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## THE EFFECTS OF PHYSICAL THERAPY IN IMPROVING SYMPTOMS IN PATIENTS WITH COXARTHROSIS

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### Abstract

*Aim.* Rheumatic diseases due to their frequency, polymorphism and involvement in the daily life of the patient, as well as the influence on the social status of the patient, require much greater attention from all those who deal with their treatment (kinetic recovery in rheumatology), these having a percentage high morbidity. Coxarthrosis is a current problem of the elderly, but more recently it also affects people of the second age, impairing their mobility.

The purpose of the research is to discover the effectiveness of physical exercises in improving symptoms in patients diagnosed with coxarthrosis. For this, several secondary objectives were established, such as: combating hip pain, regaining joint mobility, increasing muscle strength and improving functional independence.

*Materials and methods.* The study was conducted with a sample of five patients, four female and one male, with an average age of 63. The research was carried out on the basis of measurements on joint mobility and muscle strength, but also on the basis of a questionnaire on the ease of practicing daily activities by the patients.

*Results.* Regarding the evolution of muscle strength regarding hip flexion and extension movements, a slight increase in muscle strength is observed in the case of both movements. The higher values of the standard deviations recorded at the final assessment demonstrate the decrease in group homogeneity due to the more pronounced increase in muscle strength in the case of two patients, respectively the less obvious increase in muscle strength in the case of the other three subjects. At the same time, a more obvious increase in muscle strength can be observed regarding the flexion movement compared to the extension movement, respectively a better evolution of the muscle strength can be observed regarding the right hip compared to the left one.

*Conclusions.* For 80% of the patients, the applied program was beneficial from the point of view of joint mobility, only one patient did not respond positively to the program due to associated conditions, the situation being similar in the case of muscle strength. Progress was also noted in terms of the functionality of the subjects in practicing daily activities, but these observations are subjective, being ascertained based on the answers given by the patients to the questions in the questionnaire.

*Keywords:* physical therapy, coxarthrosis, pain.

### Introduction

Rheumatic diseases due to their frequency, polymorphism and involvement in the daily life of the patient, as well as the influence on the social status of the patient, require much greater attention from all those who deal with their treatment (kinetic recovery in rheumatology), these having a percentage high morbidity. (Leonida, 1963). The term rheumatism has long been used to define joint (wrist) disease. This generic meaning is imprecise, because there are other conditions (suppurations, tumors, trauma) that are not rheumatic diseases.

Rheumatism, in addition to the inflammatory character, also has a degenerative character, the result of age wear or improper nutrition of some parts of the joint. This condition of joint wear and tear occurs to a greater or lesser extent in each person with age, but only in part it manifests itself as a disease. From what was said above, it is clear that the disease is progressive (it generally appears after 40 years), affecting heavily loaded joints (knee, hip, spine). Another factor, apart from age, affects women who have reached menopause, the ovary during menstruation had a very important role in the protection of the joints.

Coxarthrosis is a pathological entity with high incidence that affects 2-4% of the adult population between 40 and 70 years old, reaching 10% over the age of 70. In 40% of cases it is bilateral, with a gap of months or years between the clinical expression on one side and the other. This disease is characterized by two fundamental aspects: on the one hand, the increase in joint tension due to mechanical causes (excessive loading, architectural, congenital or acquired defects), on the other hand, the alteration of the cartilaginous tissue that leads to the development of arthrosis; secondary cartilage changes are metabolic, infectious or inflammatory (Kiss, 1999).

From the point of view of gender and age, it was proven in a study that men of the second age who are involved in agricultural activities have a higher risk of developing a pronounced wear and tear of the hip joint that, over time, evolves

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through the appearance coxarthrosis. The study was conducted with approximately 1300 men from the Swedish city of Malmo, aged between 45-65 years, and 500 of them being farmers. (Axmacher & Lindberg, 1993).

