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A Medical Device, called RUGRAN, Improves the Correction and Stabilization of Posture

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Abstract

Posture is human fundamental ability that deals with the scientific and clinical study of body position in space, in order of maintaining balance in both static and dynamic conditions, in relation to the psychic functions, biochemical and somatosensory individual for the maintenance or achievement of health status. The aim of the present study was to examine if a medical device (plantar), called RUGRAN, can improve muscle rehabilitation in pain syndromes muscle-tendon for the correction and stabilization postural. The static pedobarographic evaluation revealed significantly higher values in terms of forefoot peak pressure, total plantar force and total contact area in subject without RUGARN plantar, compared to subjects with RUGARN plantar. This is the first study that investigated the pedobarographic changes in subjects with the RUGARN plantar. The static pedobarographic findings we observed while the subjects were standing revealed no difference of force distribution and contact area between forefoot and rearfoot and this finding did not support the hypothesis that the centre of the body shifts to forward because of excessive adipose tissue causing excessive forefoot loading.

Keywords: Rugran; Pedobarographic; Pedobarography device; Shapiro-Wilk test; Posturology

Introduction

Posture is the medical discipline that deals with the scientific and clinical study of body position in space, in order of maintaining balance in both static and dynamic conditions, in relation to the psychic functions, biochemical and somatosensory individual for the maintenance or achievement of health status [1]. The optimal posture requires a correct relationship between the various dynamic structures and musculoskeletal and depends not only on the integrity of bones and ligaments but also the balance between the various active forces (muscle tone) [2]. The muscular system always maintains a certain degree of muscle contraction (i.e., the tone) and the same movement is allowed by variations between tonic muscles antagonists for combating and symmetrically balance the force of gravity [3-5]. Posture is determined by the balance between muscle tone (active force) and gravity (passive force) adjusted according to plan space and positions: in case of asymmetries and abnormal posture, you determine conditions of varied etiological origin, biochemical, emotional, pathological dysfunctional of the stomatognathic [6-8].

Foot problems prevail among almost all ethnic and age groups. Among all foot problems, three types of foot deformation occur with a high prevalence, namely pes valgus, hallux valgus and pes cavus [9-11]. Pes cavus and pes valgus both manifest with problems in the medial longitudinal arch, while hallux valgus is associated with a metatarsophalangeal angle greater than 15° [12,13].

The plantar alterations and lower limbs modify the static and dynamic posture [14,15], up to an impact level cranial mandibular causing malocclusion and mandibular prognathism [16,17]. Appropriate corrective action using orthotics must determine postural correction with morphological restoration of balance and body stability [18,19], correct muscle stimulation with normalization of muscle tension, improvement of venous and lymphatic return through stimulation of cutaneous pressoreceptors, muscle proprioception, joint proprioceptors deeper, autonomic receptors but, at the same time, the same devices, they must have good adaptability to all types of footwear [20,21].

In order to study postural attitude, we can use force platform to evaluate sensitive receptors, weight, gait and stability, or baropodometric or dynamometric platform to analyze tonic postural system, either during static posture, either walking [21]. These platforms can also be precious for the prevention of postural disequilibrium, as well as to evaluate the efficacy of therapy usually employed in sports medicine [22-24].

The aim of the present study was to examine if a medical device (plantar), called RUGRAN (silver, gold, palladium, platinum, iridium, rhodium, osmium, ruthenium, copper), can improve muscle rehabilitation in pain syndromes muscle-tendon for the correction and stabilization postural, for the full use of body muscle strength in athletic performance and the reduction of pain caused by fatigue, stretching, muscle contracture, from asymmetries basin, by prolonged standing position and balance disorders of cervical origin.

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Materials and Methods

A total of 60 healthy male volunteers without any known history of injury or any postural or skeletal disorder that could affect normal posture or gait composed the study cohort (age 26.5 ± 5.0; height 169.5 ± 6.6 cm; body weight 68.4 ± 3.6 kg). All had the same shoe size (french 42), a right dominant leg, and a similar anthropometric profile. The participants were in good health, as defined by the absence of cardiovascular diseases, no history of endocrine disorders and they were not taking any medication. The local Institutional Ethics Committee of the Second University of Naples approved the study. Participants were provided with both written and oral information regarding the possible risks and discomforts and were ensured that they were free to withdraw from the study at any time. All procedures conformed to the directives of the Declaration of Helsinki.

Pedobarographic evaluation

Pedobarographic assessment was performed by a Mini-Emed pedobarography device (Novel, Munich, Germany). This system carries out the measurement of the static and dynamic sole pressure. The device consists of a Canon colour printer, monitor, pressure sensitive platform, remote control, power supply and connections between printer and platform as well as monitor and platform.

The pressure measurement (=assessment) platform of the device have a general frame having the dimensions of 650*290*25 mm and a perceptive area having the dimensions of 360*180 mm and there are three perceptive gauges on each cm2. The exemplification speed of the device is 14 squares in one second, deposit interval is 20 squares, pressure interval is 2-127 N/cm^2, solubility is 1 N/cm^2, accuracy rate depending on foot is 5%, heat gap is 15°C to 40°C, connection power was 220/110 volt.

During the static measurements, in order not to direct the body weight on a particular side, the participants were asked some questions to attract their attention to other issues. In order to provide a balanced assessment, they were asked to look at a stable point on the wall which is 3 meters away from them. While standing up on the platform, step width interval was fixed as 8 cm.

