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PHYSICAL THERAPEUTIC INTERVENTION TECHNIQUES IN IMPROVING FLAT BACK SYNDROME IN THE SCHOOL ENVIRONMENT

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Abstract: *The flat back symptoms are one of the most common degenerative spinal deformities among adults. This occurs due to incorrect posture over time in the school environment, as well as due to the unique lifestyle. The purpose of the paper is to highlight the important aspects related to flat back syndrome and the physiotherapy intervention methods in improving the quality of life in the school university environment. In this study, a case study with flat back syndrome was analyzed in which the role of improving the quality of life by improving the health status of the subject was highlighted.*

Key words: *flat back syndrome, physiotherapy intervention techniques, kinetic exercises.*

1. Introduction

Flat back syndrome is a postural deficit resulting from the extraction of vertebrae in the treatment of scoliosis. Patients suffering from flat back syndrome adopt certain postural attitudes to maintain a physiological posture that is as upright as possible. These postures consist of pelvic tilts, hip extensions, knee flexions, and spinal hyperextension [1].

Flat back syndrome is an abnormal condition in which the spine loses its natural kyphosis and/or lordosis and begins to flatten, causing the spine to become uneven. It is characterized by the gradual loss of normal kyphosis and/or lordosis, which results in a forward tilt of the trunk, inability to stand upright. From the subject's point of view, these changes may be subtle, but over time, the difficulties will increase, and the level of pain will increase [4], [11].

Patients suffering from flat back syndrome develop adaptive postural changes to maintain a physiologically and socially acceptable horizontal gaze [1].

Flat back syndrome was initially observed in patients who underwent surgery to reduce scoliosis. Physical impairment – scoliosis is an S-shaped curvature of the spine. Harrington rods were used in the surgery to improve the curvature. These instruments allowed the specialist to straighten and fuse the patient’s curvature, which was a positive

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aspect. Many patients treated with this type of instrumentation did very well after the surgery [13].

Scientific technology is constantly developing, thus minimizing the long-term risk for patients.

Current interventional tools allow specialists to correct the spine in different planes, decreasing the risk of developing flat back syndrome.

The disappearance of lumbar lordosis can occur because of conditions such as degenerative disc disease, vertebral compression fracture, osteoporosis and ankylosing spondylitis, post-laminectomy kyphosis syndrome and post-lumbar laminectomy syndrome (flattening of the back following lumbar decompression surgery in the case of spinal stenosis) [14].

This condition can be observed both at the lumbar and thoracic levels and is manifested by the absence of the natural-physiological lordotic and kyphotic curves, respectively.

Symptoms differ and can worsen depending on the degree of advancement of flat back syndrome. In fact, the symptoms can often become disabling and can decrease the quality of daily life.

Many patients may end up relying on medications to relieve the pain caused by flat back syndrome.

In a person with flat back syndrome, the lumbar spine does not have its natural curvature, figure 1.

This causes the head and neck to lean forward, which can make it difficult to walk and perform daily activities. As a result, the affected person struggles to maintain balance and become fatigued, causing chronic stiffness and pain in the neck, upper back, and shoulders [16].

The position adopted in this deficiency puts stress on the vertebrae and spinal discs, causing recurrent back pain, as well as pain in the groin and thighs.

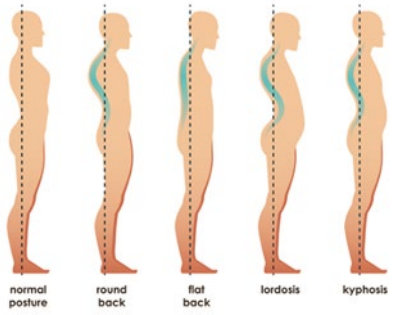

Fig. 1. *Spine posture* [15]

The patient's symptoms often worsen as the day progresses, as many patients flex their hips and knees to maintain a correct standing posture. These compensatory changes lead to mobility problems and increased muscle fatigue, as the muscles in those regions exhaust their resources [17].

Recent studies confirm that the disappearance of the normal upper thoracic kyphotic curvature causes a reduction in the anteroposterior diameter of the chest.