Current treatment strategies for rheumatic and joint diseases are symptomatic and do not limit disease progression. Research should be directed towards therapeutic modalities that target the osteoarticular structural elements and therefore delay the progression of the disease and the need for the use of joint prostheses. (Fusco et. al., 2017).

### Objectives

The main objective of this study is to assess the effectiveness of exercise in rheumatic hip recovery. Secondary objectives include: combating hip pain, regaining joint mobility, increasing muscle strength, but also improving functional independence.

### Methods

In the present article, a number of five patients were included, four people being female and one patient being male. Their average age is around 63 years, with the youngest patient being 48 years old and the oldest being 74 years old. It should be mentioned that three patients are retired, their daily activity being represented by housework, one of the patients is a former handball player at the performance level and currently an accountant, and the other patient is a construction engineer, the working conditions favoring the appearance muscle imbalances that favor and accelerate the deterioration of the coxofemoral joints. The patients chosen for this study are not exercisers. The study ran for six months, including initial and final assessments, as well as the exercise plan.

Table1. General characteristics of the patients

Parameters	Arithmetic mean	Standard deviation
Age (years)	63	13,34
Hight (cm)	171,4	9,07
Weight (kg)	83,8	17,15
BMI	28,5	5,46

The main objectives pursued by applying the exercises included in the kinetic plan are: reducing pain in the hip joints, especially in dynamics, restoring muscle strength, increasing muscle resistance, improving joint mobility and regaining balance. These objectives were achieved by applying a kinetic program carried out over a period of approximately six months, during which the patients performed exercises in the first two months without means of hindering movement, the aim being to improve joint mobility, and in the last three months, the treatment program also aimed at increasing muscle strength through resistance exercises. Exercises were performed to mobilize the hip joint, with the help of the intervention of the physiotherapist, active exercises with a role in increasing joint mobility and resistance exercises for muscle toning. Joint mobility testing

Joint mobility represents its ability to mobilize in all amplitude and in all axes and directions of movement, considered normal, allowed in a certain joint. Both amplitude and joint mobility are ensured by the anatomical and functional integrity of joint elements, such as bone epiphyses, joint capsule, synovial capsule, ligaments and the presence of synovial fluid in sufficient quantity. (Tarcău & Chiriac, 2015).

### Muscle strength testing

Muscle testing is a method of objective or subjective examination, when manual evaluation of the neuro-myo-arthrokinetic apparatus is used and is used to determine the degree of muscle strength. (Tarcău, Chiriac, 2015).

#### The walking test

The "Get up and go" test was used to evaluate walking. It is usually a test that is used in neurologically affected patients, but it can also be used in the case of rheumatic diseases of the locomotor system. The patient's gait can be scored using a six-level scale ranging from 0-5: value 0 – normal walking; value 1 – slight limp; value 2 – medium limping gait; value 3 – obvious limping; value 4 – walking with aids; value 5 – walking impossible.

In this test, the subjects were asked to stand up from a chair and move linearly for a distance of about ten meters. Their gait was studied and quantified according to the scores shown above.

#### The friction test

It is also called the Scour Test and determines the irritability of the hip joint. It is performed with the patient in the supine position while the examiner flexes and adducts the hip until there is resistance to the movement, where he performs an internal rotation and an external rotation, then the patient's lower limb is taken into abduction, where the movements of rotation. If the patient does not complain of pain, the test is repeated applying an additional compression of the hip, by pushing into the long axis of the femur. The patient is asked to rate the level of pain during the test on a scale from 0-10. On re-evaluation, an improvement in the physical condition of the hip is appreciated if there is a difference of at least two points. (Chiriac, 2010).

