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THE EFFECT OF PROPRIOCEPTIVE TRAINING IN INJURY PREVENTION OF YOUNG FOOTBALLERS

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Abstract

Agonist and antagonist muscle balance is an essential element of joint stability and motor functioning. Sport training is often accompanied by disturbances of this balance, causing musculo-tendon injuries. The objective of this study is to prove that the so-called "natural" leg of the footballer is less powerful than the leg leans. Our hypothesis supposes that with a musculation and muscular strengthening program based on proprioceptive exercises, we will be able to reduce this difference and arrive at a certain muscular balance between the two legs and thus limit or avoid the muscular injuries due to this imbalance. 23 U-21 players were chosen to lead this 8-week experience based on proprioceptive muscle-building exercises. A unipodal balance and overall postural proprioception test were applied. After the statistical processing, it was found that training based on proprioceptive muscle strengthening exercises allows players to have a better balance in both legs and therefore the reduction in risk of injury and optimal performance.

And there was a positive and significant correlation between the two legs when you use the right methods and the right procedures and proprioceptive exercises.

1-Introduction

In competitive sport the training of proprioceptive balance has a great place; it is a major ability to fine-tune movements and overall body position in various static or moving situations (Ergen E., 2008.). Proprioception is generally defined as the sense of position and movement of the limbs. The sense arises through activity in sensory neurons located in skin, muscles and joint tissues (Hanlie Jacoba Gertenbach). Proprioception is part of the somesthesia **(**body sensibility including the cutaneous and kinesthetic senses (Gertenbach, 2002).

Proprioception (made up of proprio, taken from the Latin proprius, "proper", and of [reception]) or deep sensitivity indicates the perception, conscious or not, of the position of the different parts of the body (Ashton-Miller JA., 2001). It works thanks to numerous muscle and ligament receptors, and the pathways and nerve centres involved. Proprioception is part of somesthesia. Somesthesia being the set of different sensations coming from several regions of the body (skin, hair ...).(Dellantonio, 2017)

We also talk about kinesthesia, where without entering into the semantic discussion, this last term would be used more for the part conscious of the position and movement of the different parts of the body (Nurisalem, 2015). Although related on a cognitive level, unconscious proprioception and kinesthesia (or conscious proprioceptions) call upon different physiological mechanisms (Science, 2019).

Proprioception works thanks to proprioceptors. These are of 3 orders:

1. The neuromuscular spindles present in the muscles code for the speed of stretching

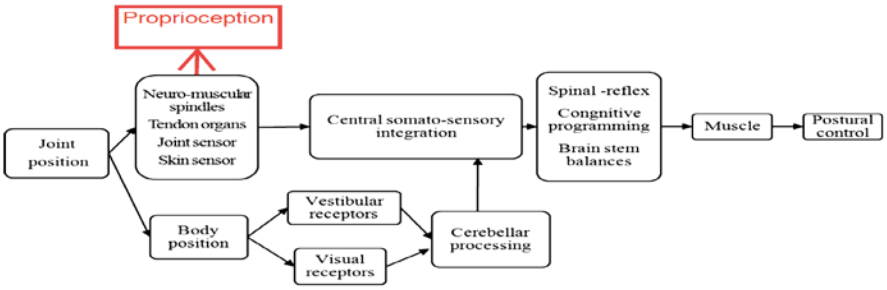
2. The Golgi tendon organs present in the tendons also code for stretching

3. Pacini and Ruffini corpuscles present in ligaments / fascias - the fibrous envelope / connective tissue that surrounds muscles and organs - and joints (the first responds to rapid pressures and the second with a lag time to pressures continuous (Paillard, 2016).

Proprioceptors will produce information on the accelerations, angles and tensions that apply to muscles and joints (S.Barsi, 2012.).

This sensory information goes from the receptors to the motor cortex (afference).The motor cortex is linked to planning, control, and the execution of voluntary movements (De Dale Purves, 20019).

Proprioception is a conscious perception or not. You are not constantly aware of your calf as you read these lines, but as soon as you read them, you become aware of your calf status. Part of your brain is dedicated to listening to these related messages (leggi, 2019).



1. Proprioception is the information from the stimulation of ligament, muscle and joint receptors to create awareness of the body.

2. Proprioception is not balance but participates in its regulation. Proprioception is made up of conscious and unconscious information.

