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THE IMPACT OF KINESIOTHERAPY IN THE RECOVERY OF ADOLESCENTS WITH SCOLIOSIS DEFICIENCY

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Abstract: *The article focuses on two groups of children with scoliosis deficiency, first group, the experimental group, with whom we worked with kinesiotherapy programs and the second group, the control group, that work only with physiotherapy programs. The method used for assessing the scoliosis deficiency was the medical examination of specialists and the VAS questionnaire regarding pain level. The results showed statistically significant difference between the initial and final evaluation of scoliosis deficiency at the experimental group. Conclusions of the research proved that using specific kinesiotherapy programs can reduce pain level and correct scoliosis deficiency.*

Key words: *kinesiotherapy, scoliosis, physical health.*

1. Introduction

Scoliosis is explained as a disturbance of the anatomical, vertical line of the spine, corresponding of a lateral roundness along with the rotation of the vertebrae. To consider scoliosis, there might usually be no less than 10° vertebral angulation on the postero-anterior radiograph, correlated with vertebral rotation. Congenital scoliosis is the repercussion of a vertebral disturbance, which triggers a mechanical abnormality of the ordinary vertebral alignment [6].

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Scoliosis is caused by several factors, but broadly the main causes of scoliosis can be classified as follows: congenital curvature (caused by bone abnormality, present at birth); neuromuscular; idiopathic curvature (the most common type, without a specific cause) and curvature of the spine for secondary reasons. Scoliosis can also be due to neurological disorders (eg paralysis); muscle abnormalities (Duchenne muscular dystrophy) or additional disorders (e.g. Marfan syndrome or neurofibromatosis) [1].

Physical therapy is a branch of physical medicine and it studies the articular and neuromuscular mechanisms that ensure the development of normal motor activities of each individual. At the heart of this science is the movement, carried out through medical recovery programs and aimed at restoring affected functions [12].

The treatment of scoliosis must be individualized according to age, the size of the curve but also the risk of progression. This includes designing the recovery plan, observation, orthopedic treatment and in some cases surgical correction [1].

The ossification process takes place in three primary centres: one of them is the endochondral centre (it develops in the vertebral body) and one in each neural process. This process begins at the level of the thoracolumbar junction and takes place in the cranial and caudal directions [13].

The motor component of the innervation of the spine is formed by the roots of the ventral spinal nerve, having the roots that appear from the anterior horn of the spinal segment and with the role of sending motor impulses to muscles and joints, thus making it possible to initiate movements [8].

In addition to the skeleton, three major muscle groups comprise the back. These groups are: the intrinsic muscle group, also known as the deep group, hereinafter, the superficial muscle group and the intermediate muscle group. These muscle groups serve to allow for primary back movements, including flexion / extension, lateral rotation and bending, limb movement, and provide assistance with respiratory effort [6]. The second component of the intrinsic muscle group that makes up the back is the trans-verso-spinalis group. In relation to the erectile spine group, these muscles are arranged in depth [2].

Goniometry of kyphosis measurement is made starting from the initial standing position, the goniometric axes are fixed, the fixed axis of the goniometer is positioned at the vertical axis of the body, and the inclinometer is fixed in the affected area of the spine. This measures the deviation of the antero-posterior axis of the spine, starting from the normal position of the spine [14].

The condition of scoliosis can be identified both by the patient, by the parents, or by school screening and most often by the doctor, the prominence of the posterior thoracic wall is the most visible external manifestation of the curvature of the spine [4].

In some cases, a muscle disorder has been postulated as a possible etiology of idiopathic scoliosis. Currently, the cause is considered to be multifactorial, with factors such as genetics, including

metabolic, hormonal and biomechanical. [5]. some research has shown that fatigue scoliosis, caused by long periods of sitting or standing in orthostatic, can also indicate scoliosis. The explanation is that the more pronounced the curves, the more intense muscle intervention is needed to compensate and keep the body aligned and balanced [3].

The examination should include both the curve itself, but it is very important to pay interest to the vertebral objects too. Normally, there must be 2 pedicles at each vertebra and there must be a rotation of the spine. Thus, real scoliosis is not only a coronal deformation, but as well a rotatory deformation [10].

