

3. Speed Anatomy

SPEED IN TEAM GAMES, WE USE THE SUPPORTING TERMS

- dynamics (power, strength, acceleration, frequency)
- agility (coordination, balance, strength, power)
- mobility (flexibility, elasticity, biomechanics, forces affecting on joints/angle)

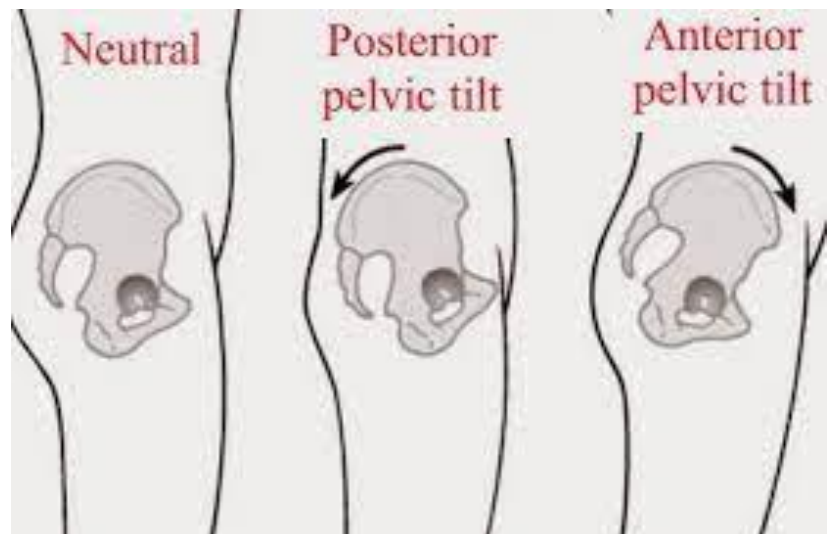
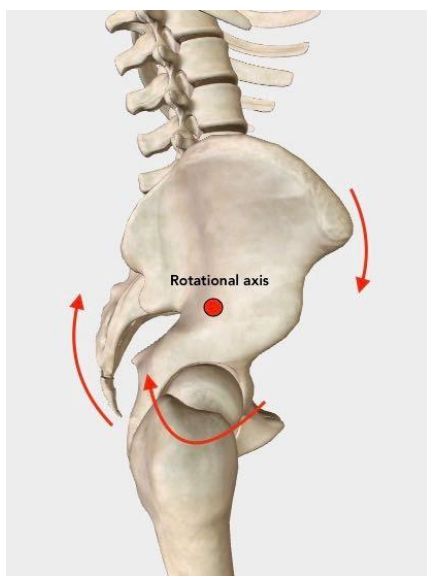
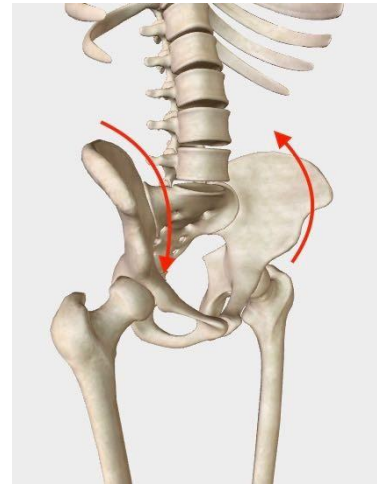
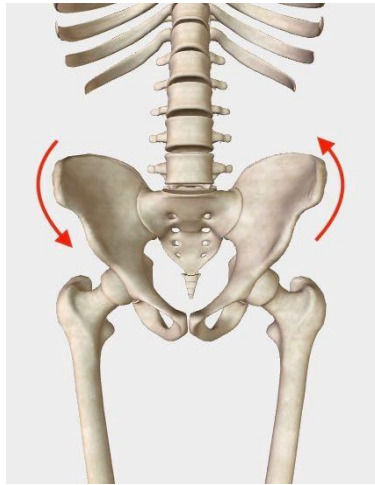


TERMS	description	
Dynamics	Power Strength Acceleration Frequency	S P E E D
Agility	Coordination Balance Movement Strength	
Mobility	Flexibility Elasticity Biomechanics Forces affecting on joints/angle Suppleness	