### Trendelenburg test

It indicates an impairment of the osteo-muscular stability of the hip. Normally, in unipodalism, the gluteus medius, gluteus minimus, and tensor fascia lata muscles contract with a force that lifts the pelvis to the opposite side to maintain hip fixation. If there is an impairment of the strength of these muscles or of the femur-pelvis lever mechanism, the weight of the body will cause the pelvis on the side of the raised lower limb to descend. This test is also positive in congenital dislocation, destruction of the femoral head, femoral neck fractures or severe degrees of coxa vara. In all variations of this test, the patient will have a characteristic stooped gait. There are three grades of this test divided as follows: grade I means a slight deviation, tilting to the opposite side in unipodal, but without significant tilting of the pelvis, and with prolonged walking lameness occurs due to fatigue; grade II means tilting of the pelvis in unipod, and grade III is characterized by the accentuated tilt of the pelvis in unipod, and the center of gravity shifts outside the support surface or the patient cannot stand in unipod support. (Chiriac, 2010).

### Lequesne scale

This evaluation method consists of three questionnaires regarding the patient's usual activities, pain and discomfort, respectively the maximum walking distance, and the assessment of the severity of the disease is done by means of a score. There are five levels of appreciation, each level represented by a score. The value 0 indicates a good functionality of the patient, so that he does not encounter difficulties in carrying out the activity, and the value 2 records the impossibility of the patient to carry out the respective activity, these interpretations being valid for the usual activities (ADL). Regarding pain and discomfort, there are three levels of interpretation of its intensity, with values ranging from 0-2. From the point of view of the maximum walking distance, there are six degrees of appreciation of the severity of this condition. (Chiriac, 2010).

### Color Luscher test

It is a projective and verbal chromatic test made by Professor Max Luscher. With the help of this test, based on the selection in order of the preference of a set of colors, an adequate knowledge of personality traits can be conceived. The deep relationship between color and man, embodied through a hierarchy of chromatic preferences, provides important information about the complexity of the human self. The author argued that subjects who select identical color combinations have relatively similar personalities. (Picco & Dzindolet, 1994).

The results regarding the assessment of joint mobility are represented in the tables below, by means of comparisons between the arithmetic means and the initial and final standard deviations, expressed in degrees.

Table 2. Joint mobility values for hip flexion and extension

Parameters	Flexion right hip	Flexion left hip	Extension right hip	Extension right hip
Arithmetic mean				
Initial Evaluation	60,8 °	63,6 °	13,4 °	17,2 °
Standard deviation				
Initial evaluation	31,48 °	31,42 °	7,7 °	6,41 °
Arithmetic mean	64,2 °	66,6 °	15,6 °	19,2 °
Final Evaluation				
Standard deviation				
Final evaluation	33,71 °	33,61 °	8,67 °	8,52 °

Table 2 shows better mobility of the left hip in terms of flexion and extension movements. The high standard deviations in flexion movement show the low homogeneity of the study group, a fact explained by the large differences between patients in terms of general characteristics and associated diseases.

Table 3. Joint mobility values regarding hip abduction and adduction

Parameters	Abduction right hip	Abduction left hip	Adduct hip ion right	Adduction left hip
Arithmetic mean				
Initial Evaluation	21,4 °	27 °	9,6 °	11,6 °
Standard deviation				
Initial evaluation	10,57 °	10,58 °	4,72 °	4,72 °
Arithmetic mean	24,4 °	29,8 °	11 °	14 °
Final Evaluation				
Standard deviation				
Final evaluation	11,43 °	11,92 °	5,38 °	6,04 °

Table 3 shows an increased joint mobility of the left hip, the reference being made to abduction and adduction movements. In this situation too, increased values of the standard deviations are found, especially regarding the abduction movement.

Table 4. Joint mobility values regarding internal rotation and external rotation of the hip

Parameters	Internal rotation right hip	Internal rotation left hip	External rotation right hip	External rotation left hip
Arithmetic mean				
Initial Evaluation	12,8 °	18,2 °	15 °	16,8 °
Standard deviation				
Initial evaluation	5,44 °	11,03 °	4,69 °	7,12 °
Arithmetic mean				
Final Evaluation	14,6 °	20,2 °	17,4 °	18,8 °
Standard deviation				
Final evaluation	7,23 °	12,79 °	6,91 °	8,61 °

According to Table 4, there is again an increase in joint mobility for the left hip in both internal and external rotation. In this situation, the values of the standard deviations are lower, signifying a greater homogeneity of the study group, resulting in a more severe impairment of the hip in terms of the two mentioned movements.

