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## *Physical exercises as a treatment for spinal cord injuries in university students*

*Ejercicios físicos como tratamiento para lesiones de la columna vertebral, en estudiantes universitarios*

*Exercício físico como tratamento para lesões medulares em estudantes universitários*

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## ABSTRACT

Raising the quality of life of students in all university careers is one of the most important challenges for Physical Education specialists, and therapy in particular; however, when beneficiaries have spinal cord injuries, they need adequate physical and mental rehabilitation. The objective was to develop physical exercises as a treatment to compensate for the recovery time of students with spinal cord injuries who attend the therapeutic area of the Universidad de Oriente, through Physical Education classes. In the research, theoretical and empirical methods were used to know the real state of the problem, in addition to the techniques to collect and process information. The physical exercises proposed are fundamentally aimed at students who have scoliosis, and in a prophylactic-therapeutic way, treatment is offered to compensate and/or prevent the time of onset of pain that allows immediate recovery and incorporation into the teaching-learning process within the physical education classes. A structure and methodological ordering of the contents was taken into account in four staggered stages during the application of the treatment, in correspondence with the individual characteristics of the sample. The specialists who evaluated the proposal considered it feasible for its application and useful.

**Keywords:** physical exercises, university students, injuries.

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## RESUMEN

Elevar la calidad de vida de estudiantes en todas las carreras universitarias es uno de los retos más importantes para los especialistas de Educación Física, y la terapéutica en particular; sin embargo, cuando los beneficiarios presentan lesiones en la columna vertebral, necesitan una adecuada rehabilitación física y mental. Se planteó como objetivo desarrollar ejercicios físicos como tratamiento para compensar el tiempo de recuperación de los estudiantes con lesiones en la columna vertebral que asisten al área terapéutica de la Universidad de Oriente, a través de las clases de Educación Física. En la investigación, se utilizaron métodos de nivel teórico y empírico, para conocer el estado real del problema, además de las técnicas para recoger y procesar información. Los ejercicios físicos propuestos están dirigidos fundamentalmente a estudiantes que presentan escoliosis, y de forma



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profiláctica-terapéutica se ofrece tratamiento para compensar y/o prevenir el tiempo de aparición del dolor que permita su recuperación inmediata e incorporación al proceso de enseñanza-aprendizaje dentro de las clases de Educación Física. Se tuvo en cuenta una estructura y ordenamiento metodológico de los contenidos en cuatro etapas escalonadas durante la aplicación del tratamiento, en correspondencia con las características individuales de la muestra. Los especialistas que valoraron la propuesta lo consideraron factible para su aplicación y de utilidad.

**Palabras clave:** ejercicios físicos, estudiantes universitarios, lesiones.

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### **RESUMO**

Elevar a qualidade de vida dos estudantes em todas as carreiras universitárias é um dos desafios mais importantes para os especialistas em Educação Física e, em particular, para a terapia; Contudo, quando os beneficiários apresentam lesões na medula espinhal, necessitam de reabilitação física e mental adequada. O objetivo foi desenvolver exercícios físicos como tratamento para compensar o tempo de recuperação de alunos com lesões medulares que frequentam a área terapêutica da Universidade de Oriente, por meio de aulas de Educação Física. Na pesquisa foram utilizados métodos teóricos e empíricos para conhecer o real estado do problema, além das técnicas para coletar e processar informações. Os exercícios físicos propostos são direcionados fundamentalmente aos alunos portadores de escoliose, e de forma profilático-terapêutica é oferecido tratamento para compensar e/ou prevenir o momento do aparecimento da dor que permite recuperação imediata e incorporação no processo de ensino-aprendizagem dentro do aulas de educação física. Foi considerada uma estrutura e ordenação metodológica dos conteúdos em quatro etapas escalonadas durante a aplicação do tratamento, em correspondência com as características individuais da amostra. Os especialistas que avaliaram a proposta consideraram-na viável e útil para sua aplicação.

**Palavras-chave:** exercícios físicos, universitários, lesões.

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## INTRODUCTION

The study is based on the manifestations observed in the systematic teaching practice of Physical Education, within the therapeutic areas in the Higher Education center, such as the passivity of students during classes, the lack of participation in them and individual and unidirectional learning to plan for success.

These facts led to modifications in the teaching-learning process and to search for new ways of application to improve the health status of students who attend the therapeutic area as an alternative to Physical Education classes.

