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SUMMARY

Key words: barycentre, stabilometric platform, testing

The purpose of the present paper is that of highlighting by means of the studies performed with the help of the posturograph – new element in the theory and praxis of medical rehabilitation – its applicability in the evaluation and treatment of patients with balance disorders, consequence of the articular modifications due to degenerative processes.

The main idea is that of defining the role and the efficiency of this non-invasive tool in the rehabilitation of patients suffering from articular affections due to ageing, as well as in preventing this process by means of modern prophylaxis methods by reducing subsequently the physical and material costs implied by this pathology.

The studies comprised in this paper will back up the idea that posturography, due to the fine balance modifications which it intercepts, can constitute a useful early, pre-radiologic diagnostic method for arthrosis of various etiologies, as well as a valuable therapeutic remedy thanks to the already elaborated training programs, offering the possibility to train or to compensate the diagnosed deficits.

The evaluation of the subjects will be performed in the special part of the paper, by means of clinical-statistical, epidemiological, randomized studies which will refer to patients suffering from arthritis of various articular levels of the lower limb, of various etiologies, on which one has applied either conservatory therapy or surgical. The studies are based on the posturographically registered data. The statistic elaboration of the data obtained this way will be performed according to various criteria (gender, age, the affected joint, the degree of the articular affection, the causes which led to osteoarthritis.)

The hypothesis at work starts from the fact that the arthritic affection holds the 4th place in general morbidity and has a chronic evolution, often invalidating. The identification of the treatment strategy in the lower limb osteoarthritis continues to represent the object of many research programs, aiming especially at its prophylaxis, because it implies costs that are significantly lower.

In the formulation of the objectives of the present paper there were the conclusions derived from the synthesis of the present state of the research in the field, creating an association between the etiologic diagnosis of the disease and the clinical and functional results obtained by means of the effects of specific kinetotherapy and secondarily, of other forms of treatment: physical techniques, medication.

The objectives of the study were represented by the selection of the cases and their confirmation according to the criteria for the diagnosis of arthritic disease, the establishment and the analysis of the existence of some correlations between the functional state of the affected joints, the pain and the patients' degree of mobility, the analysis of the efficiency of physical-kinetic treatment acting on the physical-pathological joints, the symptomatic and functional elements in the degenerative affections, the elaboration of a therapeutic strategy with clinical-functional character, adapted to the evolutionary degree of the arthritic affection and of the associated pathology, the contribution of this research in the treatment of the lower limb arthritic affection.

The Doctor Thesis, comprising a number of 162 pages is structured in 2 chapters and 10 subchapters, in which there are presented aspects regarding the anatomy and the biomechanics of the large lower limb joints, the present state of articular biomechanics and the present state of therapies in arthritic

pathology. These aspects will be predominantly studied throughout the paper and they will highlight the importance and the efficiency of the posturographic method in indicating the anomalies caused by articular modification and the practical application of the obtained data.

The central objective of the thesis, that of underlining the role of posturography in the management of arthritic pathology recuperation, was followed in the special part of the paper in 3 of the 5 performed studies, aiming at the deviations of balance and body stability due to the degenerative affection in supporting joints, that is, the 1st study highlights the consequences of long-term immobilization, secondary to chronic, degenerative affections of the lower limb at bone, muscular and joint level, with an accent on coordination and balance, the second refers to the re-education protocol for patients suffering from gonarthrosis, by means of an aimed posturographic training of the feed-back type, the third study analyzes the deviations of the center of gravity due to coxarthrosis, associated or not with scoliosis, as well as the correction of abnormal dynamic stereotypes (antalgic gait, limping), leading to the overstressing of the healthy lower limb due to additional load, the fourth study entangles a modular training program, by a step-by-step accentuation of balance and the secondary development of rectification reflexes and the fifth and last study concentrates upon the re-education of balance in orthostatism, with an accent on dosing the exercises, while taking into account the fact that muscular fatigue can be a negative factor in the rehabilitation of persons suffering from degenerative affections of the lower limb.

1. THE PRESENT STATE OF KNOWLEDGE

1.1. The topicality and importance of posturographic determinations and kinetotherapy in the recovery from arthritic affections of the lower limb.