As a result of compression of the heart, chest pain and palpitations occur. This condition is more frequently associated with mitral valve prolapse and bicuspid aortic valve than with pseudoheart disease. The application of manual therapy to the appropriate thoracic and cervical areas, followed by daily performance of recommended exercises and stretching procedures, seem to have preventive roles in this case [9].

In another study, a patient was found to have a significantly shortened anteroposterior diameter of the chest, leading to the diagnosis of flat back syndrome. The heart was flattened and

oriented vertically, the spine was uncurved, and there was compression of the right ventricular outflow tract [3].

The spine becomes straight, the chest is flat, the abdomen is sucked in, and the pelvis is almost horizontal. The mobility of the spine suffers especially from the lack of lumbar curvature, and the spine completely loses its ability to cushion sudden movements due to the lack of these curvatures [18].

Flat back syndrome is a combination of inability to stand due to forward flexion of the trunk and pain in the back and/or legs. It usually occurs in the setting of decreased lumbar lordosis following spinal distraction instrumentation for scoliosis, vertebral fracture, or degenerative disease. Emphasis is placed on determining the factors responsible for the development and/or persistence of flat back syndrome in these patients, despite maintenance or partial surgical restoration of lumbar lordosis.

Given the essential role that the trunk extensor muscles play in maintaining upright posture, it is possible that a new onset of weakness (post-polio syndrome) in these muscles represents a major factor contributing to flat back syndrome in these patients [8].

Other common causes and exacerbating factors include failure to increase regional lordosis during lumbar fusion for degenerative spondylosis, development of pseudarthrosis or postoperative loss of correction, development of kyphosis at the thoracolumbar junction, development of cephalad or caudate degeneration and decompensation in previous fusion, and hip flexion contractures. Prevention of flatback syndrome involves preoperative assessment of sagittal balance, avoidance of distracting instrumentation and extension of long fusions in the lower lumbar spine, improvement of physiological lordosis during lumbar fusions, and intraoperative positioning with the hips extended [7].

Another study focused on sagittal realignment for flat back and associated kyphotic decompensation [6].

Untreated, flat back syndrome can worsen and lead to complications, such as the development of head-forward posture.

Often, people with flat back syndrome use a cane or frame to help distribute body weight evenly across the pelvis and legs; this is due to the effects of decentration.

2. Material and Methods

The research was based on an experimental study. The period of implementation was 6 months with initial testing - October 2022 and final testing - March 2023.

The study is based on a case study. The subject is a 28-year-old female student diagnosed with flat back syndrome.

2.1. Research procedure

In the research, to have the most objective picture possible of the deficiency treated, the following methods were identified:

a*. Evaluation of the spine* was carried out observing the appearance of the spine in the frontal and sagittal planes:

- The head and neck are prominently forward.
- The shoulders are bent forward.
- The thoracic spine and lumbar spine do not have the natural curvature observed in most people.

- The pelvis rotates posteriorly.

***b**. Evaluation by inspection and palpation*

In this case, we refer to the palpation of muscle groups, joints and the observation of the amplitude of movements.

The subject presented muscle hypotonia when palpating the spinal extensors and thigh flexors. He also complained of pain in the paravertebral muscles in the thoracic, lumbar, gluteal muscles, and hamstring muscles. He complained of muscle contraction and pain in the neck.

***c**. Using the Shirado and Sorensen Beiring tests*

The Shirado test is a static abdominal muscle endurance test currently used in the evaluation of back pain, figure 2 [2].

Fig. 2. *Shirado test* [19]

This examines the trunk flexors and is performed with the subject in supine position, thighs and knees flexed at 90°, arms at the sides. The subject raises the shoulders off the table, maintaining this position as long as possible, in isometry. In a subject, under normal conditions, the time maintained is 2'. In the case of the subject analyzed, the time was 1'30" [12].

The Sorensen Beiring test is commonly used to assess paraspinal muscle strength, figure 3, [10].