The 2011 guidelines provide clear guidance on what type of treatment is recommended depending on the type of scoliosis (observation, exercise therapy, surgery). According to the Lyon approach, the factor that dictates the type of treatment applied is the type of scoliosis: chaotic or linear [15]. Thus, the objectives of the surgical treatment are to prevent the progression of the scoliosis angle, as well as to improve the alignment but also to achieve the balance of the spine. We must also follow the alignment of the shoulders, pelvis and neck. Spine correction is performed through a mixture of rods, hooks, screws, and cords as a bone graft is melted [18].

2. Material and Methods

2.1. Place of the research

The research took place between 07.09.2019 - 06.01.2020, within the Samed Recovery Centre in Ludus, Mures County—Romania, we conducted an observational, prospective, longitudinal study, which aimed to evaluate patients with scoliosis, in order to implement a program of physical exercises recovery. Thus, we followed the evolution of 20 patients diagnosed with scoliosis and processed the data obtained from their evaluation, to formulate data and conclusions.

In order to evaluate patients with scoliosis, we performed a series of measurements of the degree of spinal damage on the group of patients included in the study, we measured the degree of pain they felt (VAS) and we took data on ADLs (activity of daily living) patients using a questionnaire, we took the data on the diagnosis of the disease, we measured the duration of the deficiency and we took demographic data on age and gender.

This investigation was overseen in accordance with the Declaration of Helsinki (2013). It also met the ethical standards for Sport and Exercise Science Research due to the fact that the General data protection regulation entered into the appliance on 25 May 2018 (Regulation (EU) 2016/679).

2.2. Study hypothesis

In the present research, we started from the hypothesis that patients, who are diagnosed with scoliosis and follow a physical therapy program, will present at the end of treatment a lower degree of spinal damage and a significant decrease in pain.

2.3. Research protocol

As criterion of exclusion in the study were selected the following: patients must be diagnosed with scoliosis, have a degree of deficiency of at least 15° at baseline, be at least 14 years old and have pain of at least 5 degrees on the VAS scale. Thus, after the patients were previously diagnosed with scoliosis, it was measured the degree of its involvement, also using the pain measurement scale: VAS, it was analyzed the degree of pain felt at the initial moment, at the first contact between the patient and the physiotherapist.

For inclusion in the study, we chose young patients, aged between 14 years and no older than 20 years, so that the treatment has maximum effectiveness.

Patients who did not fulfil these standards were not listed in the research. In addition, we used the following list of exclusion criteria: patients age less than 14 years or older than 20 years, patients with a degree of scoliosis greater than 50° or less than 15° were forbidden from the investigation, it was also excluded from the study asymptomatic patients or those with a pain grade below 5 on the VAS scale. Patients who did not accept to be involved in the research were also excluded.

2.4. The measurement of the scoliosis deficiency

Radiological examination is mandatory, requiring radiography of the front and profile of the spine in orthostatic associated with pelvic radiography to analyze possible asymmetries and to quantify the stage of ossification of the iliac crest according to the Risser score, used in prognosis.

It was established with the help of radiography, the number of curves, their type, the angle of scoliosis and the specification of the degree of rotation of the vertebrae. It is also very important to assess the evolution of deviations in a period of time between 3 and 12 months, depending on the predictability of evolution.

Thus, the “gold standard” of any study regarding the measurement of scoliosis angle remains the technique introduced by Cobb [15].

Most of the time, it is difficult to specify the onset of scoliosis, so several types of investigations are needed in a complete clinical examination, these being static and dynamic. Thus, when inspecting a patient in orthostatic it will be assessed: the position of the pelvis and its situation relative to its normal anatomical position, establish both the location and size of the curve, it is also very important to assess the equality or inequality of the lower limbs by measuring them [11].

2.5. The measurement of pain degree and ADL (activity of daily living)

The clinical-functional evaluation of patients was performed at the beginning and end of the 90-day treatment. We evaluated the intensity of pain on the VAS scale (Visual Analog Scale). The scale from 0 to 10 illustrates the pain felt by the

patient, 0 representing no pain felt by him and 10, of course, an extremely strong pain. The assessment of functionality in terms of daily activities (ADL-Activity of daily living) was performed using a questionnaire (ADL questionnaire) [9].

2.6. Statistical analyze

The statistical analysis included elements of descriptive statistics (frequency, percentage, mean, median, standard deviation) and elements of inferential statistics. The Shapiro-Wilk test was applied to determine the distribution of the analyzed data series. For comparison of means, the t-Student test was applied, parametric test for unpaired data, respectively for paired data. The significance threshold chosen for p was 0.05. Statistical analysis was performed using the GraphPad Prism.