Apart from a series of medical and surgical aspects that were briefly mentioned, the paper underlines the importance of the elements of functional anatomy applied in the rehabilitation of arthritic joints. All therapeutic disciplines which tackle upon the difficult issue of arthritic rehabilitation must compete so as to build a synchronized treatment team. In the complex process of rehabilitation, there are involved several specialists from various fields of activity. This way, the rehabilitations appears as multidirectional, which imposes a concentrated action.

The contribution of the interdisciplinary rehabilitation team members will be oriented towards the removal or the best amelioration of the physical, sensorial and psychical state of malfunction of the patient in view of his/her reintegration at the socio-professional level.

The list of the specialists interested in the aspects of human movement is long: orthopedists, surgeons, and athletic sport coaches, engineers in the field of functional rehabilitation, therapists, and kinesiology specialists, specialists in orthotics and prosthetics, psychiatrists, designers of sports equipment. At fundamental level, the name given to the science dealing with the diverse problematic of human movement is that of kinesiology. This discipline which is at the constantly evolving combines the aspects of physiology, of motor learning and of anatomy.

The attempts to study and explain the physiological functions and structures in terms of the laws of physics and of engineering were at first performed by doctors, physicians and specialists in the medical field. At the present, research of this type, are mostly the responsibility of specialists in the field of biomedicine and bioengineering.

Posturography is a modern method used in the ORL field, in order to determine vestibular reflexes. The study, which is meant to constitute the subject of the present Doctor's Thesis, sets itself, as an element of newness in the theory and praxis of medical rehabilitation, to highlight the applicability of this method also for the evaluation of patients with balance disorders, as a consequence of joint modifications.

The device which determines the deviations from the norm of various balance parameters (libration amplitude in various directions: antero-posterior, lateral, lateral right – side, lateral left – side, anterior, posterior, then the balance coefficients in the antero-posterior and lateral directions, as well as the alignment of the center of gravity), is the posturograph, a



computerized device built from a platform fitted with movement sensors that can register the variations of the gravitational line of the body.

Any displacement of the body, even a minor one, will trigger displacements of the projection of the gravitational line of the body within the support basis. These deviations are immediately visualized on the

computer display. With the help of this method one can analyze balance and stability in various conditions (eyes closed, with stable support or not, immobilized, in closed chain mobilizations, etc.)

The main idea of the method is represented by the mechanical adjustment and by the redistribution of the muscular tonus, so that the patient should try to maintain his/ her balance. This way, one can examine a person's ability to integrate the visual, vestibular muscular-skeletal systems, with the purpose of providing the balance function and of performing a precise and correct rehabilitation which should take all individual characteristics into considerations, as well as the stage of the disease. The functional scales used for the evaluation (the Tinetti scale for gait and the Tinetti scale for balance) give information regarding the activities in deficit.

The posturograph or the Global Postural System (GPS) is a system for advanced postural analysis which makes use of non-invasive techniques and methods for diagnosis and evaluation in the field of medical rehabilitation, being the only device of this type in Romania. The posturograph makes use of a digital program in order to visualize the data and to determine the diagnosis, revolutionizing the methods of balance analysis and of vertebral static disorders.

1.2. Anatomic-physiological and biomechanical data of the knee

The first part of the anatomic functional support presents the clinical and biomechanical anatomy of the bone structures, of the menisci, the muscles, of the origins and of the muscular insertions, stressing upon

supporting structures. The importance of the bonding and gliding structures in the flexion-extension and automatic rotation movements was highlighted, as well as in the stabilization on the frontal and lateral plan and in the biomechanics of the femoral-patellar joint. The presentation of the joint surfaces, of the important structural elements of the joint capsule was accompanied by images. The main function of ligaments is that of limiting joint movements and implicitly that of articular stabilization, as well as the prevention of sub – contortions and contortions. In the sagittal plane, the balance of the body is created by a series of oscillations to the front and the back of the ideal position of the center of gravity vertical line. The anterior oscillation is more important, due to the long anterior leg lever; the posterior one is smaller, due to the short calcaneal lever. In the case of anterior oscillation, the posterior muscles (the triceps, the ischio-sural muscles, the hamstring, the great gluteus muscles, the paravertebral muscles) prevent the fall and in the case of posterior oscillation, the anterior ones (the extensors, the anterior sural muscles, the quadriceps, the abdominal muscles) will balance the body. Our balance is active and permanently makes use of the muscular strengths which neutralize the rotational effects of the gravity force.