The evaluation was performed separately for each foot. The following eight parameters were evaluated during static measurement: (1) forefoot peak pressure value (N/cm^2), (2) rearfoot peak pressure value (N/cm^2), (3) total plantar force (N), (4) forefoot plantar force percentage (%), (5) rearfoot plantar force percentage (%), (6) total contact area (cm^2), (7) forefoot plantar contact area percentage (%), and (8) rearfoot plantar contact area percentage (%). All subject were tested with and without a medical plantar device called RUGRAN (silver 20%, gold 20%, palladium 15%, platinum 17%, iridium 7%, rhodium 1%, osmium 9%, ruthenium 4%, copper 7%).

Statistical analysis

Statistical analyses were performed by the R Project for Statistical Computing (version 3.1.0). Descriptive and outcome statistics are presented as mean (M) ± Standard Deviation (SD), and statistical significance was set at $p<0.05$. The Shapiro-Wilk test was used to check the normal distribution of variables. Paired T-test was used to investigate the differences between without RUGARN plantar and with RUGARN plantar. Postural stability and static pressure distribution were measured in single-leg stance on both sides.

Results

The static pedobarographic evaluation revealed significantly higher values in terms of forefoot peak pressure, total plantar force and total contact area in subject without RUGARN plantar, compared to subjects with RUGARN plantar (Table 1).

Parameteres	Plantar	No Plantar	p value
Forefoot peak pressure (N/cm^2)	6.6 ± 2.7	8.1 ± 2.1	p<0.05
Rearfoot peak pressure (N/cm^2)	10.2 ±2.8	11.3 ± 3.2	p>0.05
Total plantar force (N)	330.1 ± 82.9	411.4 ± 93.3	p<0.01
Forefoot plantar force percentage (%)	60.9 ± 15.1	61.6 ± 13.4	p>0.05
Rearfoot plantar force percentage (%)	39.1 ± 14.2	38.8 ± 10.5	p>0.05
Total contact area (cm^2)	81.8 ± 16.3	84.7 ± 13.3	p<0.05
Forefoot plantar contact area percentage (%)	52.1 ± 8.4	51.9 ± 3.4	p>0.05
Rearfoot plantar contact area percentage (%)	49.8 ± 6.5	49.3 ± 6.6	p>0.05
Data are presented as mean ± standard deviation			

Table 1: Comparison of static pedobarographic values.

Discussion

This is the first study that investigated the pedobarographic changes in subjects with the RUGARN plantar. The static pedobarographic findings we observed while the subjects were standing revealed no difference of force distribution and contact area between forefoot and rearfoot and this finding did not support the hypothesis that the centre of the body shifts to forward because of excessive adipose tissue causing excessive forefoot loading. Posturology is fundamental to recognize the anatomo-functional relationship between certain postural attitude and some pathological conditions otherwise difficult to recognize.

Posture is defined as the position of the body at a given point in time. We have a correct posture when muscular and skeletal district are balanced [25]. The participation of virtually every part of the body in the mechanism of gait requires efficient control by the nervous system, which explains why walking is not possible immediately after birth in humans; in a physiological gait is an extremely energy efficient form of locomotion, which means that any disturbance of its normal mechanisms is accompanied by increased energy costs and decreased muscle efficiency. Thus when patients in rehabilitation must learn to walk again, it is essential to conduct a thorough evaluation of the existing movement abnormalities in the joints and the functional parameters of the various muscles and muscle groups [17]. Massion et al. [26] demonstrated that the coordination between posture and movement are the results from two parallel controls. They operate on multi joint motion units of the overall biomechanical system responsible for both the movement and its associated postural adjustment. An example is ankle and hip eigen movements during voluntary forward bending of the trunk. In this case, a critical aspect for the coordination of the two eigenmovements is their timing, which is a function of their respective inertias.

When an incorrect relationship exists among different parts of body producing an higher tension on retaining structure, and body equilibrium is unpaired, postural problems may occur. Neurosensorial system, through vestibular, visual and proprioceptive mechanisms contribute to a correct posture. Moreover, specific neurophysiologic mechanisms play an important role in maintaining a correct postural tone [27,28].

In our study we found increased peak pressure only in the forefoot region during static measurement perhaps because of the lower grade of obesity in our study population. It was not surprising to find higher total force and total contact area in subjects without RUGARN plantar because of the exposure to higher loads. Plantar pressure pattern can indicate the condition of the biomechanics of foot and ankle. It is widely used for diagnosis of foot health problems [29-31]. Considering the high prevalence of the mentioned three kinds of foot deformities the human foot has two functions: weight-bearing and propulsion [13,20,32-34]. The areas under the five metatarsal heads, hallux and calcaneus, are mainly load-bearing locations [35-39]. Therefore, the peak and mean pressure values, the pressure time integrals and the force under these areas are commonly used to analyze and compare plantar pressure patterns among foot types.

The kinematic pattern of the normal movements that take place in all the joints involved in walking is similar in the sagittal plane in nearly all individuals. Inter-subject differences can be seen in kinematic analysis primarily in the frontal projection. The forces that operate while walking are generated by muscle actions that accelerate or retard the movement of various body segments, gravity, and momentum. Any disturbance of this extraordinarily efficient mechanism for exploiting the force of momentum will cause a loss of energy efficiency in the gait. Therefore, when we are teaching patients to walk again, it is essential to restore the normal rhythm of gait, including the fluid movement of both lower and upper limbs. In conclusion it seem that RUGARN plantar can improves plantar pressure.

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