The use of physical exercise as a therapeutic and treatment means dates back to ancient times and the works of doctors and specialists who in past times prescribed certain physical activities as medicine and obtained positive results with this type of procedure are well known, so Therapeutic Physical Culture became a medical discipline within Physical Education.

It applies its means to the cure of diseases and injuries, to the prophylaxis of exacerbations and complications, as well as to the recovery of work capacity; the main means used as an essential stimulator of vital functions in the body is physical exercise, which makes it different from other therapeutic means.

There are different experiences in the application of therapeutic treatments to restore the level of activity in the region of the spine, in addition to that applied through acupressure in the most frequent injuries, there are Thai chi and Pilates exercises. One of these applications was worked on by Benítez *et al.* (2022) who express that the results and validation of the corrective physical exercise program for beneficiaries with scoliosis show a high level of satisfactory assimilation to the planned load, in addition to correcting the curvatures of scoliosis and improving the quality of life and the performance of daily activities.



In the past, scoliosis presented a dismal prognosis that perpetuated the common false perception that all its types inevitably led to disability, with back pain and cardiopulmonary compromise; in this sense, Young *et al.* (2023) and Zeca *et al.* (2023) state that scoliosis, in general, varies with the etiopathogenesis, location and type of curves.

However, Benitez *et al.* (2022) demonstrate, through their research, that a program of corrective physical exercises can be part of the treatment of spinal injuries and will improve the quality of life and the performance of daily and school activities. According to Vega (2022), to strengthen the spine it is necessary to do frequent physical exercise, based on prior consideration of physical capacity, age and state of health.

This allows to specify that due to the characteristics of Physical Education classes, where abilities and skills are worked on and the student is subjected to a regimen of physical exercises and he must reach his maximum effort and, in some cases, exceed his physical and mental possibilities to improve their physical condition, sometimes certain muscle and joint regions are affected, mainly in the spine.

When reaching the maximum or exceeding their physical and mental possibilities, muscle fatigue is caused, followed by an energy blockage of the most affected region, which produces intense pain as a defense of the body to prevent the continuity of the load of physical activity; therefore, the treatment towards strengthening the paravertebral muscles, through physical exercises carried out within Physical Education classes, is of utmost importance to improve your physical condition.

From this perspective, López (2022) states that:

(...) optimal strengthening of the paravertebral muscles contributes to reducing low back pain and increasing spinal functionality. For this reason, the need to promote the comprehensive and harmonious development of the lumbar muscles through recommended, low-risk exercises, in order to create healthy habits, is understandable. (p.6)



The spine represents a main element in the search for a correct body posture; it is a very vulnerable structure and susceptible to spinal alterations. Amado (2020) considers that providing stability and muscle tone to this area is essential in the prevention of spinal injuries, which is why the spine fulfills three essential physiological *functions*:

- Allows movement between body parts (head, thorax and pelvis).
- Supports internal and external loads.
- Protects the spinal cord and nerve roots.

From the educational field, students should be encouraged to become aware of appropriate postural habits, where the spine or any other element of the musculoskeletal system is not overloaded. Within the prevention of back pain, postural hygiene and ergonomics play a very important role, since through these disciplines it is taught how to do all types of activities in the safest and lightest way for the back.

From what was analyzed in the research reviewed and what was observed in Physical Education classes, it has been confirmed that in most cases the injuries are associated with different meridians and tsubos (points) in the regions where they are located. In correspondence with the above, the objective was set to develop physical exercises as a treatment to compensate for the recovery time of students with spinal cord injuries who attend the therapeutic area of the Universidad de Oriente, through Physical Education classes.

## ***MATERIALS AND METHODS***

The research was carried out with Physical Education class groups that attend the therapeutic area at the Universidad de Oriente, the population and sample under study was 20 students with injuries to the spinal column (scoliosis), of them, 12 females and 8 men, all with similar characteristics, corresponding to the type of scoliosis, with a diagnosis of cervicodorsal and lumbar dorsum scoliosis for 100 %, a descriptive procedure, an



interpretive procedure and a propositional phase were contemplated, based on the information collected.

The method used in the research is ethnographic, it is one of the most used methods to analyze teaching practices, where action is taken from the point of view of the subjects who participate in a specific sociocultural field "Ethnographic research is the research method through which the way of life of a specific social unit is learned and this may be (...) a school"(Ramírez, 2022, pág. 295).