The forces that stress the knee grow considerably when walking, running, and jumping. Apart from the body weight there appear additional loads, variable in every moment. In the dynamic balance of gait, the center of gravity will permanently have the tendency to cross the support basis, like a sort of fall to the front. On every step, the limb at the front – for braking – will remove the unbalance that the back limb – for take-off – has created on the body. In the frontal plan, the center of gravity moves with each step towards the supporting limb. Before the center of gravity reaches above the

supporting limb, the support changes on the other pelvic limb and the center of gravity moves again. It describes therefore some sort of sinusoidal curve between the successive support bases. As a consequence, the distance between the vertical drawn down from the center of gravity of the body and the mechanic ax of the supporting lower limb is higher when walking than when in one – leg support. The pusher arm of the force exercised by the body weight on the knee grows, determining an augmentation of the muscular strength which must balance the body weight and as a result, an increase of the tensions at the level of the joint surface.

1.3. Anatomico-physiological and biomechanical data of the hip

This subchapter concentrates on the elements that give the hip the particularities of supporting joint. Under usual biped conditions, the postural muscular contraction is present, a constant role in biped stability being played by the antagonist action of abductors and adductors, insisting on the mechanism of the abductors and their importance in the one-foot upright position (Balance of Pauwels).

1.4. Generalities regarding osteoarthritis

This subchapter makes a brief review of some aspects connected with the incidence, the pathological anatomy and the pathogenesis of joint modifications, of the diagnose criteria in gonarthrosis and coxarthrosis, of imagistic elements (supported by images) and of conservatory and surgical treatment.

2. PERSONAL CONTRIBUTIONS

2.1 The evaluation of balance and stability disorders due to long-term immobilization in the case of lower limb degenerative affections

The thesis tackles for the first time in Romanian research upon the vast thematic of the lower limb degenerative pathology and of the balance disorders induced by it, regardless of the treatment method, either conservatory or surgical, studying specific aspects and suggesting adequate therapeutic programs.

I have proven the importance and the efficiency of posturographic training in regaining balance and stability, functions deteriorated by the joint affection as such, as well as by the secondary privation of the mechanic system. The first two studies refer to **The evaluation of balance and stability disorders due to long-term immobilization in the case of lower limb degenerative affections** and take on to approach some aspects of the consequences of immobilization, secondary to chronic, degenerative diseases of the pelvic limb at bone, muscular and joint level, stressing upon coordination and balance.

These studies provide information about the pathogenesis of the sequelae following long-term immobilization, the complex methodology of the rehabilitation program, the duration and the efficiency of the treatment, particularities of the latter for various categories of patients.

The negative effects of long-term immobilization and the rest in bed have become the preoccupation of doctors within the last five decades. Before 1950, the rest in bed and the immobilization were used at a large

scale in the treatment of acute affections and of traumas. The invoked principle was that according to which immobilization favors the cicatrisation and the healing of various lesions. One used to ignore the unfavorable consequences of the lack of activity upon the healthy body parts.

The consequences of long-term immobilization are to be found at the level of more than one single apparatus or system. They are grouped under the name of deconditioning syndrome, defined as a decrease of the functional capacity of mainly the mioartrokinetic system, but also of the other apparatus and systems and they should be mentioned as a separate diagnosis than the initial affection which has led to the limitation of normal physical activity.

At the level of the locomotor apparatus, the immobilization disturbs the morphology and the functionality of all component structures. The articular cartilage which is immobilized denotes the modification between the matrix components and water, with a decrease of the tissue metabolism. The repercussions in the biomechanical plan refer to the reduction of the elasticity mode and of the shear mode, proof of the accentuation of the plastic component in the detriment of the elastic one, while diminishing the cartilage capacity of coping with mechanical stress.

The ligaments and the tendons deprived of the mechanic stimulus reduce their resistance to tendon-bone. The increase of the ligament compliance is expressed by the decrease in the maximum stress when the “collapse” occurs and in the capacity of energy absorption of the bone-ligament-bone complex. The values are situated at about a third from the control, for immobilizations of eight weeks. The deterioration speeds for the biomechanical properties of the ligaments have individual cellular, ultra-structural and biochemical characteristics.

The immobilization of the muscle is translated at macroscopic level by the reduction of the muscular mass, by the selective affectation of the muscular fibers of type I (with oxidative metabolism, slow contraction and with high resistance to fatigue). At histological level, one can detect a myopathy which is reversible on remobilization.

