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THE INFLUENCE OF BIOFEEDBACK IN POSTURAL REHABILITATION OF ATHLETES

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ABSTRACT. Background. A balanced posture allows sports movements PERFORMANCE with optimal consumption of energy and minimal stress on the musculoskeletal system with the help of the technology offered by the posturograph, we can identify the center of gravity deviations, the points of support, the load, the weight distribution in the soles, the anterior posteriorized or compressed posture, the asymmetries of the body. By an interpretation in biomechanical context, any compensations or decompensations can be identified. **Aim.** The aim of the study is to improve posture through biofeedback treatment using the GPS 600 device**. Materials.** The Posturograph or Global Postural System (GPS) is an advanced postural analysis system that uses techniques and methods of noninvasive diagnosis and evaluation in the field of medical recovery. Posturography includes 2 diagnostic units and software. **Methods.** We used the following methods: bibliographic study methods, method of observation, measurement method, experimental method, statistical method. **Applied treatments.** The treatments for re-educating the posture with the GPS 600 device took place for 2 weeks. During the treatment, the subjects had to maintain their body position / posture as indicated by the device. **Results.** From the 12 athletes, the anteriority of the head improved, the center of gravity, loading on the right and left lower limbs. At the end of the 2 weeks, the athletes reached a perfect balance of the center of gravity and the weight distribution on the lower limbs**. Conclusion.** Biofeedback treatments with the GPS 600 device help to improve POSTURE and maintain the results over time.

Keywords: *biofeedback, posture, athletes, GPS 600*

INTRODUCERE. ***Influența biofeedback-ului în reeducarea posturală a sportivilor.*** O postură echilibrată vă permite să efectuați mișcări sportive cu un consum optim de energie și un stres minim pe sistemul musculo-scheletic. Cu ajutorul tehnologiei oferite de posturograf, putem identifica abaterile cu ajutorul centrului de greutate, punctele de susținere, gradul de încărcare, distribuția greutății în tălpi, postura anterioară posteriorizată sau comprimată,

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asimetriile corpului și printr-o interpretare în context biomecanic, pot fi identificate orice compensații sau decompensări. **Scop.** Scopul studiului este de a îmbunătăți postura prin tratament de biofeedback folosind dispozitivul GPS 600. **Materiale.** Posturograful sau sistemul postural global (GPS) este un sistem avansat de analiză posturală care folosește tehnici și metode de diagnostic și evaluare neinvazivă în domeniul recuperării medicale. Posturografia include 2 unități de diagnostic și software. **Metode.** Metodele utilizate pentru evaluare au fost metoda de studiu bibliografic, metoda de observare, metode de măsurare, metoda experimentala, metoda statistica. **Tratament.** Tratamentele pentru reeducarea posturii cu dispozitivul GPS 600 au avut loc timp de 2 săptămâni. În timpul tratamentului, subiecții au trebuit să-și mențină poziția / postura corpului, așa cum este indicat de dispozitiv. **Rezultate.** Dintre cei 12 sportivi, anterioritatea capului s-a îmbunătățit, centrul de greutate, încărcarea pe membrele inferioare dreapta și stânga. La sfârșitul celor 2 săptămâni, sportivii au atins un echilibru perfect al centrului de greutate și al distribuției greutății pe membrele inferioare. **Concluzii.** Tratamentele biofeedback cu ajutorul dispozitivului GPS 600 ajută atât la îmbunătățirea, cât și la menținerea rezultatelor obținute în timp.

Cuvinte cheie: *biofeedback, postura, sportivi, GPS 600*

INTRODUCTION

A balanced posture allows to perform sports movements with optimal consumption of energy and minimal stress on the musculoskeletal system.

The existence of a dysfunction in the musculoskeletal system leads to compensations that requires a high consumption of energy and that untreated, over time can cause injuries, fractures or certain health problems.

At an overview, the movements performed by the athlete do not reflect the existence of a compensations of the musculoskeletar system so it is necessary to use more detailed advanced medical investigations to find it.

With the help of the technology offered by the posturograph, we can identify the deviations of the center of gravity, the points of support, the degree of load, the weight distribution in the soles, the anterior posteriorized or compressed posture, the asymmetries of the body and by an interpretation in biomechanical context, any compensations or decompensations can be identified.