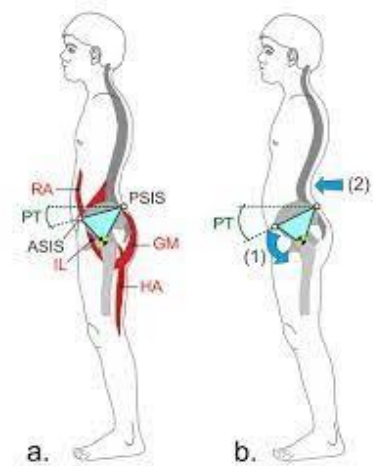
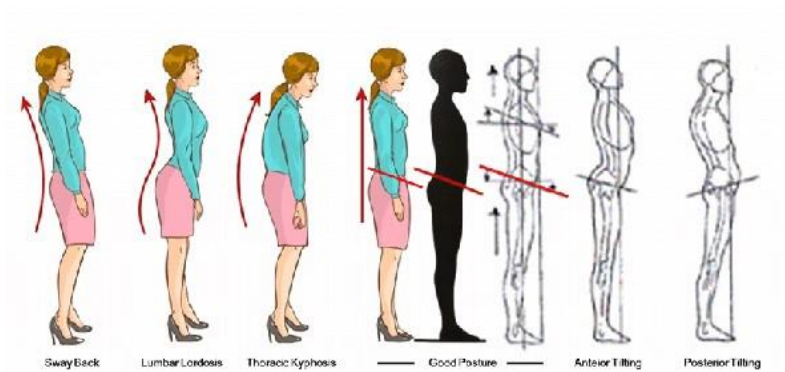
To show you how important each component is I pick **the mobility**, to prove that with the great training of speed and strength if you don't develop this component – you will never gain in the speed field!!

Our movement base is **in pelvis**. That is the core, where the motoric muscles are connected. So even if you trying to stretch the legs muscles (because you think that legs are responsible for moving forward), without making the core muscles stronger, in good balance, you will not improve the speed. That is a big process, improving speed means **HOLISTIC TRAINING** in proper way!

PELVIS

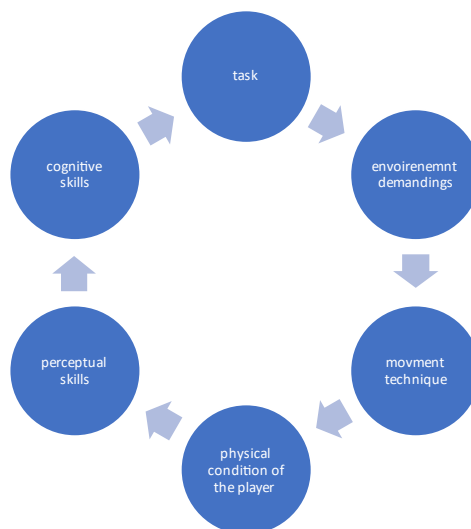


Core muscles keep our posture. If the pelvis is rotated that will affect on your muscles which might cause the injury or limit your body. For example, rotation to the back means extending the quads and shorten the hamstrings. So, if you will try to stretch the muscles it will not help already stretched quadriceps muscles, and it will not bring back to the natural tightness the hamstrings because there is no room to extend the muscles between the bones! The only solution is to bring back the pelvis to natural position by finding a right program between front and back muscles, and core muscles (deep pelvis muscles). Then the next step is to keep quadriceps muscles and hamstrings in the right strength/flexibility proportion. Only then you can use the strength capacity of the muscles to process it to the speed!



But the somatic factors are not the only one which effect on the speed:

FACTORS AFFECTING THE PLAYER'S SPEED



Coaches, I know it looks like the mountain must be moved but I assure you it is manageable. Much more difficult is to process it to the speed with the ball (because it is about everything, we talked about earlier plus some technical skills and team tactic). That is the real challenge!



SPEED OF ACTION IN TEAM SPORTS

WITH THE BALL

SPEED OF ACTION WITH THE BALL IN TEAM SPORTS

Physical component

- Coordination
- Conditioning
- Movements (ind)

Technical and tactical component

- Ball receiving, Passes and Shoots
- Dribbling
- Movements (team)

Cognitive component

- Perception speed: field, me, mates, opponents, ball
- Execution: brain – muscles
- Anticipation (analyze, imagination)
- Speed and accuracy of decisions made, es. under the pression of: time, field,opponent

Working in Poland I always asked me this question:

how is it that -even before the age of 12- our teams often compete on equal terms even with the best academies in Europe (for example, the last Lech Cup tournament or Norway Cup), and then, unfortunately, it already looks worse, and we can see it easily. Just lose the game!

In my opinion one of the key things that make a **difference is the speed of action with the ball (Gamespeed).**

As you can see in the first picture, the speed of action with the ball is influenced by many elements, they have been divided into 3 components:

- motoric/physical
- technical and tactical,
- cognitive/ sport intelligence

Each of them is extremely important and you have to work on each of them. I think that the basis here is coordination motor skills (CMS) and the technique of movement (appropriate movement patterns).