The results regarding the assessment of muscle strength are represented in the tables below, by means of comparisons between the arithmetic means and the initial and final standard deviations, expressed in Kp

Table 5. Evolution of muscle strength regarding hip flexion and extension

Parameters	Right hip flexion	Left hip flexion	Right hip extension	Left hip extension
Arithmetic mean	7,37 Kp	7,60 Kp	5,08 Kp	4,49 Kp
Initial Evaluation				
Standard deviation	2,07 Kp	3,21 Kp	2,61 Kp	3,05 Kp
Initial evaluation				
Arithmetic mean	7,52 Kp	8,04 Kp	9,47 Kp	9,99 Kp
Final Evaluation				
Standard deviation	2,15 Kp	3,47 Kp	3,17 Kp	3,58 Kp
Final evaluation				

Regarding the evolution of muscle strength regarding hip flexion and extension movements, a slight increase in muscle strength is observed in the case of both movements. The higher values of the standard deviations recorded at the final assessment demonstrate the decrease in group homogeneity due to the more pronounced increase in muscle strength in the case of two patients, respectively the less obvious increase in muscle strength in the case of the other three subjects. At the same time, a more obvious increase in muscle strength can be observed regarding the flexion movement compared to the extension movement, respectively a better evolution of the muscle strength can be observed regarding the right hip compared to the left one.

Table 6. Evolution of muscle strength regarding hip abduction and adduction

Parameters	Abduction right hip	Abduction left hip	Adduction right hip	Adduction left hip
Arithmetic mean	7,06 Kp	7,5 Kp	6,29 Kp	6,35 Kp
Initial Evaluation				
Standard deviation	1,87 Kp	1,73 Kp	1,25 Kp	1,85 Kp
Initial evaluation				
Arithmetic mean	7,83 Kp	8,02 Kp	6,88 Kp	6,74 Kp
Final Evaluation				
Standard deviation	1,95 Kp	1,82 Kp	1,32 Kp	1,97 Kp
Final evaluation				

Regarding the evolution of muscle strength regarding hip abduction and adduction movements, a slight increase in muscle strength is observed in the case of both movements. The higher values of the standard deviations recorded at the final evaluation demonstrate the decrease in group homogeneity due to the more pronounced increase in muscle strength in the case of two patients, respectively the less obvious increase in muscle strength in the case of the other three subjects. At the same time, there is a more obvious increase in muscle strength regarding the abduction movement compared to the adduction movement, respectively a better evolution of the muscle strength can be observed regarding the left hip compared to the right one.

Table 7. Evolution of muscle strength regarding internal rotation and external rotation of the hip

Parameters	Internal rotation right hip	Internal rotation left hip	External rotation right hip	External rotation left hip
Arithmetic mean Initial Evaluation	5,02 Kp	5,10 Kp	4,27 Kp	4,16
Standard deviation Initial evaluation	1,01 Kp	0,88 Kp	1,02 Kp	0,78 Kp
Arithmetic mean Final Evaluation	5,53 Kp	5,68 Kp	4,56 Kp	4,34 Kp
Standard deviation Final evaluation	1,07 Kp	0,93 Kp	1,09 Kp	0,84 Kp

Looking at the evolution of muscle strength for hip internal rotation and external rotation movements, a slight increase in muscle strength is observed for both movements. The higher values of the standard deviations recorded at the final evaluation demonstrate the decrease in group homogeneity due to the more pronounced increase in muscle strength in the case of two patients, respectively the less obvious increase in muscle strength in the case of the other three subjects. At the same time, there is a more obvious increase in muscle strength regarding the internal rotation movement compared to the external rotation, respectively a better evolution of the muscle strength regarding the left hip can be observed for the external rotation movement compared to the right one, respectively a better development of right hip muscle strength for internal rotation movement.