Probes were carried out, using different instruments such as the survey and direct observation within the groups, to determine the level of performance of the students in terms of the activities to be carried out, this allowed the execution of physical exercises as a treatment for spinal injuries.

The quantitative results of the groups of students were channeled, during the application of the physical exercises, to have support for the results that allowed a comparison of the two populations, in the search for the different variations that may occur in the academic and social development of the groups.

Other important theoretical and empirical methods, as well as statistical methods, were also used. Within the first, the analytical-synthetic method was used in the analysis of the elements that make up this process to determine its characteristics and, through a synthesis, integrate them.

The systemic-structural-functional method allowed establishing the structure, contents and methodology for the application of physical exercises as treatment; the inductive-deductive, to verify and/or confirm the need for the application of the proposal made, in the context for the improvement of vertebral injuries in university students.

The empirical level methods used were:

The experimental that allowed the hypothesis raised in the research to be verified; participant observation was used throughout the study to specify the results obtained from the application of physical exercises for the treatment of spinal injuries, with the aim of





knowing the evolution during the application within physical education classes. For the statistical processing of the results, the mathematical statistical method was used, using the specialized software IBM SPSS Statistics version 22.

The selection of the experiment group was based on the following inclusion and exclusion criteria.

Inclusion criteria:

- The acceptance by the 20 students when joining with the systematic practitioners to receive the treatment within the class group.
- Take into account both sexes and the characteristics of the spinal injury.
- The prevalence of the female sex (with average ages between 18 and 21 years).
- Diagnosis favorable to performing physical exercises mainly strengthening, stretching and breathing to treat both injuries, which are cervicodorsal and dorsolumbar scoliosis.
- The inclusion of different university courses whose corporate purpose is not the same.

Exclusion criteria:

- Fifteen students who acquired the spinal injury during their school years.
- Three students who acquired it during the gestational stage.
- Two students who have it due to hereditary causes.

Highlight that it was necessary to work on some important points addressed in the inclusion criterion, such as the first and last points. This research was carried out during several courses, but it was decided to design and apply during the 2020-2021 academic year as a motivation to include these students in the Physical Education classes in the 28-hour class program, with two weekly frequencies during the first two semesters of Physical Education I and II that continue in the second year of each university degree.



Structure and methodological ordering of the contents in four stages:

First stage:

At this stage, the receiving students provide a diagnosis (first consultation) made by the specialist doctor, detailing the exercises to be performed, as well as the type of scoliosis they present. Clinical diagnosis requires taking into account the two aspects of logic, that is, analysis and synthesis, and various tools are used such as anamnesis, clinical history, physical examination and complementary examinations.

Second stage:

After the diagnosis is made, they are sent to the therapeutic area where physical exercises are performed, in correspondence with each pathology and a dialogue is established between the Physical Education specialist within the area and the person to be treated, this is done with the objective to examine how the spinal injury was acquired, from this, the following steps are carried out:

- The specialist evaluates the movement of the recipient, mainly in the affected region, and performs neurolinguistic programming, so that the beneficiary becomes aware of the real cause of their problem.
- The specialist applies both respiratory and muscular relaxation exercises in case the beneficiary has pain (if there is no pain, the same are applied, but as a complement after the physical exercises have been performed).
- These relaxation techniques are used to help beneficiaries reduce their physical and/or mental tension, in addition to allowing them to achieve a greater level of calm by reducing levels of stress, anxiety or anger.
- The specialist applies specific physical exercises mainly from massage manipulations, to moderate the injured regions, also to stimulate the circulatory system and induce an improved flow of blood and energy in the treated students, combining techniques and manipulations of oriental massage with the western massage.



- The specialist uses proprioceptive functional training to recover joint stability, through stabilization exercises on the mat, stretching and elastic bands if required.

Third stage:

At the end of the treatment with physical exercises to improve physical condition in the therapeutic area within the Physical Education classes, the treated students are asked to present in writing the degree of satisfaction with the application of the exercises received.

Two sessions per week (Tuesday-Thursday and Wednesday-Friday) were applied to each selected subject in the morning session, up to approximately 60 minutes (1 hour) of class were used to perform physical exercises as treatment.

Although pain can present as an isolated symptom or as part of a syndrome and that there are different types of tolerances for the pain threshold, according to each student due to their physical and physiological characteristics; the following numerical scale was used to make a correct assessment of the evolution of the treated students and the effectiveness of the proposal presented (Table 1).