If we build an **appropriate base**, it will be easier to work on **technical and tactical elements later**. And this is one of the priorities in training with the youngest children. If you destroy this phase, you will be very limited as a senior, you close the doors for development, for improvements. **Technical skills depend on the physical preparation!!**

Another extremely important point is **cognitive skills**. Again, referring to the youngest players, I would pay special attention to the speed of perception and collection of information. Attractive orienteering games are a good tool here. AT this stage they develop team games skills but doing this in later age maybe it doesn't develop you so well as before, doesn't affect your technical skills so well, but affects your approach, team spirit, motivation - so develop your psychosocial skills and build the strong mentally player and strong collective.

Speed and accuracy of decision-making - that is, all training measures in which there will be pressure of time, space or the opponent. All tasks in which we develop speed (reaction time, thinking). It's not just children who love this kind of competition. Personally, I do a lot of it during training, also with adults.

1. Gamespeed development

- Perception
- The intensity of training
- is the repetition method without repetitions
- Supporting independent decision making
- Focus on fast movements switching



GAMESPEED DEVELOPMENT

Principles

Above you can see 5 rules by which we improve the **speed of action with the ball (gamespeed)**.

I wrote about the speed of **perception (1)** a moment ago.

The intensity of training (2) will be the key among children. Remember that "**Good and poor training takes the same amount of time**" (W. Herra). It is best to give up queues, long standing and translating tasks. It is better to give up passively reproduced movements, passively repeated exercises. Games should be arranged so that the intensity (engagement) is as high as possible.

Children need a short break to drink and they are ready to go on. They tire out quickly, but regenerate even faster. Seniors can have long theory sessions, with great tactical solutions, but it will not make them stronger if they don't try in the field. Every minute counts!

The best training is **the repetition method without repetitions (3)**:

"REPETITIVE METHOD WITHOUT REPETITION"

For many years, in Poland and in other European countries, **the strict (closed, stiff, passive) method** was the dominant method of teaching team games techniques to young players. As a result of the development of our sports, it was understood that in order for team games to become a faster game, and for the players themselves to be characterized by greater sport intelligence and decision-making, something should be changed in the teaching methodology.

And so, our western neighbors introduced a new method of teaching technique a few years ago, "**repetition method without repetition**", assuming that nothing happens twice on the pitch, so you should adjust your training to match conditions.

What does it mean?

When teaching, for example, passing a ball, you deviated from its strokes in pairs, in place for a few minutes. In a match, such a situation does not occur, each pass is different (due to - distance, rival, field sector, body position, quality of the turf, movement ...), so instead of making thousands of passes in place, they were replaced with passes in motion, after leading the ball, getting into position or in play. The same applies to teaching ball admissions and other techniques. That improve their creativity, experiment with the body, with the ball, according to the situation. The brain notices the solutions, results, and make it in the right brain shelf. Later the brain has an easy access to saved answer.

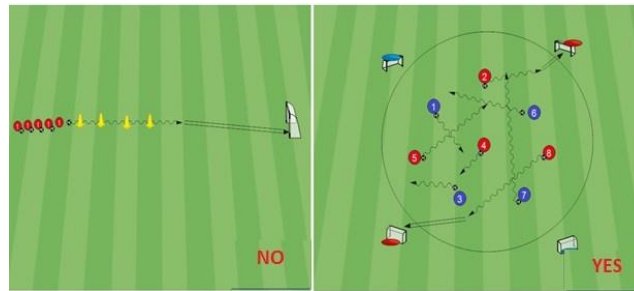
How to teach, for example, ball handling, dribbling?

Instead of using the strict form and leading the ball back and forth between the cones, it is better to guide the ball between the friends and perform the tasks indicated by the coach (technique, motor skills, drill ...). Of course, by leading the ball between the cones, we improve these skills, but not in terms of the game. Lack of decision-making, no need to raise the head and observe the space (concentration on the ball), passive repetition of movement acts, lack of thinking lead to a situation where the player catches habits that will **delay his game**.

It was predicted a dozen or so years ago that in football it will be difficult to improve football technique, but the speed of decision-making on the pitch is so, thanks to our sport will be faster and faster.

That is why the "repetition method without repetitions", the game and game fragments were chosen as the main training methods. It doesn't completely eliminate the strict form (it is especially useful in individual training), but marginalizing its role.

AN EXEMPLARY EXERCISE REPLACING THE STRICT FORM WITH THE "REPETITION WITHOUT REPETITION" METHOD.
 OBJECTIVE: **IMPROVING DRYBLING.**



STRICT FORM

- The players in a row lead the ball in a slalom. After its completion, they shoot at the goal.
- Defects:
 - Repetition of movement acts not occurring during the game (the opponent will not line up one after the other),
 - Player's eyesight focused on the ball,
 - No need to anticipate (the player does not develop abstract thinking),
 - One blunt exercise, no arrhythmia,
 - Lack of decision -making,
 - For larger groups, low exercise intensity.
- Exercise in this form, repeated systematically, develops ball control, but has a negative impact on the child's decision -making processes, which are crucial in modern football.