The gait test results were quantified in the table below by means of arithmetic means and standard deviations recorded at the two assessments. These averages were made based on the qualifications given to each patient.

Table 8. Evolution of patients' gait

Parameters	Values
Arithmetic mean initial evaluation	2,4
Standard deviation initial evaluation	1,14
Arithmetic mean final evaluation	2
Standard deviation final evaluation	1,22

Looking at the arithmetic averages of the qualifications obtained by the patients, a decrease is observed, meaning a slight improvement in the quality of walking. The increase in the standard deviation shows the difference between the evolution of patients with a better state of health compared to those whose evolution of the disease is more accentuated, and the effects of associated diseases are more present. Therefore, the initial average obtained after the evaluation is rated with the value of 2.4, and in the end this value is 2, this value is interpreted as "average limp". Speaking of standard deviations, it is understood from the table shown above that in the end the differences between the values obtained by the subjects are larger, so the final standard deviation is 1.22.

Table 9. Evolution of scores regarding the friction test

Parameters	Values
Arithmetic mean initial evaluation	7,2
Arithmetic mean final evaluation	1,48
Standard deviation initial evaluation	5,8
Standard deviation final evaluation	1,92

Table 9 highlights the level of pain felt by the subjects at the level of the hip joint. The initial arithmetic mean shows a high level of pain 7,2, suggesting severe joint damage. The final arithmetic mean shows an evolution of the patients' health the value being 5.8 and demonstrates the effectiveness of the exercises applied to them, reducing the level of pain.

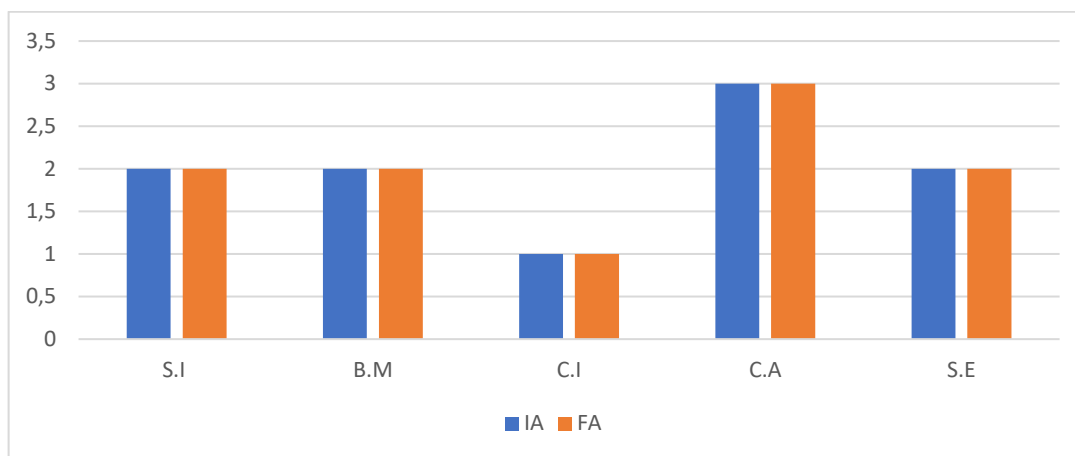


Figure 1. Trendelenburg test

Analyzing the chart above, it can be seen that there was no improvement in the group in terms of the degree of joint damage. No new values are recorded, because coxarthrosis is a degenerative condition, therefore the degree identified at the initial assessment can only degenerate, otherwise no lower scores were quantified in any of the 5 subjects, therefore the pelvis inclination remains the same in each of the study participants. So the first subject falls into degree I, which means that the inclination of the pelvis is insignificant, regarding the second, third and fifth subjects the degree of inclination of the pelvis is II, resulting in the fact that they have an inclined pelvis, and the the fourth subject shown in the figure above falls under grade III, meaning that the basin is characterized by a pronounced slope.