3. Results

To be included in the study, we selected patients who presented to the Samed recovery clinic in the city of Ludus and were diagnosed with scoliosis, who presented with pain.

In the following table, we have presented the demographic data and the characteristics of the studied group.

Table 1

Gender representation of the patients

Gender	Experimental group	Control group
Female	6 (60%)	7 (70%)
Male	4 (40%)	3 (30%)
Total	10	10

Following the inclusion criteria in the study, we formed the experimental group, Group 1, which consists of 10 patients, of which, 6 patients are female and 4 male patients. The second group is the control group and consists of 7 male patients and 3 female patients.

Table 2

Types of scoliosis depending on the affected area

Types of scoliosis	Experimental group	Control group
Cervical-thoracic scoliosis	1 (10%)	2 (20%)
Thoracic scoliosis	5 (50%)	5 (50%)
Thoraco-lumbar scoliosis	2 (20%)	0 (0%)
Lumbar scoliosis	2 (20%)	3 (30%)
Total	**10**	**10**

Following the storage of data on the diagnosis of the disease in table no. 3, we noticed that cervical-thoracic scoliosis is more present in group II, thoracic scoliosis is found in equal numbers in the two groups, thoraco-lumbar scoliosis is present only in the experimental group, and lumbar scoliosis is more present in the control group.

Table 3

Representation of age, degree of pain and deficit

Age of patients, degree of pain and deficit	Experimental group	Control group	Value of p
Age	16.30±1.494 (16.00)	16.50±1.581 (16.50)	0.7746
Degree of initial pain	7.100±1.792 (7.500)	7.100±1.595 (7.000)	0.9999
Degree of the initial deficit	32.50±8.898 (32.50)	29.50±8.317 (30.00)	0.4461
Degree of pain at evaluation	5.400±1.776 (6.000)	6.400±1.838 (6.500)	0.2319
Degree of deficit at evaluation	27.60±10.21 (30.00)	29.50±8.317 (30.00)	0.6537

Two study groups were formed. First group, the experimental group, being represented by patients who followed a recovery exercise program (physiotherapy), and second group, the control group, being represented by patients who did not follow a recovery exercise program.

Of the total number of patients diagnosed with scoliosis (20), 10 patients received a recommendation from the clinic doctor to perform a recovery exercise program under the guidance of a physiotherapist, while the 2nd group of 10 patients received the recommendation to carry out only physiotherapy programs.

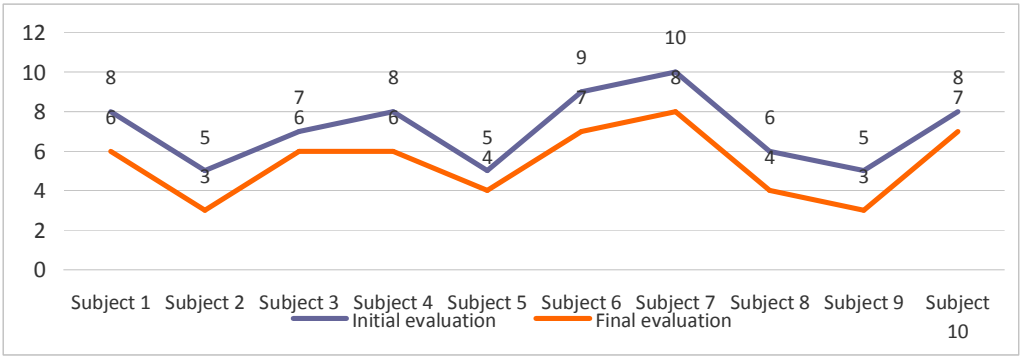

Fig. 1. *VAS representation for experimental group at the initial and final evaluation*