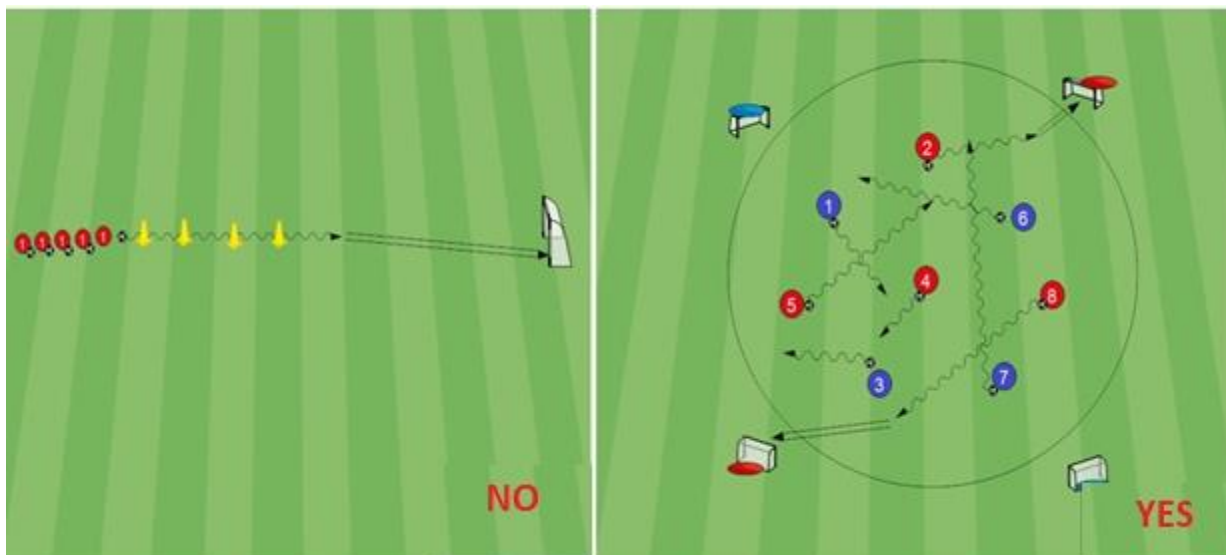
"REPETITION METHOD WITHOUT REPETITIONS"

- Competitors divided into 2 subgroups. Their task is to lead the ball between themselves in a task-oriented way (creativity of the trainer). At the signal (sign), hitting the ball into the correct goal. A form of fun and competition.
- Pros:
 - Improving dribbling in match conditions (the need to slow down / accelerate movements / change the direction of the ball ...)
 - Head (sight) raised to avoid collision (anticipation),
 - Handling the ball in variable conditions (depends on the setting of partners),
 - Possibility to combine exercises with motor and technical tasks,
 - High decision -making by players,
 - High exercise intensity.

The graphic presents an exemplary exercise replacing the strict form with the "repetition without repetition" method.

The final decision regarding the choice of training methods and forms always depends on the coach (club), but let's have a vision of what kind of player we want to raise and choose training means so that we get closer to the assumed goal.