Biochemically speaking, we witness the alteration of the coupling mechanism between the excitation and the contraction (the reduction of the calcium intake in the endoplasmic reticulum and of its dissociation from the fiber proteins) which leads to an increase of the contraction force of the simple muscular contraction and to the displacement to the left of the force curve which is frequent for the titanic contraction, which is clinically translated by the early appearance of muscular fatigue.

Moreover, the immobilization in shortened position of the muscle determines a decrease of the post – hyper polarization, which does not happen in the case of the immobilization in elongated position.

These findings plead in favor of the hypothesis of the retrograde trophic influence of the muscular metabolism on the motor nerves. Therefore, the immobilization in the elongated position of the muscle attenuates the effects of inactivity and of the mass loss which occurs in the case of immobilization in shortened position.

The suffering of the mioartrokinetic apparatus in long term immobilizations is evident at all levels: muscles, tendons, ligaments, bone, central and peripheral nervous system (as for the storage, processing and elaboration of the motor information). It delays and prolongs the functional recovery of patients and their social reintegration.

At the present, the reduction of the immobilization period according to various acute affections is almost axiomatic. It can be found in the

therapeutic approach of acute cardiovascular, respiratory, neurologic, and orthopedic-traumatic events, etc.

The general objectives have followed the determination of the immobilization sequelae, secondary to the degenerative pathology of the pelvic limb, at the level of the mioartrokinetic system and most of all at the level of the balance and coordination functions and the establishment of a complex training program in view of the functional rehabilitation.

The subchapter will comprise a clinical-statistic, epidemiologic, randomized study and the conclusions will lead to the elaboration of a complex training program meant for the patients who suffer from coordination and balance deficits, which appeared both due to the articular affection as such and to the implicit immobilization.

The training program comprises a special section for the training of postural and balance control, functions modified due to immobilization. We made use of specific equipment, used both for the evaluation and for the training, the main component of which is an electronic platform capable to register the displacements of the center of gravity of the individual.

The primary objectives that were followed were the balance and coordination disorders, associated with the immobilization in patients who suffered arthroscopic interventions at the level of the knee joint for degenerative lesions. The evolution of such disorders varies depending on the type of training.

In terms of material and method we used clinical evaluation scales for balance and coordination and control equipment for human balance, ECHOM, produced by the National Institute for Research and Development in the field of Fine Mechanics with the following components: electronic

platform, detachable elastic support, calibration and display module, personal computer and specialized software.

With the help of this device we have obtained a series of parameters: balance parameters resulted from the tests on the vertical posture and the stability limits.

Each subject takes part in three balance tests, with duration of 20 seconds each, for the following test conditions: eyes open, rigid surface (OSDR); eyes closed, rigid surface (OISR); eyes open, elastic surface (ODSE); eyes closed, elastic surface (OISE).

The functioning principle of the device is the following: the patient stand vertically on the platform in a comfortable position, arms along the body. He/she looks at the computer display situated at about one meter from his/her eyes, where the center of gravity is marked as a red cross.

The start of the test is given with the TEST command from the display of the monitor, moment when the patient is invited to set his/her center of gravity at the intersection of the axis (X,Y) from the monitor, moving his/her legs so that the achieved position should be comfortable and perfectly vertical.

The EVALUATION command is followed by the registration of some curves which mark the oscillations of the center of gravity at point 0 from the intersection of the X and Y axis. The testing conditions are modified successively, OSDR, OISR, ODSE, OISE. Each time, one will follow, with the help of the TEST command, the centering of the red cross at point 0 of the axis intersection.

The balance parameters registered for each subject and the test conditions: the lateral libration amplitude, A_x ; the antero-posterior balance direction, A_y ; balance coefficient in antero-posterior direction, E_{ap} ; balance

coefficient in lateral direction, E_{sd} ; the lateral alignment of the center of gravity X_c ; the antero-posterior alignment of the center of gravity, Y_c .