3. Motor control or movement orchestration, is the processing of information (proprioceptive + sensory) + muscle control + intentions in the execution of specific tasks at a time T.

4. Proprioception and muscle control are linked, hence the proposal to work on proprioception by increasing contractile quality in specific positions (Idriss, 2013).

5. The addition of elastic bands wrapped around the body can also play on the production of proprioceptive information.

6. Proprioception is not only a mechanism of pro-action but also of pre-action hence the importance of being in control of one's body (Chu, 2016).

Proprioception has multiple interests:

- strengthening of deep muscles and peri-articular muscles
- favor the reflex activity of the muscles during imbalances
- participates in the prevention of joint and ligament injuries

- optimizes the recruitment of motor units.

Care must be taken to work on the various joints (ankle, knee, hip, shoulder, neck, etc.), after going through the sheathing and strengthening stages of the different muscle groups (Lephart, 2002).

Prospect of proving that the non-dominant leg of the footballer is less powerful than the dominant leg.Our hypothesis supposes that a specific muscular strengthening program based on proprioceptive exercises could decrease this difference and arrive at a certain muscular balance between the two legs and thus limit or avoid muscular injuries due to this imbalance.

2-Methods and means:

2-1-Experimental method:

For the concretization of our research, we saw it was necessary to use the experimental method in order to answer our initial questions; because D. DELIGNIERES and P. DURET define experimentation as: “The empirical testing in a methodical way of a theoretical hypothesis”. The development of a scientific hypothesis is based on the simulation power of models Researchers operate their models formally, and can thus make predictions about the real functioning of their object .a hypothesis is a proposition deduced from a scientific theory, capable of being validated by experimentation, the latter will consist in verifying that the phenomena observed correspond to predictions from simulations carried out using the model.

2-2-The participants

Twenty three U-21 players have been chosen for our 8 weeks training experience with two sessions per week. The training period consisted of predominantly physical sessions and proprioceptive exercises to strengthen the lower limbs on a football field with suitable equipments. A pre-test was carried out comprising a test of uni-podal balance and overall postural proprioception. The port training test was done at the end of the training program.

The 8 weeks training program based on muscle building exercises included:

- warming up
- Prerequisite required sheathing on all articular stages

- Progressive training.
- Specific barefoot workouts.
- Short sequence of 10 to 15 seconds to go to longer times. Or: short period to long period exercises (10 to 15 seconds)
- Quickly add variety because adaptations are quick. Or: different types of specific exercises to add more variety thus help develop adaptation more quickly.

2-3-Unipodal balance and global postural proprioception test:

This unipodal static balance test, on one leg and closed eyes, measures the effectiveness of proprioception and control of posture on a support of reduced surface, the sole of the foot. Proprioception gathers all the body information from the joints, muscles and bones. It allows, in addition to vision and receptors present in the inner ear, to know and act on the position and movements of each part of the body. This protocol, along with other health-related tests, is part of the HEPA (Health Enhancing Physical Activity) program, which is an inter-federal program to combat physical inactivity and promote physical activity for general health.

2-4-Test procedure:

The only equipment needed is a stopwatch. The test execution instructions are as follows. You have to be barefoot, so without shoes but you can possibly keep your socks. You have to fold one leg against the other and put your hands on your waist. When this unipodal position is adopted, we close our eyes and try to maintain this balance as long as possible. The presence of another person is necessary to time the duration of posture with eyes closed. This test is carried out three times on the same foot and only the longest of the 3 tries is kept.

Measurement Procedures:

The assessor begins to time as soon as the subject in a correct stationary position. He stops the stopwatch as soon as the subject loses his balance, that is to say if he begins to move the support footor as soon as the free foot is no longer in contact with the knee. The result is noted in seconds. The consultation of the following table allows an evaluation on 5 levels taking into account the age and sex of the test subject. For example, the optimal

balance level (index 5) is reached from 31 seconds for a man aged 20 to 29 years.

3-Results:

After having exposed the methodology of our study, here are the results of the tests carried out on our sample (experimental group). In this chapter we will dissect the results obtained in the Pre-tests and the Post-tests, to try to validate the hypothesis issued in this study.

The battery of tests developed for this study made it possible to follow the evolution of the proprioceptive indices of each player, throughout the experiment, as (Koutchouk Sidi Mohamed, 2013) confirms in his study.