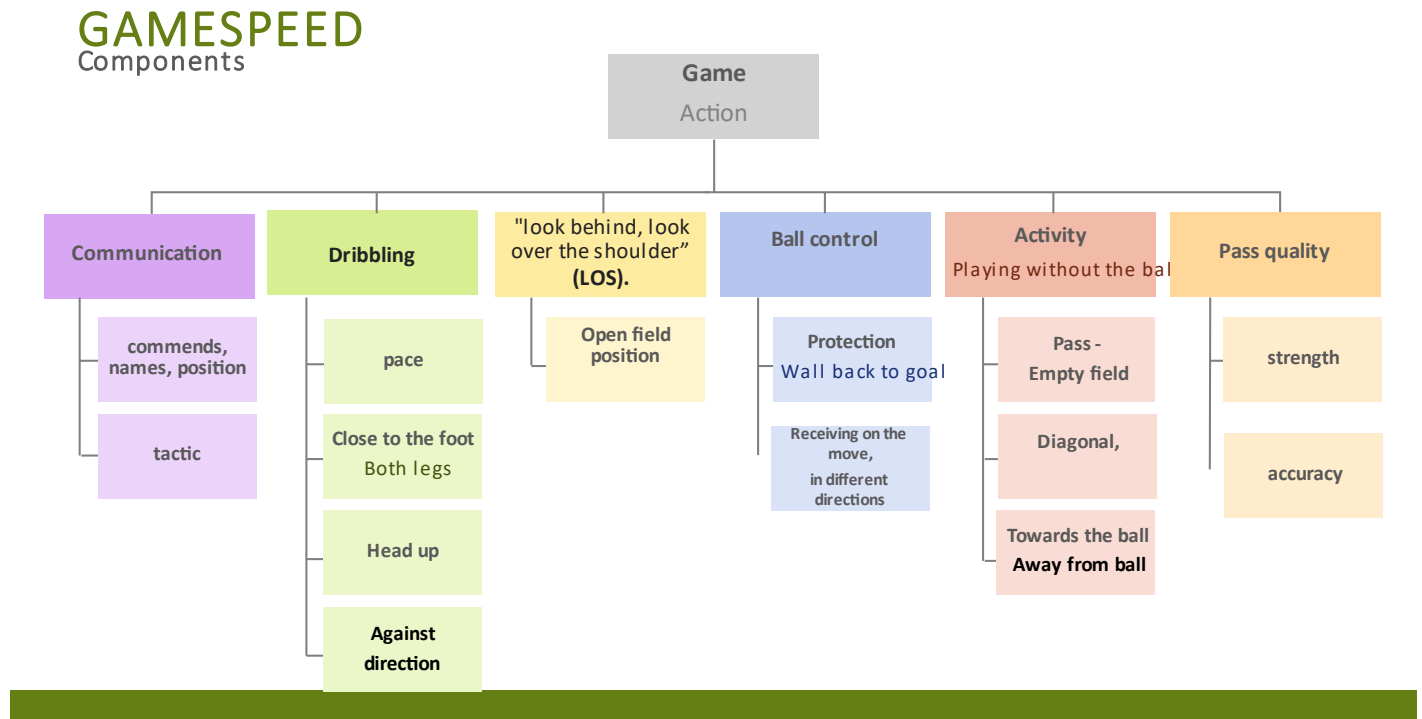
Again:



Supporting independent decision making (4)

Focus on fast movements switching (5)

Recommendations:



This section of the notes provides tips to pay attention to during training. Many of them are discussed in my trainings and seminars I run (e.g. in the Basics and Details).

Of course, in the youngest groups I would focus on ball control, dribbling, communication, and the "look behind, look over the shoulder" (LOS).

Perhaps you see this the first time, but I think you understand it very well. You can work on it from an early age.

This is one of the key elements of the **speed of perception**.

In addition, each of the listed elements is extremely important. As soon as the children come out of the **egocentric stage** and we start working on the passes, it is worth working on the recommendations listed here from the very beginning (e.g. strength and accuracy of passing, directional party, open position, playing without the ball).

2. Training structure

This is a small summary that highlights the essence of **GAMESPEED** – requirements for best speed development, creating the best environment for progress this ability.

GAMESPEED – requirements for best speed development, creating the best environment for progress this ability.

"Good and poor training takes the same amount of time"

1. Start with the exercises, drills, but switch asap to the games!
2. Permanently increase the pression (time, field, opponent).
3. Main are the advantage games.
4. Decrease the playing field and increase amount of the players.
5. Provoke to achieve the demanding actions/solutions.
6. On the end shot to the goal (from holding and protecting the ball switch always to the same gam es with the shot).
7. Take care of the intensity and breaks!

TRAINING STRUCTURE

the essence of GAMESPEED



More and more often I try to use games in advantage even in the youngest groups of 5/6-year-olds. In 2014, when I joined the Brazilian Soccer School, for example, I had 15 players in G12 training, and we always play on 3 parallel pitches. Instead of putting them into equal teams, I divided the children into three fives. They all played 3 x 2. They didn't complain, didn't say it is not fair or too hard. They accepted the challenge without even notice that something is wrong.

I also love the game on square field, where the players in the middle hold their hands or move on the legs and hands same time, or upside down. Then the children have time for what you see in the notes - that is, to perceive, observe and adjust the action.

I would say the **GAMESPEED** is the key factor of wining.

When analyzing a straight-line run, it can be divided into three phases: **acceleration, reaching maximum speed and maintaining maximum speed**. In many team disciplines, e.g. in handball, football, the key phase of the run is **acceleration**, which takes place in the first few meters (**2-5m**), which is often followed by a **change of direction**, sometimes preceded by an **earlier short stopping** of the player.

When planning your speed training, you should take into account your position. On the example of **football**, the greatest **percentage of sprint to the entire distance run** is achieved by the attackers (2.4% of the total distance, approx. **260 m of which approx. 180 m with the ball at the leg**) and side defenders (2.3% of the total distance, approx. 250 m of which approx. 100 m) with the ball at the leg. Therefore, it is important what distance (running distance) you will cover in training and what % of these runs you should perform with the ball.