The lateral libration amplitude, A_x (mm), defines the displacement of the center of gravity in lateral direction, calculated from the following difference:

$$A_x = X_{\max} - X_{\min}$$

Where:

X_{\max} = the maximum displacement of the center of gravity in lateral direction

X_{\min} = the minimum displacement of the center of gravity in lateral direction

The libration amplitude in antero-posterior direction, A_y (mm), represents the displacement of the center of gravity in antero-posterior direction, defined as the difference:

$$A_y = Y_{\max} - Y_{\min}$$

Where:

Y_{\max} = the maximum displacement of the center of gravity in antero-posterior direction

Y_{\min} = the minimum displacement of the center of gravity in antero-posterior direction

Both parameters were studied on groups of healthy patients for which a database was created. The values were registered in tables and compared to those from the specialty literature and the values obtained from the analyzed patients were reported to the reference values from the tables. We have obtained a parameter (percentage value) named the relation between the present libration amplitude in antero-posterior direction or between the lateral one and the reference amplitude, marked RA_x , respectively RA_y . In

conformity with the studies performed within the frame of the equipment homologation and other specialty research, we have considered as normal results the ones over 90 (meaning the relation between the actual value and the table value is higher than 90%).

The evolutions were assessed with the Tinetti scales for stability and gait.

The Tinetti scale for balance comprises 8 categories, marked according to table 2, with a total score between a minimum number of 0 points and a maximum number of 14 points.

From the balance parameters we have established significant evolutions for the libration amplitude and for the balance coefficients. For the parameter “the alignment of the center of gravity” we did not register significant evolutions.

The libration amplitudes and the balance coefficients are better at the patients of group A, as one can see from Chart 19. We can establish a positive evolution for all testing situations. There is even a particularity: the conditions which require open eyes, meaning adequate visual information have the least improvement.

Conclusions

It is a known fact that advanced gonarthrosis benefits largely from surgical treatment, the techniques are more and more diverse, starting from macroscopic surgery and go up to microscopic and endoscopic techniques; the risks and the benefits of each surgical method are known, as well as their long term consequences.

Kuukanen and Malkia, in the year 2000, have identified balance disorders in patients suffering from chronic gonarthrosis, determined by the disparagement of the proprioceptive inputs having as a starting point the local mioartrokinetic structures. There are no studies at the present, in the

specialty literature, dealing with the possible balance disorders in patients operated for gonarthrosis in advanced stages.

The attitude after the operation towards the patient who underwent a surgical intervention at the knee level has varied quite a lot throughout the time. Initially, the studies used to recommend rest for 1-3 weeks, at the present one estimates a rest period of about 3-7 days after the surgery, and after that the patient is integrated in an adequate rehabilitation program.

Immobilization before and after surgery, as well as balance and coordination disorders in patients operated for gonarthrosis was not pursued in any study in the specialty literature. I have considered this approach necessary, since, even though at intuitive level it is natural to recommend an early program of active kinetotherapy, we need a type of medicine based on proof in order to argue for every therapeutic stage.

The present study follows in the first part a group of patients who are on their seventh day after the surgical intervention. The immobilization has disastrous consequences on their balance, quantified with the help of some simple clinical tests, but also with the help of posturography, which is a complex analysis method, offering two types of parameters. The first category of parameters characterize balance in orthostatism under various test conditions, the second category characterizes the stability of the individual, defining the limits of stability for several directions. All these parameters degraded significantly after only 7 days of immobilization.

2.2. CLINICAL STUDY REGARDING THE RE-EDUCATION PROTOCOL IN GONARTHROSIS BY MEANS OF THE POSTUROGRAPHIC METHOD

The second part of the study dealt exclusively with immobilized patients and tried to establish an efficient and rapid rehabilitation program in the sense of balance and stability. The immobilized patients underwent a program of classic kinetotherapy; some of them also took part in parallel fixed posturographic training program, of the bio- feedback type, organized with the help of the ECHOM device platform. The evaluation of the two groups of patients after 7 days has indicated significant increase of the clinical and paraclinical parameters which define balance.

Moreover, the group which underwent the posturographic training in parallel registers clearly higher performance than the group with classic kinetotherapy. As a consequence, the rehabilitation of balance and stability which were deteriorated due to immobilization requires a complex approach, in the sense of the most rapid and most efficient rehabilitation of individual abilities. This approach entangles the design of a combined program, using various methodologies, in order to prevent all unwanted effects of immobilization. The rehabilitation of the postural abilities of the individual is granted by the kinetotherapy program which also serves the other purposes (the recovery of muscular strength, of joint amplitudes, etc.) and also by a training which is specific to posture and stability.

For this specific training, of the bio – feedback type, I have elaborated a rehabilitation protocol, following all stages for the realization of the motor control which are described at the end of the paper. This protocol represents a personal contribution to the general rehabilitation program for the patient suffering from arthrosis.