**Table 1.** - To determine the painful intensity before, during and after the treatment is applied

Scale		
Numerical value		Rigor
Equal to zero	= 0	Without pain
Equal to one	= 1	Insignificant pain
Equal to two	= 2	Very mild pain
Equal to three	= 3	Soft pain
Equal to four	= 4	More or less pain
Equal to five	= 5	Moderate pain
Equal to six	= 6	Strong pain
Equal to seven	= 7	very strong pain
Equal to eight	= 8	Severe pain
Equal to nine	= 9	very severe pain
Equal to ten	= 10	Unbearable pain

*Source of own elaboration:* Scale to determine pain and intensity, through numerical values with the rigor applied.

- When the numerical value is equal to 0, it means that the treated students do not present pain.
- When the numerical value is between 1 and 3, it means that the treated students have mild and occasional pain; but it has not altered his physical activity pattern.



- When the numerical value is between 4 and 5, it means that the treated students are active, but have had to modify and/or stop doing certain physical activities due to pain.
- When the numerical value is between 6 and 10, it means that the treated students present severe pain and significant limitations, so physical exercises must be suspended, which is immediately referred to the specialist doctor who diagnosed the pathology in question.

At the beginning of treatment, each treated student was asked the following questions to monitor their status during each physical exercise session:

- What happens to you? / Example: I have pain in the cervical, dorsal, lumbar or sacral region.
- Since when? / Example: since yesterday afternoon, since I started doing the physical exercises or since I suffered an episode of pain before starting the exercises
- What do you attribute it to? / Example: to an incorrect warm-up before starting class, to a fall I had at home or to sudden environmental changes.
- What is the cause of your pain? / Example: fighting in training, they performed a throw on me and I didn't break the fall, when I fell badly, I hit my neck.
- According to the magnitude of the pain and according to the scale presented with a numerical value from 0 to 10, what numerical value do you give to your pain at this moment? / Example: I give it a numerical value from 2 to 10.

The Physical Education and therapeutic specialist involve the students that are been treating so that they can express the cause of their illness (if they know it).

At the end of each physical exercise as treatment, each student treated was asked the following:

- How do you feel right now? / Example: good, bad or average.



- According to the magnitude of the pain and according to the scale presented with a numerical value from 0 to 10, what numerical value do you give to your pain at this moment? / Example: I give it a numerical value of 0 or 1.

For this, it is based on the characteristics of the pain and in this way know its etiology (origin of pain), and therefore its diagnosis and treatment.

These features are:

- A: onset of pain: how long have you had the pain?
- L: location of pain: where does it hurt?
- I: pain intensity: according to the magnitude of the pain and according to the scale presented with a numerical value from 0 to 10, what numerical value do you give to your pain at this moment?
- C: character of the pain: what is the pain like? What type of pain sensation do you have? Stabbing pain (piercing, lacerating), burning (I have a sensation as if it were burning inside me), burning or burning, oppressive (suffocating).
- I: radiation of pain: It is the path that the pain travels from its original location to another place, where does the pain run to?
- A: pain relief: what is your pain relieved? how is your pain relieved? how is your pain relieved?
- FRE: pain frequency: It is the number of times the pain has occurred with similar characteristics: how often does the pain occur? How frequently does the pain occur?
- DU: duration of pain: the time since its appearance, since when have you had the pain? How long has the pain lasted for you?
- SA: accompanying symptoms of pain: What are the accompanying symptoms of your pain? Such as nausea, vomiting, diarrhea, fever, tremor, etc.



- SA: Accompanying signs: What are the accompanying signs of your pain? sweating, paleness, chills, neurological disorders, etc.
- FA: aggravating factors: What are the circumstances that increase your pain? / Example: after performing certain movements or being at rest, etc.
- FA: Mitigating factors: What are the circumstances that reduce your pain? / Example: resting after performing physical exercises, some body positions, performing stretches or lung relaxation exercises, as well as muscle relaxation exercises, etc.
- FAC: drugs to consume to relieve pain: What medications relieve your pain? What medication causes your pain?

Physical exercises as a treatment for scoliosis in general are very effective in maintaining health, useful for the symptomatic treatment of pain and can correct, prevent, alleviate and cure various functional symptoms and conditions, in addition to providing the following benefits:

- They are usually harmless exercises when dosed and/or planned, in correspondence with the vertebral injury that is diagnosed.
- They do not present side effects when properly dosed and/or planned.
- It produces correction, prevention, relief, improvement and in many cases the non-appearance of pain for a long time, to improve the various health problems that each student presents.
- It can be carried out by any professional in the area where you work and who is previously prepared.
- It's safe, simple, and pain-free.
- It can be applied to beneficiaries who present the same pathology depending on age, sex, with prior planning and/or dosage and characteristics of the spinal injury they present.



