



ASPECTS REGARDING SPEED AND ACCELERATION TRAINING IN FOOTBALL

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Abstract

One of the most important abilities in sports is the speed or ability to move quickly. From a mechanical point of view, the speed is expressed by the ratio of space to time. The term speed incorporates three elements: the reaction time, the frequency of motion per unit time, and the level of running a given distance. The correlation between these three factors determines the speed performance required by an exercise. Thus, the ability to be quick, to react quickly depends on the player's reaction at the beginning of the action, the ability to play the game, to react in a given situation of the match and to apply ground force to move quickly..

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JEL classification: I20, I29

Introduction

In most sports, athletes start from either a stationary or a partially moving posture and attempt to reach maximum speed as quickly as possible. This is referred to as acceleration or the rate of change velocity. Speed refers to the point at which athletes can accelerate no more and have reached their maximum rate of movement. At this point, athletes attempt to hold that pace as long as possible and to minimize slowing due to fatigue, friction and air resistance.

Sports, in general, and football especially are played with multiple starts and stops and many changes in direction, so, it is no surprise that the average speeds players attain during competition are well below their maximums. On only a few occasions will football players accelerate for 60 meters, the approximate distance it takes a world-class sprinter to reach maximum speed. This is why what people generally refer to as speed is more accurately termed acceleration to maximum speed (Foran, B., 2001).

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1. Factors affecting speed and acceleration

Everyone can improve speed and acceleration, but rarely will any athlete approach his genetic speed potential unless the correct training techniques are followed.

During the last decades physiologists uncovered changes to muscle fiber types (fast twitch white and fast twitch red), researchers have also been aware that stride rate (steps per second), stride length and speed in short distances improve with proper training. This knowledge has broadened training emphasis from programs that focused mainly on form and anaerobic conditioning to a holistic approach that includes programs that also alter stride rate and length.

Factors affecting both speed and acceleration are: genetic factors such as fast twitch and slow twitch fiber percentages, body fat, age, gender, anaerobic or speed endurance.

Muscle fiber

Three types of muscle fiber are found in various parts of every athlete's body:

1. Slow twitch red (type I) – this fiber relies on oxygen to produce energy. It develops force slowly, is fatigue resistant and has a long twitch time, low power output, high aerobic capacity for energy supply and limited potential for rapid force development and anaerobic power.
2. Fast twitch red (type II a) – this intermediate fiber type can contribute to both anaerobic and aerobic activity. It develops force moderately fast and has moderate fatigability, twitch time, power output, aerobic and anaerobic power.
3. Fast twitch white (type II b) – this fiber does not rely on oxygen to produce energy, it develops force rapidly and has fatigability (low endurance), a short twitch time, high power output, low aerobic power and high anaerobic power.

Muscles with a high percentage of fast twitch fibers exert quicker, more powerful contractions. Individuals born with a high percentage of fast twitch fiber in the muscles involved in sprinting have a higher speed potential than those born with a preponderance of slow twitch fiber, which is more suitable for sports requiring high aerobic endurance.

Speed endurance

Speed endurance will not change stride rate or stride length, but it will determine the amount of slowing at the end of a long sprint, the pace at which acceleration to maximum speed occurs and even speed on repetitive short sprints. In other words, players with poor speed endurance are unable to accelerate and sprint at the same high level repeatedly during a game because of fatigue.

Sprinting always takes place in the absence of oxygen, a condition under which the skeletal muscles can function for only a short time. When oxygen



requirements exceed the ability of the body to uptake oxygen, pyruvic acid forms from glucose and is reduced to lactic acid. This process occurs only in the absence of oxygen, producing energy-rich phosphate bonds to allow muscle contraction to continue. At this point (much sooner for the poorly conditioned players) slowing occurs because of lactic acid buildup. Improved lactic acid tolerance, increased quick-energy stores and improvement in the rate that quick-energy is available are related to factors such as anaerobic fitness, age and nutrition.

Components of football speed

Determination, strength, fitness and skills are important, but speed is the commodity that can change the course of a match all by itself.

Speed in football includes more than just running fast. Quickness, short bursts of movement, rapid movement in all directions, the ability to start and stop rapidly, speed of reaction time, these are all examples of game speed.

Speed includes the ability to react quickly, change direction on a dime, change speeds and repeatedly perform these tasks at a consistently high level throughout a match.

What speed can do for a player or a team should not be understated. The main obstacle in the path of acquiring speed is commitment. Although we often talk about speed, coaches typically do not set aside time during practice to focus on improving game speed. Players and coaches alike must understand that every athlete can become faster with applied effort.

Words like „explosive” and „quick” are used interchangeably when discussing the speed of athletes. These qualities are important if you are a forward accelerating past a defender or a defender recovering during a breakaway. We now know that the words explosive and quick are describing power. Now is the time to begin to define speed accurately. To determine football relevant speed, we must first identify the components. Speed in relation to football involves strength, endurance (fitness), ability to change direction, reaction time and running mechanics.

Strength – is crucial for many reasons:

- to build endurance, strength levels must be optimal
- strength is a component of power
- strength is necessary to reduce the risk of injury that is associated with the intensity of sprint training, interval training, plyometrics and gamelike conditions
- increase in stride length is closely associated with an increase in leg strength.