The originality of our research lies in the fact that we will use both the posturograph for identification of deficits as well as for their correction in real time, using the information provided by the device, technique known as biofeedback.

Modern biofeedback is the technique of using electronic equipment to instantly discover certain physiological imbalances and to teach patients to correct these otherwise involuntary misalignments through manipulation displayed signals (usually visual and / or acoustic)

In rehabilitation, modern biofeedback has gained a strong place in the treatment of motor neuron lesions superior, especially in the retraining muscles and in inducing the relaxation of the spastic muscles a patients with stroke (Basmajian et al, 1981).

The number and the time of the meetings are determined by the general state of health and the patient's ability to learn to control their physical responses.

Therapy specialists through the biofeedback technique can be doctors specialized in psychiatry, psychologists, nurses, dentists or physiotherapists.

To learn these techniques of biofeedback and to install a visible result, most people need about 8-12 sessions.

The ultimate goal for the patients is to be able to exercise through exercise control posture, muscle tone or blood circulation without the help of a monitor.

Biofeedback is generally delivered through visual displays or acoustic signals, however, more recently virtual technology (VR) or exergaming technology has been used as biofeedback signals.

VR technology and exergming technology have been investigated mainly in post-stroke rehabilitation, however, more recent work has shown that this type of biofeedback is effective in improving exercise technique in the musculoskeletal system in any patient (Oonagh M Giggins et al. , 2013).

Authors such as Maciaszek J. et al. (2014), Macizszek J. (2018) and Sayenko D. et al. (2012) had investigated the effects of biofeedback training with the help of the posturograph.

Some authors study the effect of visual feedback of the center of pressure versuscenter of gravity on postural control during a new permanent movement. In the during treatment participants had to hold for 20-30 seconds on a swab foam.

Syenko D. et al. (2012) has used patient destabilization by modifying the platform support, during which time the patient had to keep his center of gravity in the same position.

Others studied the effects of visual feedback, which it was improved over time in the balance training.

Hasegawa N. et al. (2017) studied the increase of sensory biofeedback (BF) for postural control which is widely used to improve postural stability.

However, effective sensory information in BF motor learning systems for postural control are still unknown.

Chien-Hung Lai (2013) shows the effects of interactive video-based exercise on balance.

Interactive exercise based on six-week video games improves the balance. The training effects remain partially after 6 weeks of interventions without exercises.

The existence of a dysfunction in the musculoskeletal system leads to compensations that require a high energy consumption and that over time can cause injuries and wear.

With the help of posturograph technology, we can identify deviations of the center of gravity, support points, the load, weight distribution in the soles, anterior, posterior or compressed posture, body asymmetries and through an interpretation in a biomechanical context can identify possible compensations

Our research will use posturograph both to identify deficits and to correct them in real time, using the information provided by the device, a technique known as biofeedback.

The study included a screening phase involving 12 MMA athletes between the ages of 15 and 28, who sought to identify signs of physical deconditioning.

The initial and final evaluation included GPS 600 posturograph testing

HYPOTHESIS

The use of the posturograph in the analysis of posture helps the deconditioning syndrome in adults who are professionally involved in activities that require the repetition of the same movement for a long time.

AIM

The aim of the study is to improve posture through biofeedback treatment using the GPS 600 device.

MATERIALS

The Posturograph or Global Postural System (GPS) is an advanced postural analysis system that uses techniques and methods of noninvasive diagnosis and evaluation in the field of medical recovery.

Posturography includes 2 diagnostic units and software:

• Podoscope - is used in the analysis of static disorders of the foot and the position of the center of gravity; with its help the captured images are processed, determining the exact length of each leg, the existence of static plantar disorders (flat foot, hollow, etc.), as well as possible deviations at the ankle.

• Postural analysis unit - is used to determine deficiencies in the spine, through a system of video cameras that allow the acquisition of high-resolution images, images that are then processed by software, to analyze all segmental or global deviations of the body.

Postural analysis is performed from the front, back and profile and can diagnose deficiencies of the spine in the sagittal or frontal plane (scoliosis, kyphosis, hyperlordosis).