*“The distances covered are **a lot less** than what was reported in the 80s and is possibly due to how the game has changed with a better use of substitutions during the game to make sure players can perform **fast movements** for almost **21%** of the total distance covered.”*

In handball most sprints do the wings, ahead of backs/defenders, pivots and goalkeepers, respectively.

“Defining “rest” as standing, walking or jogging, and work as the distance covered by high intensity running or sprinting, the work-to-rest ratio for our handball players was 1:2.”

That is, they found that for every minute of work (high intensity movement essentially), there are 2 minutes of rest (low intensity movement or none at all).

Additionally, in a paper also published in the Journal of Strength & Conditioning Research in 2012 entitled Physical and Physiological Demands of Elite Team Handball, based on time-motion analysis of 30 elite male players with at least 5 years of experience in the top Portuguese handball professional league, the authors found;

“In >60% of the occurrences, the time between maximal intensity activities was >90 seconds, and 52.4% of the recovery periods were fulfilled by low-intensity activities (32.2 +/- 19.33% walking; 8.6 +/- 16.68% sideways medium-intensity movement; 7.3 +/- 9.29% jogging; 4.3 +/- 8.77% backwards movement). However, in almost half of the recovery time, the players were standing still (44.9 +/- 23.03%).”

“Time-motion analysis showed that during the average 73 minutes of match time, 825 activity changes were performed at 6 seconds intervals.”

A change in movement every 6 seconds on average!

The authors also found;

*“They performed 38 (+/- 6) high-speed runs, with an average duration of 2 (+/- 0.6 seconds.)” **av 12m.***

So on average, there is a change in movement made by field players every few seconds, indicating a very high number of accelerations and decelerations, as well as changes of directions in the process.

But when it comes to the football, the sprint sometimes might be longer, up to 30-40m. And then the break to utilize the fatigue and recover enough to repeat the same distance with max speed takes up to 4min. I notice after 4-5reps that the speed decrease, so that is the moment you don't develop max speed anymore, but more speed endurance.

Aerobic ability is still vital. But this does not mean to go out and perform 5- 10km runs. Rather you require a good aerobic level to be able to recover during your rest periods before your next effort. surprise is the 2km per game that goalkeepers cover.

You should do speed training using the repetition method, with a break to fully rest each time you complete a given segment. You will find the relationship between work and rest a few paragraphs below. The number of series depends on the training macrocycle you are currently in and the break between series should be 6-10 minutes and be active in order to accelerate the regeneration and reconstruction of energy substrates used during speed training (phosphocreatine and muscle glycogen).

In order to shape speed, you need to be regenerated. As I wrote before, speed is dependent on the efficiency of your nervous system, and this is the case when you are rested. Therefore, you should do speed training at the beginning of your training microcycle, in the initial phase of training, after an appropriate dynamic warm-up. Pay attention to the rest breaks between successive repetitions, starting from 1:20 and ending with 1:12 (1 sec of work: 20 sec of break).

Speed and agility are key skills, the high level of which may determine the final sporting success. Hence, speed training is of great importance in the physical preparation of players for sports competition. Speed is the ability to cover a distance in the shortest possible time and its level is closely related to muscle strength. An important aspect is also that the speed is strongly genetically determined and its maximum level depends on the type of muscle fibers. It is equally important to use sensitive periods to shape it, which fall between the age of 10 and 14. During this period, a young footballer can improve his speed results by about 20% and significantly improve his reaction time and agility.

Speed consists of haste, maximum speed, and speed endurance. In football, acceleration is the basis of success in the game. During the match, the average length of a sprint is about **17m**, often followed by braking, changing the direction of the run and accelerating again. Most sprints take place with the so-called the volatile phase, i.e. when the player is already in a slight jog / movement. A common activity is sprint - a momentary deceleration and acceleration again at maximum intensity.

Running speed is determined by two components: stride length and stride frequency. The combination of these components gives a mathematical model of running speed. To increase the speed of the run, you should work on both of these components at the same time, which somewhat limits the selection of training measures.



METHODS

SPEED

SPEED / physical ability				
Time reaction and efficient start	Acceleration	Step length	Frequency	Max speed and power
Actions				
<ul style="list-style-type: none"> power (50% of max power)/ Bolid and Fiat reactive training resistance dynamic power 	<ul style="list-style-type: none"> resistance acceleration drills/ switching plyometrics 	<ul style="list-style-type: none"> Technical running drills Flexibility Mobility Strength Coordination Resistance running drills 	<ul style="list-style-type: none"> Resistance training Flying accelerations Running drills Plyometrics supramaximal coordination Technical running drills 	<ul style="list-style-type: none"> strength max, strength endurance agility resistance supramaximal (downhill, gums, treadmill, bike) plyometrics

Tools: gym/weights, laying ladders, standing ladders, medicine/heavy balls, Swiss/rehab balls, hurdles, small hurdles, coins, sticks, stairs, hills, treadmills, spin bikes, elastic bands, ropes, weight slides, heavy vest, boxes, steppers etc.