The results of the present study indicate that immobilization affects all structures and functions of the locomotor apparatus, being responsible for a multitude of malfunctions. As a consequence, the rehabilitation program must be adapted so that, on the one hand, it should be implemented early in order to prevent the occurrence of the known malfunctions, and on the other hand, it should treat in a specific and unitary manner the diagnosed disorders. Within the rehabilitation programs, the posturographic training must be present, as a specific reeducation method for postural control. The value of this method resides in the use of the platform both for tests and for treatment.

2.3. CLINICAL STUDY: THE POSTUROGRAPHIC ANALYSIS OF THE CENTER OF GRAVITY IN PATIENTS WITH COXARTHROSIS

The present study analyzes the projection of the center of gravity within the support polygon and the distribution of the body weight on the lower limbs, as a comparison between two groups of subjects. For group A, the evaluation was of the one-time type and for group B the evaluation was performed before the operation. So, one will analyze the load and stress degree at the level of the hip joints before the operation, following that an identical analysis will be performed after the operation within the same group of study.

In this respect, one made use of the stabilometric platform GPS400 which, by means of the pressure sensors tests the repartition of the body weight on the lower limbs and analyzes at the same time the oscillations which appear during the orthostatic position.

The principle of the stabilometric method is the analysis of the variation of the center of gravity in orthostatic position. The postural evaluation is performed for the purpose of the diagnosis of the deviations of mechanical loads at hip level, of the efficiency of the surgical intervention and of the rehabilitation programs. A prospective study was performed on a total number of 21 healthy persons who did not present any problems at the level of the hip joints or at the level of the lower limbs and on 17 patients who were diagnosed with coxarthrosis and had recommendation for total hip arthroplasty.

The closer the center of gravity is to the support basis; the balance of the human body is more stable and is projected closer to the center of the support polygon. In order to achieve stable balance, one must also take into account the contribution of the atmospheric pressure, “as a passive stabilizing factor”, the way it was demonstrated by the Weber brothers. Some of the affections at the level of the coxo-femoral joints can influence the way in which weight is distributed at the level of the lower limbs, respectively, the projection of the center of gravity in the support polygon.

In the view of the specialists, within normal gait, the total weight of the hip joint reaches the relation of $2 \frac{1}{2}$ to the body weight. To the extent to which the body line approaches the center of the hip joint, the force component due to the action of the abductor mechanism decreases, with a corresponding reduction towards the force applied to the acetabule, the head and the femoral neck. According to Zeman, one takes into consideration three loads associated to the three critical cases in a gait cycle: support on the heel (I), total support on the limb (II), the unfolding of the toes (III).

Postural evaluation is performed for the purpose of the diagnosis of mechanical load deviations at hip levels, for the purpose of the surgical intervention efficiency and that of the rehabilitation programs. The evaluation was performed for a preset duration of 30 seconds and the parameters determined as the displacement polygon of the barycenter (Chart 1), oscillographic (Chart 2), by the representation of the oscillation frequency (Chart 3) and by the mathematic elaboration of these data were the following: the number of registrations; the medium frontal and sagittal deviations; the length of the curve followed by the center of gravity within the test time interval; the surface of the projection of the center of gravity for 90% trust interval (obtained by the elimination of 10% of its extreme variations); the medium speed of the variation of the center of gravity; the frequency of the oscillations of the center of gravity; the frequency of the fundamental harmonic oscillations of the Fourier type, both left-right and antero-posterior.

So, the regular and complete biomechanical analysis at the level of the hip joint can bring additional information in the case of the complex pre-surgical review, contributing this way to the establishment of the future therapeutic conduct.

The analysis of the center of gravity on patients with total hip arthroplasty indication is necessary even from the pre-surgical period in order to determine the joint load degree at the level of the coxo-femoral joints and to establish the static stereotype, and then the dynamic one of the patient's orthostatic position. This way one can conceive complex rehabilitation programs in view of the correction of the orthostatic or dynamic stereotype, learned throughout time.

The presence of pain at the level of the affected hip leads most frequently to the learning of some habits and of a static and dynamic stereotype that is wring, moving in a reflex way the body weight on the healthy lower limb, overstressing this way the healthy joint.

The asymmetric stress due to the wrong positioning of the center of gravity can lead to the impairment of the healthy joint or the acceleration of the wearing out of the endoprosthesis.

The study of posture helps in view of a better understanding of the mechanism which generates articular stress, pain and discomfort which finally lead to the modification of gait.