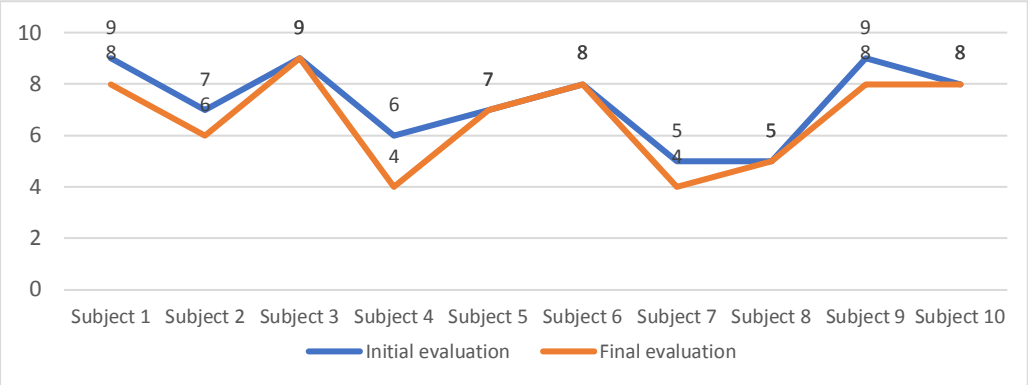

Fig. 2. *VAS representation for control group at the initial and final evaluation*

Table 4

Representation of the pain and deficit at the control group

Experimental group	Initial evaluation	Final evaluation	Value of p
Degree of pain	7.100±1.792 (7.500)	5.400±1.776 (6.000)	**<0.0001**
Degree of deficit	32.50±8.898 (32.50)	27.60±10.21 (30.00)	**0.0028**

Using the T-Student test, with p<0.05, at the experimental group, can be observed a statistically significant difference (<0.0001) between the averages of the degree of pain at the initial evaluation compared with the final evaluation.

Using the T-Student test, with p <0.05, at the experimental group, can be observed a statistically significant difference (0.0028) between the averages of the deficit degree at the initial evaluation and at the final evaluation.

After processing and interpreting the data we came to several conclusions by comparing the final data of the study regarding the two groups of patients, comparing the initial and final data, the hypothesis that the percentage of people affected by scoliosis is higher in the case of female patients was confirmed. The final report for this research showed that from the total number of patients diagnosed with scoliosis, 13 patients are female, while only 7 are male. Thus, in the experimental group, 60% of patients are female and only 40% male, and in the control group 70% of patients are female and only 30% male.

Regarding the data taken on the degree of pain felt by patients, data were taken at the initial time, when the patient presented to the clinic and at the end of 90 days of treatment. Thus, comparing the two figures, we can see that the patients initially presented almost the same degree of pain in the two groups.

The hypothesis mentioned in the beginning of the research, according to which, the patients who followed the recovery program felt a considerable decrease in the degree of pain, was demonstrated, the physiotherapy program leads to the correction of scoliosis by reducing the degree of curvature in the

spine. Thus, the experiment al group, presented at the end of the recovery program, a reduction by an average of 5° of the degree of scoliosis damage, while the control group, presented only a reduction of the degree of pain.

4. Discussions

From our study, it appears that the group of patients followed is part of the implementation of an exercise program. We also noticed that the people who completed the medical recovery program (physiotherapy), proposed and implemented by a multidisciplinary medical team, consisting of orthopaedists, physiotherapists, nurses and specialized staff in the clinic, have a higher degree of mobility and a lower VAS score. On the patients we followed, we noticed a higher share of the effect on the female gender to the detriment of the male gender.

Evaluations of patients with scoliosis have been discussed in various studies. Similar results can be found in the study “Epidemiology of adolescent idiopathic scoliosis” [7], published in December 2012, and their result is that scoliosis is a common disease with a general prevalence of 0.47-5.2%, a result in the literature. In this regard, the study showed that the ratio between women and men in terms of scoliosis varies from 1.5: 1 to 3: 1, and it expands significantly with increasing age. They also concluded that the ratio of female to male increases from 1.4: 1 in curves from 10 ° to 20 ° to 7.2: 1 in curves> 40 °.

In our study, we demonstrated a theory also researched in the article: "Physiotherapy scoliosis-specific exercises—a comprehensive review of seven major schools", published in 2016 [17], according to which scoliosis-specific recovery exercises are a good alternative at the expense of surgery.

Also, because during the physical therapy program, we carefully follow the correction of breathing or learning it correctly, we noticed important favourable changes on the appearance of the rib cage, but also a correct and harmonious development of the respiratory muscles.

5. Conclusions

Based on the hypothesis that patients who are diagnosed with scoliosis and follow a physical therapy program will present at the end of treatment a lower degree of spinal damage but also a significant decrease in the degree of pain felt, we reached results with significant differences statistically, in terms of correcting scoliosis but also improving the lifestyle of patients. The results also showed a decrease in the degree of pain felt by patients, thus demonstrating the hypothesis from which we started in this study.

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