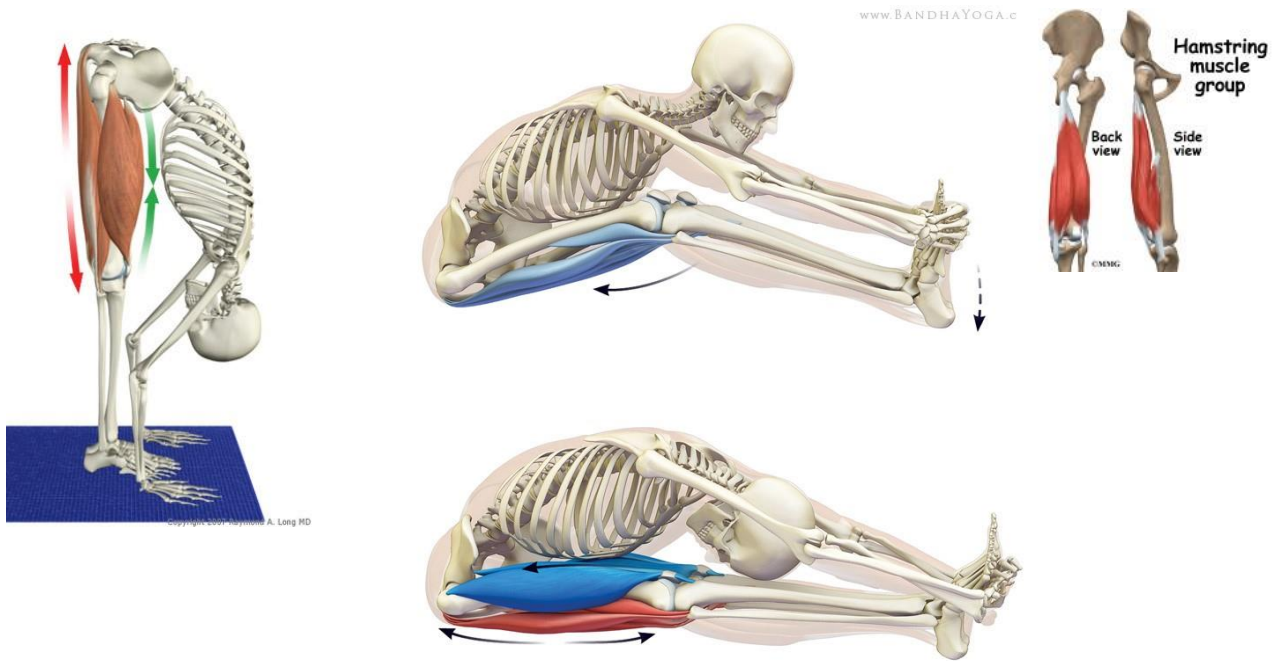
As you can see above the speed can be improved by strength training, but you can use many tools and very wild equipment for to achieve it.

Speed can also be trained by developing strength.

- **No exercise improves your running speed more than running at full speed.** During sprints, the athlete produces a high level of power in a short time. This is a strong stimulus for the nervous system, creating conditions for adaptation and increasing the flow rate of nerve impulses and stimulating muscle fibers to stronger and faster contractions. Neurological adaptation during well-planned maximum strength training and sprint runs increases the rate of force development (RFD) and the generation of impulses.
- Our muscles are made of muscle fibers that have different levels of excitability. Red (slowtwitch) fibers have a low degree of excitation. White fibers have this threshold much higher. **The number of muscle (motor) units involved in contraction depends on the amount and rhythm of nerve impulses sent to the muscle.**
- **Strength training improves the nervous mechanisms and allows you to stimulate more and more motor units of the muscle.** this method of work is great, because we can increase muscle strength practically without increasing the volume of muscles.
- The strength of the muscle increases faster than the tendons, ligaments and connective tissue, therefore the use of too heavy loads may cause them to tear.

SPEED REQUIRES A PLAYER TO HAVE A HIGH LEVEL OF MUSCULAR STRENGTH.

This brings a lot of benefits but it also very risky. Remember when you stretch hamstrings your quads are getting shorter. Our muscle chain is made from the antagonist muscles: one is straightening the leg and another one is bending the leg.