This way, one has concluded that the deviation of the center of gravity in frontal plan is higher in patients who present pain at the level of the coxo-femoral joint than in patients not suffering from these affections. The complex and correct functional reeducation must also have in view the postural reeducation by means of the barycenter analysis and the reestablishment of a correct biomechanical balance at the level of the basin.

2.4. The kinetoprofilaxy program intended for postural amelioration

The present subchapter deals with the problematic of specific training, knowing the fact that balance disorders influence in a negative manner the quality of life. In order to fight this back, it is necessary to implement a complex program for the rehabilitation of balance. The early implementation of some treatments like movement or physiotherapy can improve balance.

Treatment, in general, corresponds to the disease in which the balance disorder appears. Medical praxis has proven that balance loss can be at least partially (if not totally) recovered in most situations with the help of

adequate training. Trainings are performed both on stable and unstable surface. The exercises are adjusted, varying the height of the center of gravity (the closer to the support surface, the better the determined balance).

The recovery of the body balance and of the movements remains an objective which is necessary in the kinetotherapy treatment. Kinetotherapy is recognized by the typology of the balance recovery exercises. Making use of characteristic techniques and procedures, the kinetotherapeutic treatment succeeds to improve both the static balance and the dynamic one. The introduction of special physical exercises within the rehabilitation program is performed according to the type of the affection which led to the balance disorders.

A valuable technique in the affections where the balance disorders are minor is represented by the unbalancing of the body from some postures, which will trigger known rebalancing and stabilization reactions.

The balancing reflexes are very important reflexes in the performance of posture and locomotion that is they maintain the body's center of gravity within the support surface. The unbalancing must not be done in a rapid way, but gradually, in order to allow the wanted reactions to appear. As a continuation of the kinetotherapeutic treatment, there is also the physiotherapeutic one with a multitude of procedures together with medical massage (characteristic is its progressiveness and its performance according to the age; the program is constituted by 6 groups of 5 exercises; from the point of view of the load, each exercise group is performed in four stages D – B – C – A, each having three levels of difficulty).

Before a subject starts undergoing a kinetoprophylactic program, which will trigger a significant improvement of the anatomo-functional state of his/her locomotor apparatus, it is recommended to perform a test on this apparatus.

It is a global test which allows the physio-kinetotherapeut to asses and to form his work groups, proving at the same time to the tested subjects that, even though they are healthy, they do present important deficits of the MNAK apparatus; at the same time, a preliminary global test allows both the physio-kinetotherapeut and the patients to asses and even quantify the progress achieved thereafter.

2.5. THE RE-EDUCATION OF BALANCE AND GAIT IN PATIENTS SUFFERING FROM DEGENERATIVE AFFECTIONS OF THE LOWER LIMB

This subchapter started from the idea that balance while standing and gait are the most affected functions in the initial stages of the lower limb arthrosis. Kinetotherapy can play a major part in the reeducation of these affections, representing together with the medicine treatment a *sine qua non* condition for a better life for these patients. It was considered that one of the most important aspects of the kinetotherapy programs is represented by the dosage of exercises, taking into account that fatigue can be a negative factor in the rehabilitation of the persons suffering from degenerative affections of the lower limb.

We made use of the Berg test to evaluate balance, as well as of the test Up and Go clocked up, considering that these are among the ones mostly used at world level, and also of the Lequesne algofunctional index for the lower limb arthrosis.

In this study we have set forth from the assumption that in the incipient stages of the lower limb arthrosis, a rigorous kinetotherapy program, with individualized dosage which is performed daily can have pregnant benefic effects in the amelioration of body balance and of gait in persons suffering from degenerative affection in stages 1 and 2 on the

Lequesne scale, materialized in the increase of the score obtained on the Berg scale, as well as the decrease of the number of seconds necessary for the Timed Up and Go test (timed Rise and Walk).

The results obtained confirm the hypothesis that was the starting point and demonstrates implicitly the efficiency of the kinetic treatment focused on the reeducation of body balance and gait, being especially important in the prevention of falls.

Therefore, we believe that the test "Rise and walk" highlights in a clearer way the results obtained, by reducing the duration of the test performed under secure conditions.

We find that the kinetotherapy programs implemented early in the treatment of a person suffering from degenerative affections of the lower limbs can help him/ her find the necessary resources to cope with the disease within the first 2 stages according to the Lequesne scale.