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CASE STUDY ON THE THERAPEUTIC APPROACH TO STRESS FRACTURES

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Abstract

Sports pathology is in continuous progress, stress fractures are present in a high percentage among amateur athletes as well as among professionals. In the first stage of recovery, the exercises were mainly used in the supine position, the aim was to reduce the pressure at the lower level, therefore walking with a crutch was chosen. Central to the recovery plan was the exercises used in the pool. These were integrated in the second stage, more precisely in the 5th recovery week, because it allowed unloading the weight in the water and facilitated mechanical work with resistance on all the targeted muscle groups. The exercises specific to the practiced sport were used in the last stage to integrate the athlete into the complexity of the game and reduce the occurrence of recurrence at the tibial level. The approach from the medical point of view is based on the multidisciplinary team that is composed of a doctor, physiotherapist and nutritionist to provide a successful medical procedure.

Introduction

Both in performance sports and at the amateur level, stress fractures are a problem that causes significant dysfunction, with an incidence that reaches 20% of all sports injuries. This pathology is also observed among the military, with a rate that reaches from 5% to 10% of thier total number , the cause being, a high degree of training overload [1], [2].

A primary classification of stress fractures is made according to their location, that being said most stress fractures are; at the tibia level, approximately 49% at the level of the tarsal bones, 25% the metatarsals, 9% the femur and fibula

however are affected at a lower percentage [3], this fact indicates a high prevalence of the extremities, the lower parts of the body for an obvious reason, the pressure exerted is proportionally greater on the respective compartments. Another classification of this pathology is made with the help of magnetic resonance, with the images seen on T1 and T2 being correlated with the recovery period [4].
The factors that trigger the occurrence of this type of fracture are diverse; sudden weight loss, overtraining, type of footwear, hormonal disturbances but also an insufficient intake of vitamin D [5], [6].

During maximal physical effort, through a sudden change in physical activity, the bones respond through a mechanism called the bone remodeling process to increase their resistance. If this type of effort is performed repeatedly, the body cannot adapt, the elastic and plastic deformation increases beyond the physiological limits, the consequence being microfractures that will later generate a stress fracture. Repetitive stress on the reconstruction process produces an osteocytic imbalance that disrupts the optimal functioning of osteoclasts and osteoblasts [7], [8].

The main symptoms in the event of a stress fracture are: pain, sensitivity to palpation, local edemas that are exacerbated after physical exertion, however, initially the pain will decrease (after the athlete has a period of rest), but if the exertion continues beyond these signals given by the body, then pain can be omnipresent [4].

Material-method

This study took place between 20.05.2023-25.08.2023, it is a case study that includes a single patient who gave his consent by signing the informed consent regarding the treatment methods and techniques that will be applied.

Working assumptions:

- the implementation of hydrokinetotherapy techniques can reduce and improve the recovery after stress fractures;
- integrating the athlete as quickly as possible into a recovery plan adapted to each individual's needs can contribute to the way the fracture is consolidated and reducing the time it tales to return to the field;

This study is about a performance sportsman, handball player, the position occupied in the field is that of center, with a central defender profile, aged 23, with a height of 193 cm, a weight of 95 kg, presenting a stress fracture located in the medial segment of the tibia. The previously described athlete has no history of stress fractures.

During the physical examination, the athlete complained of a pain that had persisted for approximately 3 weeks in the anterior area of the tibia of the left lower limb and sensitivity to palpation, as well as the quality of life being gradually disrupted affecting performances during training and the actual games themselves. The condition gradually started in the final period of the championship against the background of overloading due to the high number of games.

The final diagnosis was assigned with the help of X-rays, more precisely through an X-ray that was taken later, in which changes in bone density were observed in the area exemplified above, by which the attending physician recommended the integration of the patient into a recovery plan adapted to his needs [9].

Once the pathology was diagnosed, the multidisciplinary team, together with the athlete, decided to supplement with a drug used in the treatment of osteoporosis, during 3 months, which is also recommended as an adjunctive treatment in case of fractures.

Following the doctor's recommendation, the multidisciplinary team began the recovery in several branches that included elements of balneo-physio-kinesiotherapy and elements in the field of nutrition.

At the physical therapy program, the patient's anamnesis was performed, the initial assessment included anthropometric measurements and scales, objectives specific to the recovery stage, but also a series of exercises combined with physical therapy.

The parameters of the functional status were evaluated with a goniometer, the metric tape and scales, with the role of monitoring the recovery progress, and with the help of the CT device, the degree of bone reconstruction present in the fracture focus was evaluated [10], [11], [12].

To monitor the recovery process, we used the VAS (Visual Analog Scale) and QOL (Quality of Life) scales, which had the role of evaluating the level of pain and the quality of life felt by the athlete. These markers directed the level of complexity of the exercises, giving us valuable information about its general condition [13], [14].