The software allows the storage of the patient's medical data, both those resulting from posturographic tests and those related to the medical history or medical treatments that follow. It is useful for monitoring the evolution of patients and the effectiveness of recommended therapies.

Based on data obtained from a complete posturography, personalized physiotherapy and medical recovery programs are developed.

METHODS

We used the following methods:

• bibliographic study method - the study of specialized literature to update the theoretical basis;

• method of observation - intentional tracking, correct and systematic recording of events and situational context for each subject;

• measurement method - the evaluation of subjects using posturograph provides somatometric and functional data;

• experimental method - application of the program proposed by the working methodology;

• statistical method - data processing and interpretation using SPSS program, descriptive statistical analysis, ANOVA test.

APPLIED TREATMENTS

The treatments for re-educating the posture with the GPS 600 device took place for 2 weeks as follows: the subjects came to treatment for 5 days.

During the treatment, the subjects had to maintain their body position / posture as indicated by the device. The device indicates the position that should be balanced, a correct posture. During each treatment, maintaining the correct posture was for 10 times for 20 seconds.

RESULTS

The 12 athletes improved, the anteriority of the head as follows:
- In 8 athletes it improved between 0-1.0 cm;
- In 4 athletes it improved between 1.1-2 cm.

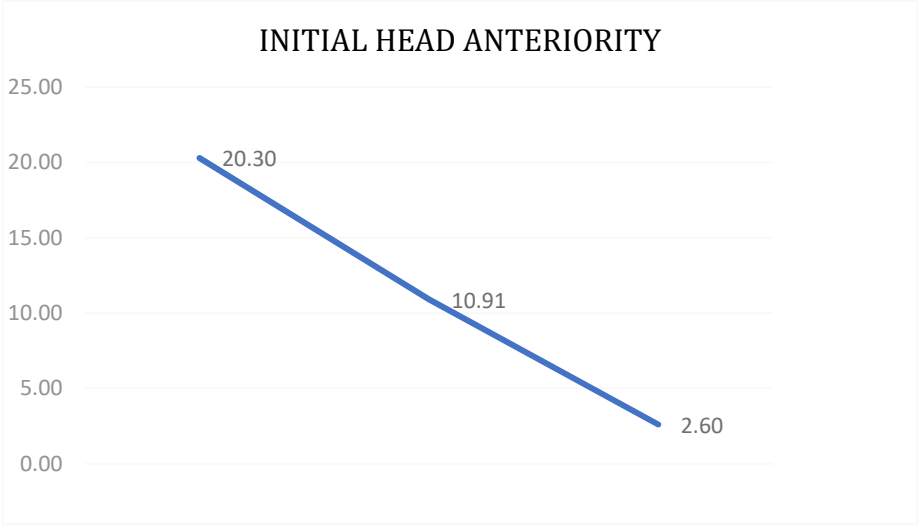

Figure 1. Initial results of the anteriorised head (cm)