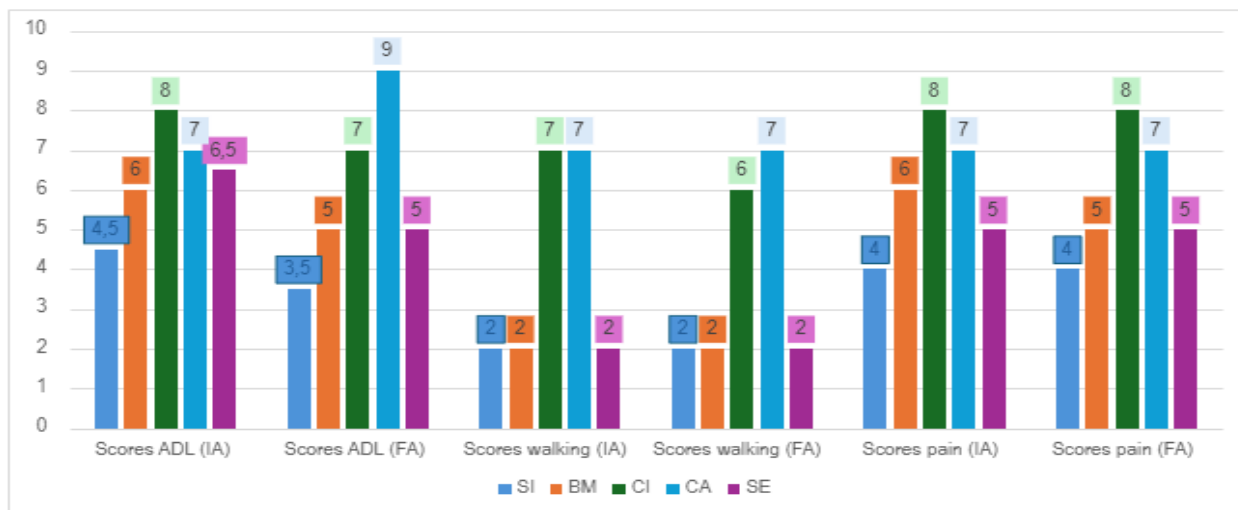


Figure 2. Lequesne scale

In the previously attached figure, the initial and final values of the Lequesne scale are shown in order to be able to observe the improvements in the state of health, but also their degradations. Taking each subject separately, new values can be observed, but also constant values, so that, in the case of the first subject mentioned in the diagram, an increase of one point is highlighted in the case of activities in the sphere of ADL and a constant score in the case of the assessment of walking and of pain. Therefore, the ability to carry out daily activities is initially evaluated with a score of 4.5, which means that the patient in question can carry out his daily activities with moderate discomfort. Regarding the initial and final evaluation of the gait, the grade received by him is 2. Also, the assessment of pain remains marked with grade 4 in both assessments. A second subject out of the 5 evaluated shows an improvement of 1 point in ADL, finally obtaining a score of 5, and the pain remains scored as 2. In terms of walking, the score obtained is 2, both initially and in final. The third subject initially obtains a grade of 7 evaluating the possibility of carrying out daily activities, and in the end the grade improves by one point. In addition, walking also gets a better grade than the initial one, but evaluating the pain, the

grade remains 8 even when the final evaluation is done. Following the fourth topic in the diagram, it can be seen that the final score received on the ADL scale is two points higher, which means that daily activities are much more difficult to achieve than during the first assessment. Gait is graded 7, both initially and finally, denoting that it is performed with great discomfort. Looking at the scores obtained in the pain assessment, it can be seen that they remain identical.

The last subject registers improvements, the final grade obtained in the ADL is 5, the pain is low, but it is observed that it is constant and remains the same, and walking does not get improvements either.