Hydrokinetotherapy or recovery in water was the tool that was used from the first recovery stages because it allowed for the unloading of weight in water[15]. Joint, muscle and bone pressure being significantly reduced, this favored the maintenance of muscle strength by implementing isotonic exercises with increasing load, at the same time protecting the newly formed callus and moving to a higher stage of consolidation.

The recovery plan we used was consistent with the literature, it was structured in stages, presenting a series of progression goals that correlated with the symptoms and potential described by the athlete.

Phased recovery plan

Weeks 1-4

The first stage of recovery lasted about 4 weeks, I performed exercises predominantly in the supine position through which I aimed to maintain joint mobility, maintain muscle tone, muscle strength and reduce pain. During these weeks we performed isometric exercises at the level of: quadriceps, glutes, sural triceps; isotonic exercises aimed at the joints used in movement such as: free movements, movements performed against gravity from the supine position, at the edge of the bed and from the prone position.

In the last week of the first stage, I introduced the exercises with a slight resistance from the physiotherapist but also with the help of an elastic band, on all the muscle groups of the lower limbs, performed up to the pain limit without loading and demanding the fracture focus**.**

In order to reduce the degree of pressure present at the lower level, we implemented walking with a crutch through which our subject was taught to perform the steps efficiently in order to be able to move safely and in accordance with the specifics of the pathology he presented.

The pain was controlled by rest, physiotherapy consisting of electrotherapy and ultrasound therapy, cryotherapy applied 3-5 times a day for 15 minutes each application.

Also at this stage the athlete went to the gym to maintain the muscle strength of the upper body, performed it 5 times a week and consisted of exercises based on auxotonic contractions.

Weeks 5-8

During these weeks we considered: increasing muscle strength, protecting the newly formed callus and increasing the quality of life, pain did not present an impediment when the specific exercises were carried out.

Hydrokinetotherapy, more precisely recovery in the pool was implemented from week 5, it was divided into 3 phases in the following way: the warm-up phase lasted on average between 10 and 15 minutes, it took place both at the edge of the pool and in the pool. Exercises with a low level of difficulty were used such as: flexions-extensions, adductions-abductions, internal-external rotations performed freely because we aimed to warm up all joints and muscles involved in recovery.

The actual work phase took place in the pool, lasted approximately 30-40 minutes, it started with exercises aimed at distally positioned joints such as: the ankle joints, then exercises were performed at the level of the knees and at the coxofemoral level joints. The level of intensity used in this phase depended on the moment of recuperation at the beginning it was based on free exercises, walking exercises, walking with an added step, lunges and later it was opted for elements from the school of running, jumping, sprints and different types of running. The last phase of this process was called the recovery phase, it lasted on average 5-10 minutes and used free walking exercises, breathing exercises through which we tried to regulate respiratory and cardiac work and at the same time actual muscle unloading.

The kinetotherapeutic exercises presented a higher degree of difficulty compared to the previous stage. Exercises in the supine position, in the sitting position and in the upright position were performed isotonically, with body weight, free or with the opposite resistance from elastic bands aimed at increasing muscle strength in the lower limbs, improving coordination and increasing self-confidence.

Exercises in the strength room were reduced and performed only two days a week due to the high volume of training present in both the pool and the physical therapy room.

At the beginning of week 5, normal walking resumed, without crutches, and the athlete performed a good part of the extra sports activities without difficulties.

Weeks 9-12

The last stage of recovery came with a series of objectives that were defined as follows: maximizing muscle parameters, improving motor coordination and increasing exercise tolerance.

The exercises were mainly used from orthostatism and were composed of: running exercises, dynamic pivoting exercises, jumping, exercises specific to the handball game to integrate the athlete into the complexity of the sport practiced and get him in shape to be able to resume with success the activities you were doing before the injury.

The exercises used in the fitness room focused on the lower body muscles, the number of sessions from the previous stage was maintained, but their purpose was completely different because at this moment they could be used exactly on the muscles that were responsible for taking over the pressure of the body's weight in order to prevent recurrence at the tibial level.

In addition to the emphasis on stress fracture recovery we also aimed at limiting physical deconditioning throughout the recovery, it was sought that the acquisitions attributed during the competitive period are maintained throughout the

working period, through exercises specific to the type of sport practiced by the athlete.

Results

In this study, the results were monitored with the help of the tape measure, goniometer, QOL scales, VAS and also with the help of x-rays. These parameters were evaluated at each recovery stage, meaning that in weeks 1,5 and 9 we used the scales mentioned above and radiography was used to identify the fracture. At the end of recovery CT was the diagnostic method to validate bone consolidation.

Articular mobility was evaluated on all load-bearing joints with the help of the goniometer, both at the beginning of the evaluation and during the course, its impairment was not found.

Week 1

X-rays of the left calf from the front and from the side were performed, which confirmed the presence of the pathology called a stress fracture.