Table1. Comparison between left leg and right leg in prét-test

Tests	left leg		right leg		T calculated	T Board	D of F n-1	L .S	M.S
	x	*s*	*x*	*s*					
Experimental group	21,78	2,08	20,69	1,49	2,03	2,69	44	0·01	Significant

Statistical analysis of the results of the pre-tests (table 1) represent the data from the Unipodal Balance Test and overall postural proprioception of the parameters of comparison between the right leg and the left leg measured before the experimental intervention, before the application of the training program, with a statistical threshold of 0.05, a degree of freedom 22, and "t" of Student = 2.03.

We note that the results of the tests for the two legs, and the values obtained show that there is a significant difference between the two legs, right leg = 20.69 while the left leg = 21.78 and that the experimentation will confirm or deny us the hypothesis previously expressed.

Table 2.Comparison between pre-test and post-test of right leg:

Tests	Pré-test		Post-Test		T calculated	T Board	D of F n-1	L .S	M.S
	x	*s*	*x*	*s*					
Experimental group	20,69	1,49	26,34	1,92	19,80	2,82	22	0·01	Signif icant

If we observe the results of the pre-tests and post-tests obtained by the G E (table n ° 2) we observe significant improvements between the Pre-test and the Post-Test of the proprioceptive parameters of the right leg (Delignières, 2004). What comforts us in our experimental approach, in the sense that a training based on muscle strengthening exercises adapted to the needs of muscular balance in football is likely to bring considerable improvements to the physical qualities necessary for good performance such as demonstrates (DOUCET, 2007). It is the improvement of the player's physiological potentials in close relation with the motor skills of football activity show that proprioceptive training followed by technical-tactical training allows better strength development only in reverse order. So it's all about planning the strength training first, then training to develop the other skills.

Table 3.Comparison between pre-test and post-test of left leg:

Tests	Pret-test		Post-test		T calculated	T Board	D of F n-1	L .S	M.S
	x	*s*	*x*	*s*					
Experimental group	21,78	2,08	27,52	2,53	16,88	2,82	22	0·01	Signif icant

The results of the pre-tests and post-tests obtained by the E.G (table n ° 3) we observe significant improvements between the Pre-test and the Post-Test of the proprioceptive parameters of the left leg. What comforts us in our experimental approach, in the sense that a training based on muscle

strengthening exercises adapted to the needs of muscular balance in football is likely to bring considerable improvements to the physical qualities necessary for good performance such as demonstrates (LAMBERTIN, 2000)(LAMBERTIN, 2000,) It is the improvement of the player's physiological potentials in close relation with the motor skills of football activity show that proprioceptive training followed by technical-tactical training allows better strength development only in reverse order (G.Adda, 2015) . So it's all about planning the strength training first, then training to develop the other skills (Berthoz, 2013).

Table 4.Comparison between left and right leg in post test

Tests	left leg		right leg		T calculated	T Board	D of F n-1	L .S	M.S
	x	*s*	*x*	*s*					
Experimental group	27,52	2,53	26,34	1,92	1,76	2,69	44	0·01	Signi ficant

Statistical analysis of the results of the post-tests (table 4) represent the data from the Unipodal Balance Test and overall postural proprioception of the parameters of comparison between the right leg and the left leg measured before the experimental intervention, before the application of the training program, with a statistical threshold of 0.05, a degree of freedom 22, and "t" of Student = 1.76 as confirms in his study (Bachir, 2019).

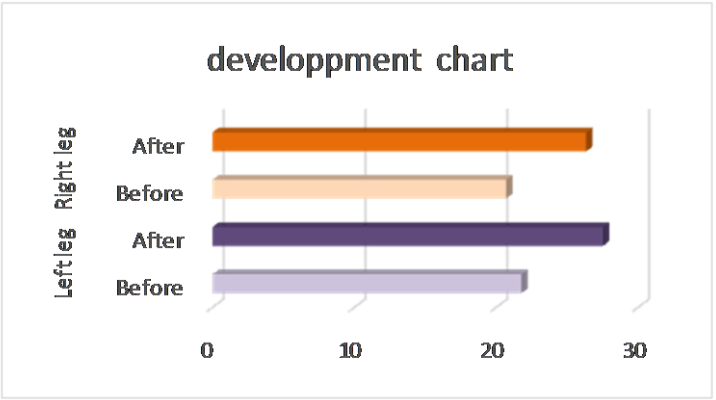
We note that the results of the test for both legs, and the values obtained show that there is a significant difference between the two legs, right leg = 26.34 while the left leg = 27.52, and that the experiment at confirm the hypothesis previously expressed. That is to say, a strengthening training adapted to the muscular balance of the two legs is possible, to avoid the risk of injuries to the so-called natural leg of the footballer.