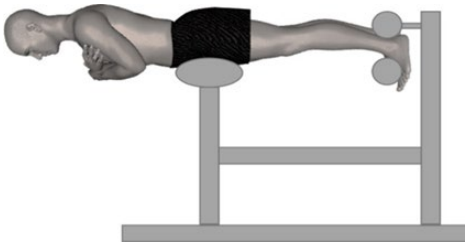

Fig. 3. *Testing position for the Biering-Sorensen test* [10]

This examines the extensors of the spine and is performed with the subject in a prone position, at the edge of the table, the pelvis and ankles are firmly held by the examiners. The subject will maintain the body weight for as long as possible. A healthy subject maintains the position for 2'. In the case of the analyzed subject, the time was 1'10".

The test has proven to be a good assessment tool for predicting the risk of non-specific back pain in patients [20].

***d.** Pain level assessment*

A visual analog scale (VAS) is a simple but valuable instrument that attempts to measure a characteristic or attitude that is believed to vary across a range of values and cannot be easily measured directly [5].

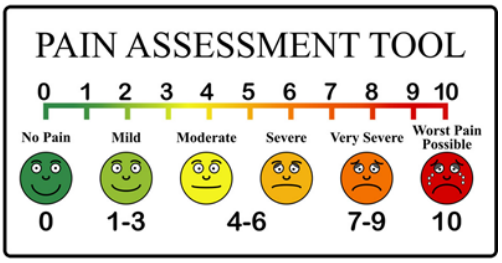

Fig. 4. *Visual analog scale* [21]

The visual analogue scale (VAS), figure 4, determines the intensity of pain, having a horizontal or vertical line 10 cm next to the patient, which indicates the level of pain. The scale ranges from 0 - no pain to 10 - intense pain. The patient is asked to indicate the level of pain.

2.2. Individualized recovery program

During the exercise program for correcting a flat back, the aim was to create the mechanical conditions corresponding to the appearance of physiological curvatures of the spine, to develop joint mobility of the whole body and to make the movements more coordinated and suitable for the purpose for which they are performed. Special attention was paid to relaxing and toning the muscles of the back and spine.

To correct a flat back, exercises that are performed on the spot and especially while moving, freely or with portable objects have been identified. Thus, the most important means used are static exercises in the form of positions derived from the basic positions of standing, sitting, kneeling and lying down, and dynamic exercises as follows:

a) exercises for the trunk in the form of flexion movements in the dorsal region, extensions in the lumbar region, lateral bending to the right and left, twisting to the right and left.

b) exercises with the arms in the form of forward, lateral and downward rotation movements, to amplify the dorsal flexion movement of the trunk.

c) leg exercises, in the form of extension movements, in which abductions, adductions, stretching, bending, sharing, pendulums and rotations were performed.

d) specific breathing exercises after each heavy core exercise, after weighted or applicative exercises.

e) applicative exercises in the form of rolling and walking.

f) exercises with portable objects that increase the corrective effects of the listed exercises.

The kinetic program was carried out based on the following objectives:

a. Reducing muscle pain because of muscle relaxation.
b. Developing mobility and coordination, flexibility and ability of the whole body.
c. Increasing chest elasticity and normal lung capacity.
d. Remodeling the physiological curvatures of the spine.

The recovery program, in which the subject participated, was carried out over a period of 6 months, weekly, with three sessions per week, the duration of a session being one hour - one hour and 30 minutes.

The exercises encompass several objectives, for this reason they were assigned taking into account the clinical picture of the subject and the level of difficulty of the exercises.

Regardless of the objective pursued, the exercises were performed at a slow and gradual pace to avoid possible injuries. After each exercise, the subject took a 20" break. The dosage of the exercises increased over time until the final stage, depending on the nature of the exercises and the patient's capabilities.

In the first two months, the subject performed exercises aimed at all objectives, but we focused more on the objectives of muscle relaxation and stretching, muscle toning, but also on developing spinal mobility.

In the next two months, all objectives

were pursued, but emphasis was placed on muscle toning and developing mobility to create physiological curves and on developing coordination, flexibility and overall body ability.

In the last two months, all objectives were also pursued, especially increasing muscle tone and muscle strength.

3. Results and Discussions

The following results were obtained during the research:

3.1. *Spine assessment – inspection and palpation*

Following this evaluation, it was observed that in the muscle groups analyzed at the initial evaluation, the subject no longer presented muscle hypotonia of the spinal extensors and no longer complained of pain in the gluteal muscles and hamstring muscles. Also, both the muscle contraction and the neck pain disappeared.