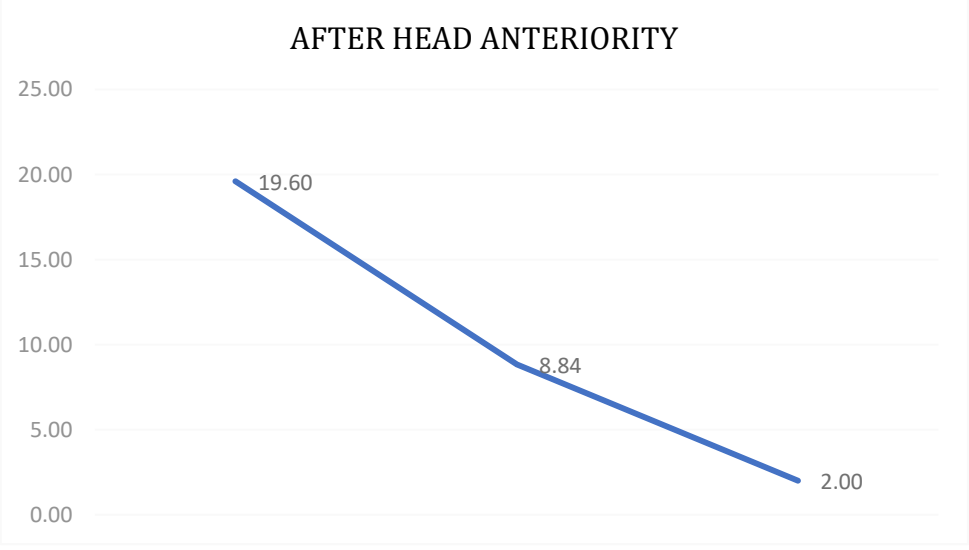

Figure 2. Final results of anteriorised head (cm)

The center of gravity has been improved by the following values:
- In 10 athletes it improved between: 0-2.0 cm;
- In 2 athletes it changed by 2.8 cm.

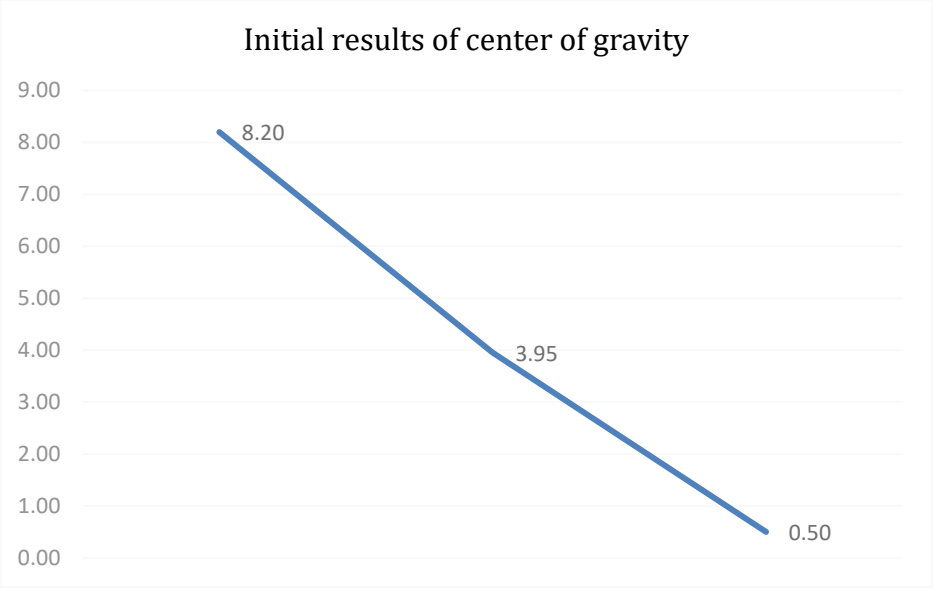

Figure 3. Initial results of center of gravity (cm)

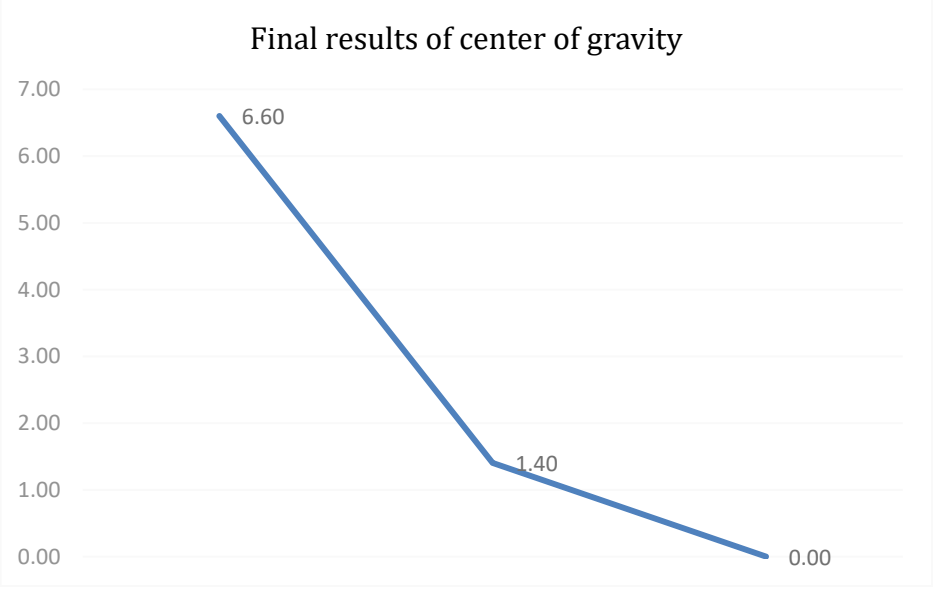

Figure 4. Final results of center of gravity (cm)