Therefore, this test helped to understand the functionality of the hip and to identify the remaining functional in terms of mobility of each of the 5; on the other hand this questionnaire helped to make the exercise program.

The effect of physical exercises in increasing the functionality of the hip joint can be seen by the final results contained in the Lequesne scale, these results being supported by another study, which was carried out in Japan, with 353 female patients aged two and third. These were divided into two categories, those who practice physical exercises regularly and those who practice physical exercises occasionally. (Kondo et. al., 2017). Patients who exercised regularly showed better hip functionality, especially with regard to walking and stair climbing, thus it has been shown that the functionality of the joint can be improved even at older ages.

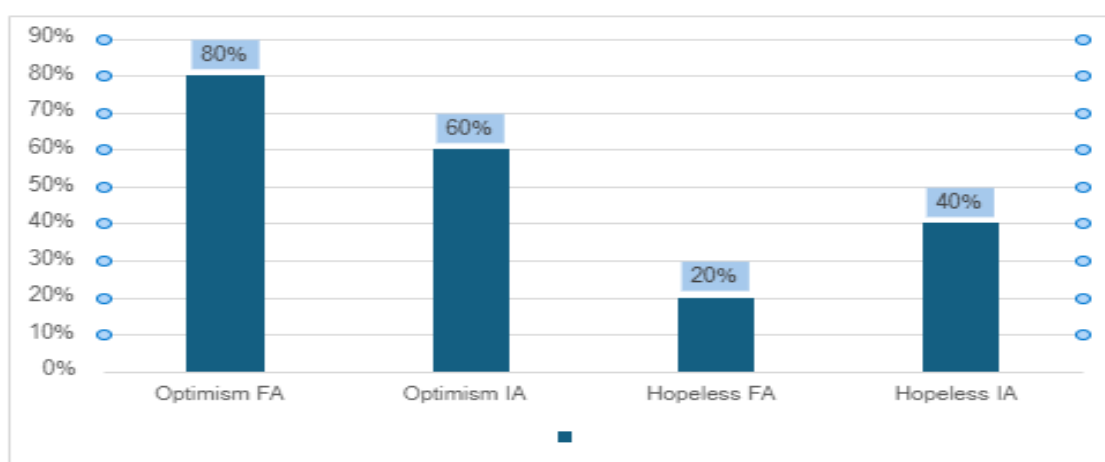


Figure 3. Color Luscher test

From Figure 3, improvements can also be seen in the mood of the subjects; so that in the case of 4 subjects the effects of the kinetic plan also had a positive effect on mental states, and in the case of one subject the new percentages do not bring changes, her state still remaining one of discomfort and self-doubt. In the case of this topic, it can be said that the hip impairment is intertwined with many other impairments, and all of these make self-confidence to be substantially low. Therefore, in the final evaluation, colors such as: blue, bright yellow, orange red were chosen, these being colors that bring peace, confidence and a lot of desire to get well, however black was also chosen, a color that according to the test conveys feelings of riot and tension.

### Discussions

The effect of physical exercises in increasing the functionality of the hip joint can be seen by the final results contained in the Lequesne scale, these results being supported by another study, "which was carried out in Japan, with 353 female patients of the second age as subjects and the third. These were divided into two categories, those who practice physical exercises regularly and those who practice physical exercises occasionally. Patients who exercised regularly showed better hip functionality, especially with regard to walking and climbing stairs, thus it has been shown that the functionality of the joint can be improved even at older ages." (Kondo et. al., 2017)

The results obtained were compared with those calculated in another study, to evaluate the effect of the exercises used, especially the mobilization with movement of the hip joint. From the two studies, it appears that "mobilization with movement increases the range of motion and reduces pain, 64 with increases in joint mobility for hip flexion and internal rotation movements and functional test values being improved." (Beselga et.al. 2016)

### Conclusions

In conclusion, considering the data presented in this paper through the tests and the results obtained within them, some conclusions can be presented regarding the evolution of the patients' functionality.