3.2. The *Shirado* test

The evaluation following the Sdirado test shows values of 1'30". at the initial testing and 2'10". at the final test. The subject managed to maintain the shoulder position in isometry for 2'10" (figure 5).

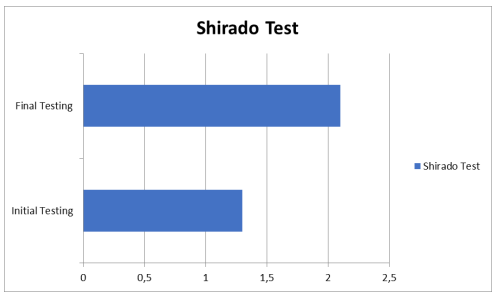

Fig. 5. *Values obtained from the Shirado test*

From figure 5. it can be seen that, at the final testing, the subject managed to maintain the shoulders raised in isometry for 2'10", compared to 1'30", the time obtained at the first evaluation, thus resulting in an increase of 0.8 percent compared to the initial result. Exercises to increase the muscle strength of the neck and to develop its coordination and suppleness led to an increase in the tone of the flexor muscles involved.

3.3. *Biering Sorensen* Test, (figure 6)

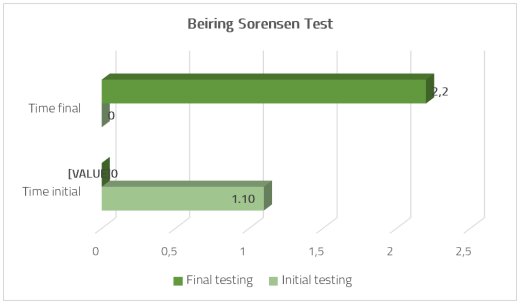

Fig. 6. *Biering Sorensen test values*

The values highlight the optimization of the time of maintaining the trunk in extension in a proportion of 50%.

Compared to the time of 1'10", obtained in the initial testing, the subject managed to maintain the trunk in isometry for 2'20". Since, initially, the subject felt intense pain in the area of the extensor muscles of the spine (erector spinalis, neck - posterior part), but also in the muscles located in the surface plane, in the first stage we focused on performing exercises to de-tension and stretch the paravertebral muscles, both in the thoracic and lumbar areas and on manual relaxation therapy.

In the next stage, we focused on performing exercises to improve muscle control and tone the muscles, so that at

the final evaluation the subject achieved an increase in the time he could maintain the trunk in extension.

3.4. Evaluation of pain intensity level on the VAS scale

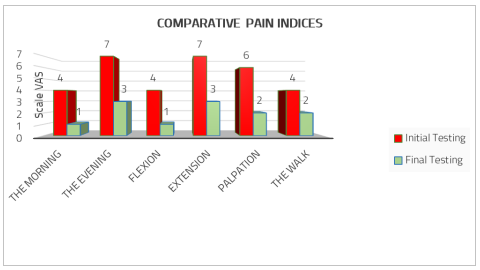

Fig. 7. *Pain intensity levels on the VAS scale*

The graph highlights considerable improvements in pain in all aspects analyzed. The thoracic and lumbar de-tensioning exercises with which the recovery program began were resumed monthly, especially since the subject highlighted pain as the main impediment in carrying out the activities presented. Also, the application of manual therapy, which involved local stretching of the fascia in the paravertebral area, the application of slight pressures in the area, while the subject sat on a chair, flexing the head and neck, the decontracting massage of the shortened iliocostal muscles, the application of transverse pressures in the contracted area, led to a considerable decrease in pain, fig. 7.

3. Conclusions

Research into pain in flat back syndrome can reveal several important aspects that can contribute to the understanding and management of this condition.

Pain can be from poor posture, muscle injuries, herniated discs or degenerative conditions, making it essential to identify the specific cause for effective treatment.

Flat back syndrome has a significant impact on quality of life, affecting daily activities, mobility and emotional well-being. It is important for patients to be aware of this impact and to use a therapy specific to pathology.

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