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## Methodological guidelines for the application of physical exercises as treatment for spinal cord injuries

- Recovery time: between sets of exercises, two to five minutes.
- The place must be spacious, with adequate ventilation and lighting.
- The technical-hygienic conditions necessary for this process must be respected.
- Treatment should be suspended if any symptoms appear that indicate a risk to health (fever, bleeding, pain, among others).
- Students should wear comfortable clothing to facilitate movement.
- Mobilizations should be done from the distal to the proximal areas.
- In each session, the body's reaction to the loads must be recorded and the patient's variations periodically evaluated.
- Rest during the session should allow students to fully recover.
- To work on strength, it is recommended to execute between 40% and 60% of the maximum effort, using the repetition method.
- Students must be explained what the activities to be carried out consist of before starting them.
- Students should hydrate before, during and after completing exercises.
- Breathing exercises should be performed during the rest between sets.



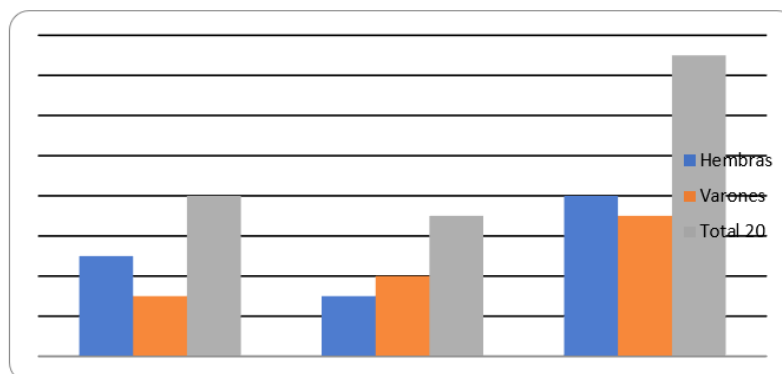
## RESULTS

The results obtained with the application of physical exercises for the treatment of scoliosis within the Physical Education classes provided elements that allowed to know its positive influence on the students and its impact, in terms of results, was obtained from the comparative analysis before, during and after the proposal is applied.

A personal history summary protocol was prepared for each student treated, which collected the results:

- From the physical examination.
- From the complementary explorations.
- Of the evolution during physical exercises as a treatment applied before, during and after.
- The level of satisfaction of students who attend the therapeutic area to provide Physical Education, as a complementary physical activity after completing the exercises, as a treatment in the first semester of the first year of all university degrees.

The results presented in Figure 1 show the scale of spinal column injuries with which we have to work, cervical-dorsal scoliosis predominated in females and dorsal-lumbar scoliosis in males, for a total of 20 students who were physical exercises were applied (Figure 1).



*Fig. 1. - Scale of spinal column injuries by sex*  
*Source: comparison by sex to determine the type of scoliosis*





Comparative analysis of the results obtained before, during and after applying the proposal (Figure 2).

1. Evolution of the students treated before applying the proposal of physical exercises to work on spinal column injuries.

- Uncompensated student: has never performed physical exercises as a treatment to compensate and/or correct the spinal injury without pain.
- Compensated student: when, despite not having performed any physical exercise as treatment, he has never experienced pain.
- Student with a compensated level of injury: when after having performed physical exercises very infrequently, a continuation of the exercises per week is not required.

2. Evolution of the students treated during the application of the proposed exercises to work on spinal column injuries.

- Uncompensated student: when, despite having applied physical exercises, the pain has not been relieved and the muscles located around the spinal injury have not been strengthened.
- Student with a compensated level of injury: when little continuation of the exercises is required with frequency of performance twice a week.
- Improved student: when they can perform most of the movements related to the condition, but require continuing treatment for some movement that is difficult to perform with a lower dosage and/or planning than expected by them.

3. Evolution of the treated students after applying the exercise proposal to work on spinal column injuries.

To determine the method used in this part of the research and to be able to collect accurate information, the elements collected through the satisfaction survey that was carried out were taken into account to obtain more reliable elements about the proposal of exercises applied to work on vertebral injuries before, during and after applying the physical



exercises, with the aim of visualizing the state of each student through their positive progress with its application and a set of data is described, through an individual analysis of the evolution of the students after applied the proposal.