The foundation on all physical movement begins with strength. The athlete who lacks strength will not benefit significantly from the training involved in improving speed. A great deal of strength is not required to change direction, but it



does take a large amount of strength to change direction quickly and precisely. Strength is necessary to change running speed from slow to fast over a short distance; weaker athletes need more time to reach top speed. Stronger athletes will be able to work on improving speed with less risk of injury.

Endurance

A proper strength and conditioning program will improve several aspects of endurance :

- ability to change speeds repetitively and continuously
- maintenance of speed over both long and short distances
- maintenance of proper running mechanics for a longer period
- ability to run repetitively at top speed with minimum rest between bursts
- reduction in injuries related to top speed running and ballistic movements.

Ability to change direction rapidly

A change of direction is effective only if it is performed rapidly. Dribbling a ball past midfield into a congested defense requires multiple changes of direction while dribbling with both feet. Movements must be sudden, quick and repetitive. By combining strength, endurance, a plyometric program and the agility drills, the football player can develop tremendous ability to change direction.

Reaction time

Performing a drill repeatedly can produce accurate movements, but, during a match, the player encounters nothing as predictable as a drill. This is where minimizing reaction time is critical for success. Reaction time in football depends on visual stimuli that the player processes to make decision. Reaction time begins when the thought for action occurs and ends when the action is complete.

Three basic parameters influence reaction time: the environment that causes the thought for action, the time between the thought for action and the initiation of action and the time between the initiation of action and its completion. Obviously, the player with slow reaction time will have fewer opportunities for success.

Running mechanics

As mentioned before, every player can improve speed, it is a simply matter of commitment. Players must continue to work on developing strength and power, but not at the expense of improving soccer skills. Therefore, coaches must alter the training schedule to avoid fatiguing players with negative side effects during practice sessions or matches.

The key elements that football players must work on are:

Stride frequency

The term used to define the turnover of the legs is „frequency”, the speed at which the feet make contact with the ground over a given period. Assuming that the length of the stride is optimal, the more often the feet contact the ground, the



more linear propulsion occurs and the faster the player will be. The more times his feet push, the more speed he produces.

Strength and endurance allow a player to create and maintain speed. Plyometrics and strength training are the tools that make it possible for the legs to perform rapid and ballistic movements.

Stride length

Increasing stride length is necessary to increase speed, but this must not occur at the expenses of good form. Although stride length may increase, two other problems arise. First, while reaching out, the lead foot is in the air longer and is not in contact with the ground, which means that no pushing off occurs. Stride frequency, therefore, decreases, so, to increase speed, stride length and stride frequency cannot be sacrificed for one another. Second, because the leg is out in front of the body when the foot lands, a reduction of speed occurs. The greater the extension of the foot, the more resistance of the body must overcome when the foot hits the ground.

Running economy

Increasing speed depends mostly on developing running economy, that is why a personal speed coach or a professional fitness trainer would be able to identify technical running errors, either by analysing videotape or by seeing a player run in person. The player and coach must learn to correct certain significant running flaws that will decidedly enhance the players running speed in all directions.

Arm carry

Observation of football players tells us that the position and movement of the arms while running are issues. Players seldom use their arms effectively while running and an absence of arm swing detracts from the ability to reach top speed. When a player uses correct form, his arms seem to lead his body in powerful movement, whether it be running, jumping or changing direction. The arms lead the legs.

Knee lift

Running in any direction is a horizontal movement. Excessive knee lift goes against this notion and can cause two other problems: a high knee lift is accommodated by a backward lean of the body; due, in part, to a backward lean, the stride is shortened. Although knee lift is important, excessive knee lift hinders speed.

Technical running errors can waste valuable energy, making players work harder than necessary. Developing running economy allows the player to get faster with less effort, so, it is important that coaches and players as well invest the time into improving running form if needed, as it can pay off huge dividends on the



football field (Schimd, S.; Alejo, B., 2002).

Conclusions

The major areas of emphasis for speed improvement for each player depend on individual testing results. The object is to adjust each training program to simulate the activities of football while focusing on the areas of weakness uncovered.

Although some players are born with more fast twitch muscle fibers than others and are more genetically suited for sprinting, all players, regardless of their genetic makeup, can improve their speed and acceleration with proper training. Acceleration and speed can be improved by taking faster steps, taking longer steps and improving sprinting form. Performance deterioration in short sprints as the game progresses can be avoided by improving speed endurance.

Before a personalized program can be designed to improve speed and acceleration, it is important to evaluate speed, stride length, stride rate, strength, power, flexibility, body composition and muscle balance. Programs can then be designed to eliminate the areas of weakness that are limiting improvement. Apply the concept of working fast to be fast in all training programs.

Plyometric training bridges the gap between strength and speed by using exercises that simulate sprinting movements and use a „down” time (foot ground contact time) less than that used during the actual sprinting action.

Form training can improve speed and acceleration and should be a part of an athlete's regular workout in all sports. Speed-endurance training should be tailored to each sport in terms of the typical distance covered, rest interval and number of repetitions, in order to improve training specificity and carryover to a sport.

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