- <https://www.youtube.com/watch?v=yUj4kgLdrSQ>
- Min 3.50 handball



Both, football players and handball players they are very low on their fit, bending the hips, and working a lot in this tight position. That of course effect on their muscles balance and elasticity. In football, hamstring injuries are the most common (same for track and field sprinters). In handball, because of impact, shoulder to shoulder fight and

throws it is not most “popular” injury, but the legs are in the same risk. So that is why is some important to focus on muscles recovery and supplementary workouts to keep them fit and injury free. The best players of the world spend same time on the “supplementary/conditioning” training as on training with the ball (technique).

Sprinting is a reported mechanism of **Hamstring Strain Injury HSI** in about **70%** of cases. For this reason, it would be very logical to pay special attention to **High-Speed running (HSR)** and Sprinting during the rehabilitation process as well as after returning to team sessions. High-intensity activities, including running at velocities close to maximal, are activities during which key moments of the game take place and which can differentiate between winners and losers.

The inability of an individual to successfully and sufficiently participate in these activities during the match, can significantly affect team performance. For that reason, football coaches are primarily interested in returning the player to the pre-injury level, and not just returning to the team work. HSR and sprinting are an important part of this puzzle due to their undeniable impact on performance but also as a significant factor in HSI prevention. Due to all the above, the total distances covered (in meters) at speeds that meet criteria of HSR (>19.8 km/h) and sprinting (>25.2 km/H) could be considered as important parameters in the assessment of long-term effects of HSI and other injuries.

Curiosity:

Whiteley et al. (2020) observed 15 professional football players with HSI. Total distances of HSR (>19.8 km/h) of each player before injury during at least 5 games (median 15 games) were collected and analyzed (average and cumulative values). Due to the large variability among players, the results were observed individually. It is interesting that the results ranged from 75 to as much as 1000m, indicating the differences in abilities, positional differences, the influence of tactics, opponent, etc. The results obtained, especially for players who did not show much variability in results from match to match, were used to predict the results in subsequent games (as if the injury had not occurred). After comparing the hypothetically predicted results and the real post-injury values, *almost 50% of the players (7 out of 15) achieved significantly less total HSR distance, during the next 15 games!*

3. Extra benefits:

Speed training is **physically and physiologically demanding**. It also puts a lot of strain on the work of the brain. Along with it, there are **injuries**, but they can be kept to a minimum. In order to do so, the development of this feature should be spread over the long term and start already **at school age**. The basis of training supporting the development of this feature is **versatility, mobility and flexibility, regular training of agility, strength, and endurance**. The increase in speed and the direct impact on soccer skills aren't the only benefits:

1. It improves the nervous mechanisms and enables the stimulation of more and more motor units/fibers of the muscle (-20%)
2. Testosterone levels increase.
3. There is definitely faster postworkout regeneration.
4. Rehabilitation after injuries is faster.
5. Prevention / Injury is avoided and thus weakening the squad, changing structures or strategy of the game.
6. The time of activity and physical efficiency in a match increase!
7. The number of technical errors (inaccuracy of passes, receptions, shots) is reduced.
8. It extends the athlete's career.
9. Influence on coordination. As higher coordination level (agility) as faster a **new efficient movement learning**.

Professional training is individual in 50 -60%!

EXTRA BENEFITS

Based on:

- **Own experience and research**
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 - The ability to quickly accelerate and de-celerate, and effectively change direction plays a key role in modern soccer (Barnes et al., 2014; Chaouachi et al., 2012; Hau- German Journal of Exercise and Sport Research gen et al., 2014; Jeffreys et al., 2017; Little & Williams, 2005)
 - *Marco Cardinale, Qatar, Aspetar Sport Medicine Journal, STRENGTH TRAINING IN HANDBALL*
- Andersen, Vidar; Fimland, Marius Steiro; Cumming, Kristoffer Toldnes; Vraalsen, Øyvind Fougli; Sæterbakken, Atle Hole Explosive Resistance Training Using Elastic Bands in Young Female Team Handball Players, Sports Medicine International Open
 - Adrian GEORGESCU, Constantin RIZESCU, Cristina VARZARU [Revista Romaneasca pentru Educatie Multidimensionala](#) 11, March 2019 , Improving Speed to Handball Players
 - JUAN CARLOS ZAPARDIEL CORTÉS1 , CARMEN FERRAGUT1 , CARMEN MANCHADO2 , JOSÉ ARTURO ABRALDES3 , HELENA VILA 11th World Congress of Performance Analysis of Sport, 2016. International Society of Performance Analysis of Sport, Difference of the speed of handball throwing during the competition in relation to efficiency: Analysis between the first and the second half.
 - <https://sasasemeredi.com/>
 - <http://www.PerfectSoccerSkills.com/>
 - <https://handballfitnessstraining.com/>