- Uncompensated student: when despite having applied physical exercises as treatment, the pain has not been relieved, the pain has increased or the maintenance of their functional disability is insufficient.
- Student with a compensated level of injury: when the continuation of the exercises with several frequencies of performance per week is not required.
- Improved student: when you can perform the most of the movements related to the condition, but it requires continuing the treatment for some movement that faces difficulty when carrying it out with a lower dosage and/or planning than expected by them.

The results presented in (Table 1) demonstrated that all students participating in the research achieved a significant increase in the physical exercises applied throughout an entire work period. Significant numbers were shown in terms of uncompensated, compensated, compensated, and improved injury level students.

The duration of the applied proposal was controlled, from the beginning to the end of it, with the objective of measuring the time necessary to solve the spinal column conditions and knowing the time available to both the Education specialists Physics like the students, to systematize the proposal; this prevented them from being excluded due to injuries that can be resolved through the proposed treatment.

After applying the survey and having an information process, the social and interactive development with the group was evident, according to the results shown, which made it possible to express that the treated students had a follow-up after the application of the proposal, with the purpose of knowing the evolution of the physical state, in correspondence of the physical condition during the frequencies that were taken into account, the performance, dosage and planning of physical exercises, as well as the treatment for vertebral injuries, in the 20 students selected as a sample.



Through the observation method, the number of frequencies to classes received was analyzed, depending on the evolution of the students treated before, during and after the proposal was applied:

- Ten students achieved a fully compensated level of injury, with two frequencies received in Physical Education classes during a school year divided into two semesters, with a moderate level of demand between semesters, which represents 50% of the selected sample and the value of the applied proposal.
- Eight students managed to compensate for their level of injury with two frequencies received in Physical Education classes, for 40% of the selected sample, which means that the execution of the physical exercise proposal in Physical Education II and IV must be improved.
- Two students were unable to improve their level of injury with the two frequencies received in the Physical Education classes, for 10% of the selected sample, it represents an unsatisfactory result, since there were external, personal causes that prevented the proposed objectives from being met. With this particular student, the work continues until he/she manages to achieve his/her goal.
- During the application of the proposal there were no adverse reactions or consequences that could lead to the definitive suspension of the applied proposal.

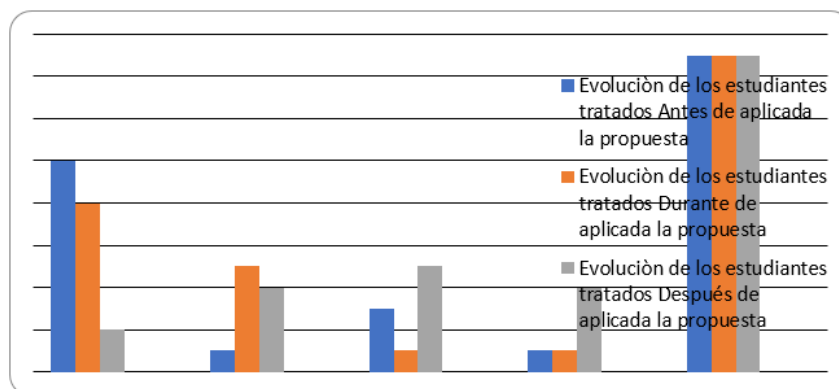


Fig. 2. - Evolution of students with scoliosis

*Source: comparison to determine the evolution before, during and after treatment*



It is shown that the results obtained with the development and application of the proposal in this group of selected students were positive, since none of them reported apparent pain or the use of drugs in case they had any pain while performing the exercises, only two could not overcome the objectives proposed by personal external factors unrelated to their execution, their evaluation was considered effective to improve health and physical conditions (Figure 2).

When describing the criteria of the 20 students treated in our research, it was found that what was issued about the result of the treatment received by each of them was free, without any type of censorship, the result of these endorsements positively compensates the efforts made. The results of the treatment received were the following:

- Eighteen students classified it as very good, for 90%.
- Two students classified it as good, for 10%, even though they did not meet the objectives.

## *DISCUSSION*

There are several studies that assess the effectiveness of kinesitherapy in preventing the progression of scoliosis and the benefits it provides. The results of the research showed an increase in the functional capacity and physical condition in students of the therapeutic area who are integrated into Physical Education classes, without the presence of complications.

