are opposed onto athletes) and the internal load for each player various tremendously for the same exercise (27). Therefore it is necessary to quantify the internal load.

As a result training load of players can be monitoring through a) external and/or b) internal load

A) External load

The easiest and simple choice to monitor players is to record the duration and type of activity during training.

Although that method reveals some issues in SSG for example, we believe that this method however ensures (at least) that the load opposed onto players is known and can be used for future references.
Furthermore, accumulation of training hours might have implications in a long-term-player-development and therefore should be monitored throughout the players' development.

Depending on the environment, if football circuits and/or interval training is used, the training load

can be measured via distances covered, number of runs, average velocities etc. As a result and in that particular situation the load is known as well and can be altered easily. This approach is very practical during pre-season to systematically increase load.

The “latest” technology whilst monitoring players is GPS units (or any other time-motion-analysis technology).

The devices are able to track players, measure distances (28-32), accelerations and decelerations (and total body load (33). GPS units are also available in real-time modus, can be synchronized with heart rate monitors and therefore, both build a good combination to assess external (GPS) + internal (hear rate) load. However, the reliability for high intensity running and very high intensity running was poor (34).

Still, training prescription can be based on time-motion-analysis if time and manpower are available to handle the data. GPS units (and heart rate systems) are quite expensive and therefore not suited for all environments.

B) Internal load

Heart rate as a measure of internal load is well established (35). Durations in different heart rate zones (usually expressed as % of max heart rate) will determine the load and training can be implemented accordingly. If real time monitoring is presented, session can be stopped when certain duration in certain heart rate zone is fulfilled.

Ratio of perceived exertion (RPE), as a subjective method to measure internal load was originally developed by Borg et al. (36) and further developed as the so-called session-RPE (37).

The session-RPE is calculated by multiplying the RPE of the session with its duration and was proven to correlate with heart rate (37-39), VO2 and accumulation of blood lactate (40) and was used in a football setting (27, 33, 40-43).

Measuring hormonal and immunological (cortisol, testosterone, noradrenaline, IgA, IgG, IgM), reactions were also measured in a football setting (44-47).

Another form of monitoring (psychological) stress (48-51) was to evaluate sleep, mood, mistrust, trait anxiety (52), coping (50) and the significant predictors/variables could explain 23% of injuries occurrence (49).

More information on training load and how it is monitored can be found HERE.

Typical content for an injury prevention program was (53):

- Jogging, skippings, running backwards and carioca
- Stretching, hamstrings, quadriceps, inner thighs and hip flexor
- Strengthening of the same muscles

- Plyometrics, variations of hopping jumping and bounding
- Agility/Change of direction

Generally, we feel that the described exercise can be put into a more football specific context, involving the ball and the program can easily be implemented into the warm-up.

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