4-Discussion:

Our initial test show a significant difference between the right and the left leg (p=0.0482), which proves that this is a common problem for athletes and it was the main reason for us to conduct this study. The final data we

collected after the training program ended shows significant decrease in the difference between the left and the right leg with a P value at 0.0839, it proves the difference is not quite statistically significant.

Figure n°1: means comparison before the left and the right leg



The Figure n°1below show us the effect size (ES) and the 95% confidence interval (CI) between the two legs results.

When we look at each side individually, the difference between the pre and post training results were extremely statistically significant (P<0.0001) for the right leg. The results were also similar for the left leg (P<0.0001).

The researcher confirms that strengthening training adapted to the muscular balance of both legs is possible (Al-Karamdi., 2016), to avoid the risk of injuries to the so-called natural leg compared to conventional training. With this approach, we found that it is possible to have progress in the physical preparation of the young footballer as advocated by modern training in high performance football.

The margin of progression of the experimental group between the pre-test and the post-test was clearly significant, and the impact of this proprioceptive work proved to be positive in the muscular balance between the two legs and consequently to reduce the risk and injury prevention for young footballers.

The hypotheses put forward, have been confirmed through experimentation, the results obtained are significant.

Whereas (A.Delacourt, 2015) suggests also integrating the physiological, technical and tactical parameters of FOOTBALL activity . In fact the player, through the phenomenon of transfers, will benefit from the development of a particular quality to improve other qualities essential in the practice of football.

The observations established between the pre-tests and post-tests are confirmed by the study with a significant improvement for the right leg. By comparing the results obtained by the two legs, we can affirm that the integration of strengthening exercises Muscle propriocetifs in football training were beneficial for the experimental group as evoked (Ben chara Mohamed Yassine, 2019) in similar studies.

Indeed, we note in this last significant improvements for the majority of the players. The improvement of the parameters of the force or muscular qualities .These results support certain longitudinal studies in team sports which have also found muscle improvements following specific training (Cometti.G, 2002).

5-Conclusion:

By referring to the multiple references which prove that an imbalance in the posture and the strength of the lower limbs automatically causes muscle and joint injuries in footballers in general and in young players in particular (J.Massion, 1992).By programming a training suitable and adapted to the requirements of football which include jumps (Mustapha, 2018), duels on the ground and air, powerful shots, accelerations and declarations, has the consequences of improving the quality of force and at the same time a gain of power and efficiency and above all avoid muscle and joint injuries and in addition the achievement of high performance (Todd S., 2012).

To conclude on the reflex movements, the processes of which we have not finished understanding, let us note that in view of their importance for the protection of our organism and their participation in its stability in our daily tasks, although they are not always sufficient in more extreme dynamic situations, it should be remembered that these mechanisms, like myotatic and reverse myotatic reflexes (C.Collet, 2001), consist of involuntary movements not controlled by the CNS and the brain.Conferring on the

postural system, its self-regulation and its autonomy in the management of gravity. Consequently, proprioceptive mechanoreceptors - here mentioned FNM and Golgi tendon organs - are therefore not passive elements. Was it necessary to recall it?

Through this first part, we have seen that the information system (and precision) that constitutes proprioception is fundamental to muscle control and therefore to motor control (A.Dupeyron, 2012). The whole of the information which it represents, from the global stability as well as segmental which it conditions, are the base of a motor skills which must be "efficient, effective and adjustable"(Bosch, 2015.) .In fact, through voluntary, automatic, reflex motor skills and the postural system in which it is expressed, proprioception is a determining factor for optimizing performance as much as it is for managing injuries (J.1Simian, juin 2017.), although it alone is not always sufficient .Stability being, by far, predominant for the fulfillment of these two vocations. This raises the question of the trainability of proprioceptive aspects. Since one of the current problems concerns the mechanical stability / mobility paradigm, fueled inter alia by the preponderant place given to situations on unstable surfaces in order to optimize proprioception**.**

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