Loading on the right and left lower limbs has improved otherwise:
- In 1 athlete improved by 7%;
- In 1 athlete improved by 5%;
- In 1 athlete improved by 3%;
- In 4 athletes it improved by 2%;
- In 2 athletes it improved by 1%;
- In 3 athletes it improved by 0%.

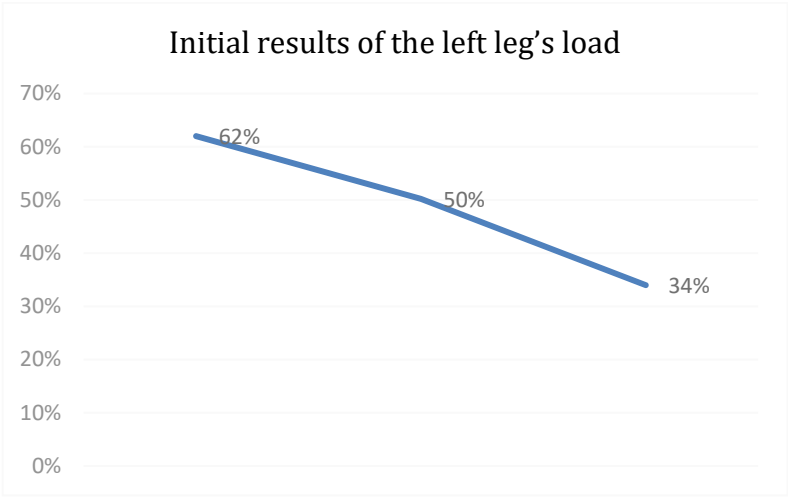

Figure 5. Initial results of the left leg's load (cm)

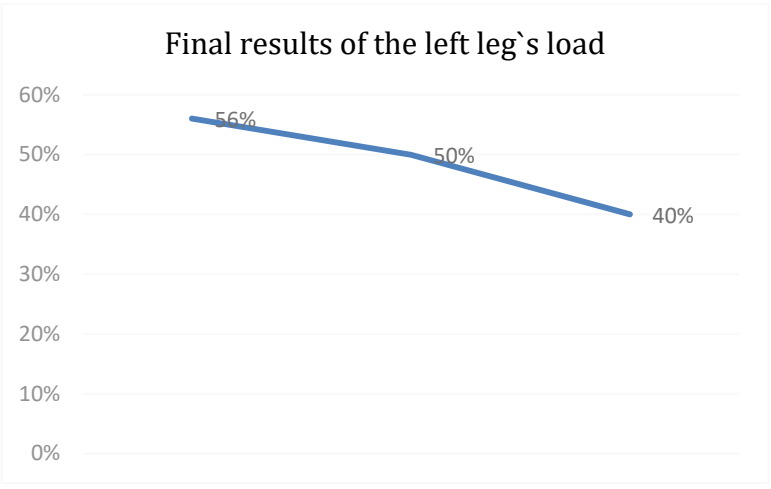

Figure 6. Final results of the left leg`s load (cm)