With this study, it was possible to verify that when physical exercises are developed and selected, according to the treatment of scoliosis, to compensate for it and there is adequate organization and control, satisfactory results can be obtained as demonstrated by the studies carried out by De Oliveira *et al.* (2021), Echemendía (2021), Echemendía *et al.* (2022) and Morales *et al.* (2022), Quiónez *et al.* (2021) who presented similar results.



Authors such as Benítez *et al.* (2022) apply a physical-corrective exercise program in patients with idiopathic scoliosis through a minimal control experimental design with pretest-posttest for a single group, supported by a type of descriptive research study that demonstrates that, through these, the quality will be improved of life and the performance of daily and school activities.

For their part, Schreiber *et al.* (2013) evaluated the Schroth technique in 31 patients with EIA, between 10 and 18 years of age, with curves between 10-45° Cobb (with or without use of a corset) for six months; at the end of the study, only an improvement in muscle balance and posture was observed in these patients, but not in slowing down the progression of IE. Meanwhile, Negrini *et al.* (2009) conducted a prospective study with a one-year follow-up, where they compared a group of 48 patients treated with the SEAS protocol. 02 (Scientific Exercises Approach to Scoliosis. Version 2) with a control group that performed other types of non-regulated exercises and concluded that SEAS exercises improve the clinical and radiological parameters of scoliosis, compared to conventional exercises ( $p < 0.05$ ).

However, no differences were found with respect to conventional exercises in the proportion of patients who finally required a corset ( $p = 0.07$ ). This is a study in which the type of treatment of the control group is not specified and Patient follow-up is short-term. Along these lines, it has been observed that in recent years groups such as SOSORT (The International Society on Scoliosis Orthopedic and Rehabilitation Treatment) have attempted to establish scientific bases by verifying the effectiveness of exercises in the treatment of IE.

This same group has published two systematic reviews in which they affirm that exercises in spinal injuries have a level of evidence. The improvement in the level of evidence is due to the fact that this latest review includes a randomized clinical trial, but, at the same time, the low general quality of the studies, the poor methodological level of the included randomized clinical trial and the impossibility of perform a meta-analysis (Negrini, *et al.*, 2008; Negrini, *et al.*, 2015 and Negrini, *et al.*, 2022).



However, Morales *et al.* (2022) express that with the effectiveness of the Schroth method applied in idiopathic scoliosis, the conservative treatment of AIS, carried out with the combination of orthoses and the Schroth exercise program (SSE) is significantly better than the treatment applied with orthopedic devices or SSE of isolated form.

For Benítez *et al.* (2022), by applying an experimental design based on physical-corrective exercises using the ATJ Matrix, the satisfactory assimilation of the load applied to them is demonstrated, where the curvatures of scoliosis are corrected, which improves quality of life and performance. of schoolchildren's and adolescents' activities.

The analysis shows that there are various ways and techniques that have been used for the treatment of spinal injuries, but none of them have shown that the application of physical exercises as a treatment is better than traditional treatments; however, if they compensate and/or if they are well dosed, they can correct spinal injuries. In all the studies carried out, emphasis is placed on improving their application as treatment.

## CONCLUSIONS

With the application of physical exercises as a treatment for spinal injuries, the possibility was created for university students who attend the therapeutic area to receive Physical Education in periods I and II, to obtain the possibility of maintaining favorable health conditions to improve their physical performance; which allows them to have continuity within the Physical Education classes during periods III and IV, in the second year of the Degree to which they belong.

The application of physical exercises also helps to increase recovery time and their prompt insertion into the teaching-learning process, in order to improve their quality of life.

The preparation needed by personnel specialized in Physical Education and Therapy in particular requires basic knowledge of human anatomy, Asian theories, self-massage, therapeutic massage, psychology applied to massage, aesthetic massage, acupressure, sports massage, physical preparation among other theoretical knowledge, which helps to



better understand the sample that needs to be worked with to improve their physical condition, as well as their quality of life.

It was possible to solve that by increasing the recovery time, between 2 to 5 days after the injury, the student does not lose the level of physical preparation obtained, which makes it possible to continue with their planning within the Physical Education classes.

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***Conflict of interests:***

The authors declare not to have any interest conflicts.

***Authors' contribution:***

The authors have participated in the writing of the work and analysis of the documents



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