1.First of all, from the point of view of joint mobility, increases in the range of motion are observed for most patients, only one of the patients still has a deficit of joint mobility due to associated diseases. The developments regarding this parameter highlight the relatively small differences between the values measured at the two evaluations, respectively



initial and final, one of the explanations being the degenerative and irreversible aspect of the disease, which can only be improved without the possibility of being fully treated.

2. The effectiveness of the kinetic program can be seen by the ease with which the subjects perform the movements, so that, despite the fact that the final values regarding joint mobility do not exceed the initial ones by much.

3. Muscle strength, slight increases are also observed compared to the beginning of the study, the explanation being similar to that of the evolution of joint mobility. Compared to the functionality of the tested group, improvements were observed in terms of performing some activities in the sphere of ADLs that increase their quality of life. These findings are rather subjective, as the scores for each activity were given based on the answers given to the patients. The only objectively evaluated parameter is the gait that shows improvement, by reducing lameness and increasing step fluency.

4. In addition to improving the functions of the hip joint, a better emotional comfort is observed, characterized by optimism, acquired as a result of the ease with which patients carry out daily activities.

5. At the same time, the emotional comfort gained by them is also fueled by the pleasant way of carrying out the kinetic program and the pleasant collaboration between the patients and the instructor.

In conclusion, the assessments and kinetic plan were found to be effective for the patients participating in this study. However, it is noted that one of the patients did not respond to the applied program, given the fact that her general health condition did not allow a useful development of the recovery program. Further, the applied kinetic program remains a success, because 80% of the subjects of this study reacted in a positive way to the whole complex of exercises, therefore it is found that the hypothesis is confirmed.

### References

- Axmacher, B.; Lindberg, H. (1993). Coxarthrosis in farmers. *Clinical Orthopaedics and Related Research*, 287, 82-86.
- Beselga, C.; Neto, F. Albuquerque-Sendín F, Hall T, Oliveira-Campelo N. (2016). Immediate effects of hip mobilization with movement in patients with hip osteoarthritis: A randomized controlled trial. *Man Ther.* 22:80-85. doi:10.1016/j.math.2015.10.007.
- Chiriac, M. (2010). *Specific kinetic techniques for the recovery of hip mobility in non-operated coxarthrosis*, Doctoral thesis, National University of Physical Education and Sport, Bucharest.
- Fusco, M.; Skaper, S.; Coaccioli, S.; Varrassi, G.; Paladini, A. (2017). Degenerative Joint Diseases and Neuroinflammation. *Pain practice: the official journal of World Institute of Pain*, Vol. 17,4, 522-532. doi:10.1111/papr.12551.
- Kiss, I. (1999) *Fiziokinetoterapia și recuperarea medicală*, Editura Medicală, București, 128-131.
- Kondo, K.; Jingushi, S.; Ohfuji, S.; Sofue, M.; Itoman, M.; Matsumoto, T.; Hamada, Y.; Shindo, H.; Takatori, Y.; Yamada, H.; Yasunaga, Y.; Ito, H.; Mori, S.; Owan, I.; Fujii, G.; Ohashi, H.; Fukushima, W.; Maeda, A.; Inui, M.; Takahashi, S.; Hirota, Y. (2017). Factors associated with functional limitations in the daily living activities of Japanese hip osteoarthritis patients. *International journal of rheumatic diseases*, Vol. 20, 1372-1382. doi:10.1111/1756-185X.12955
- Leonida, G. (1963). *Ce este reumatismul*. Editura Medicală, Bucharest, 5,73.
- Picco, R. D., Dzindolet, M. T. (1994). Examining the Lüscher color test. *Perceptual and motor skills*, 79(3\_suppl), 1555-1558.
- Tarcău, E., Chiriac, M. (2015). *Measurement and evaluation in physiotherapy - course notes*, University of Oradea, Oradea.