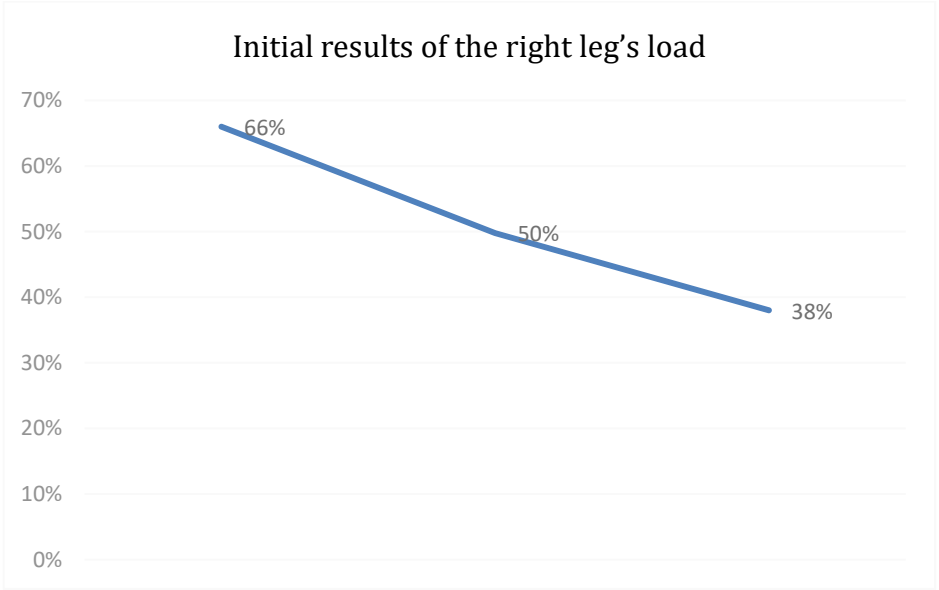

Figure 7. Initial results of the right leg's load (cm)

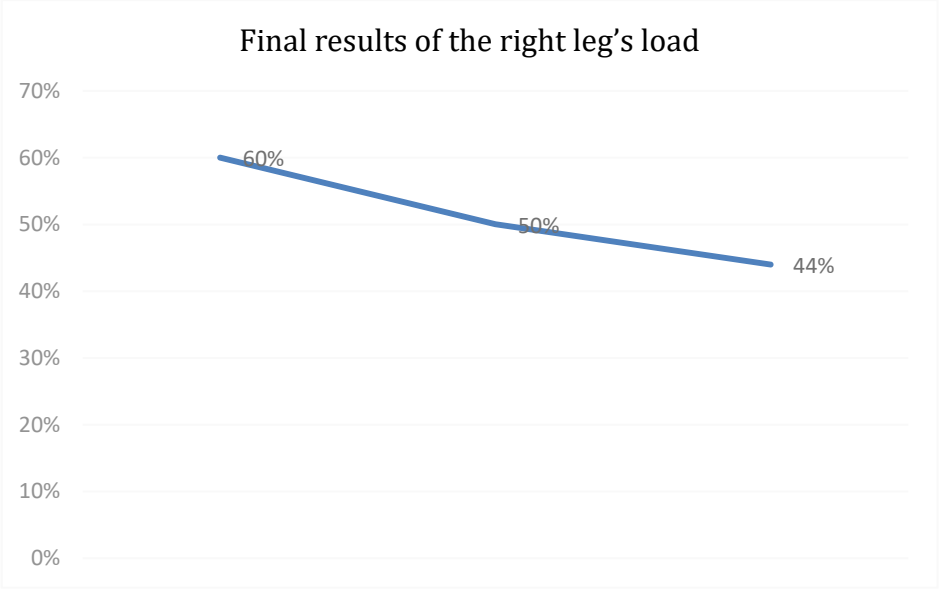

Figure 8. Final results of the right leg's load (cm)

CONCLUSIONS

At the end of the 2 weeks, the athletes reached a perfect balance of the center of gravity and the weight distribution on the lower limbs. The center of gravity reached a balance of 50-50% in 10 out of 12 athletes.

The weight distribution on the right and left lower limbs was 100% balanced in 10 of 12 athletes.

The anteriority of the head has significantly improved by 2 cm, which means that the balance is considerably improved.

During this difficult period of COVID 19 all treatments were stopped. After we resumed our activity, we re-evaluated the 12 athletes. The athletes results were the same as at the end of the 2 weeks of treatment, before the COVID period 19.

Unlike the other people, the athletes from the 6th session managed to maintain their posture in the position indicated by the device, in the correct posture position.

Biofeedback postural rehabilitation program with the help of the GPS 600 device help both to improve and maintain the results obtained over time.

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