Figure 1. X-ray from the front

Figure 2. X-ray from the profile

Table 1. Initial Measurements

Measurements	Score/value Obtained
Perimeter of left calf	43cm
Perimeter of right calf	46cm
Perimeter of left thigh	58cm
Perimeter of right thigh	61cm
VAS scale	7
QOL scale	79

In Table 1 we have represented the initial measurements taken during the first week of recovery where the scales used and the lower level perimeters are displayed.

Week 5

I repeated the measurements made in the first stage, and recorded the obtained data.

Table 2. Intermediate Measurements

Measurements	Score/value Obtained
Perimeter of left calf	44 cm
Perimeter of right calf	45 cm
Perimeter of left thigh	59 cm
Perimeter of left thigh	60 cm
VAS scale	3
QOL scale	94

Table 2 shows the measurements that were performed in the second stage of recovery.

Week 12

At the end of the recovery, we evaluated the same parameters mentioned above, in addition it was decided to perform a CT scan to validate the consolidation of the fracture.

Table 3. Final Measurements

Measurements	Score/Values obtained
Perimeter of left calf	46 cm
Perimeter of right calf	46 cm
Perimeter of left thigh	60 cm
Perimeter of right thigh	61 cm
VAS scale	1
QOL scale	107

Table 3 shows the measurements from the last stage of recovery.

Interpretation of the results

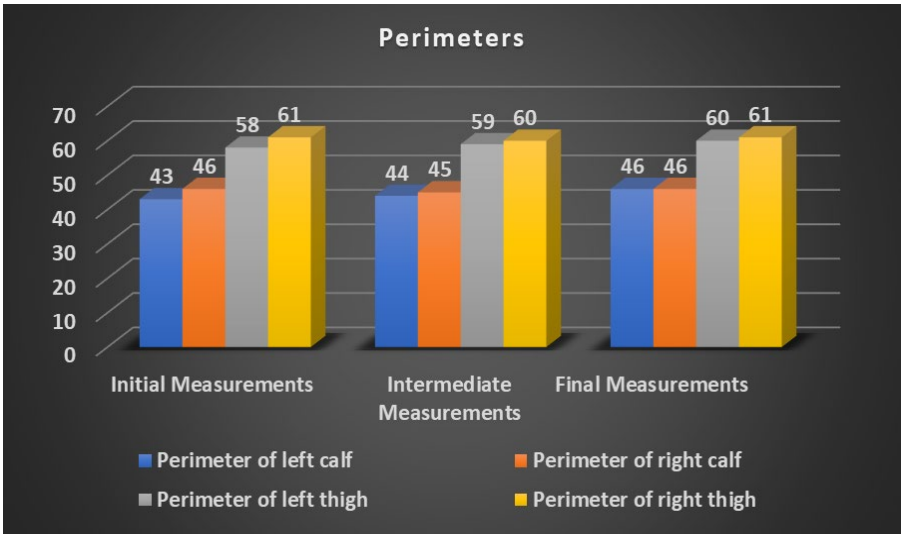

Figure 3. Perimeters Evolution

Figure 3 shows the evolution of the perimeters of the calves and thighs on both the right and the left, lower limb. The recorded results indicate a preservation of the muscle tone with a slight tendency to decrease in the 2nd stage of recovery, at the end of the recovery the tone was restored, even improved on some muscle groups.

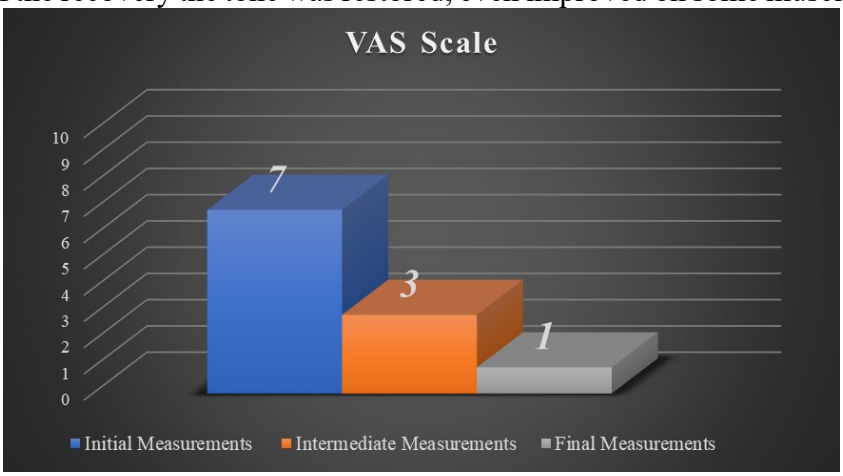

Figure 4. Evolution of the VAS Scale

The evolution of the VAS Scale was represented in Figure 4. The maximum value that could be reached was 10 which meant a significant degree of pain, a value of 1 was identified with the absence of pain. It can be seen that, at the first assessment, the pain was a signal for the medical team but also for the athlete because it affected his quality of life. In the second and third stages of recovery, the pain was no longer present in a high percentage, this fact facilitated the physical therapy exercises.

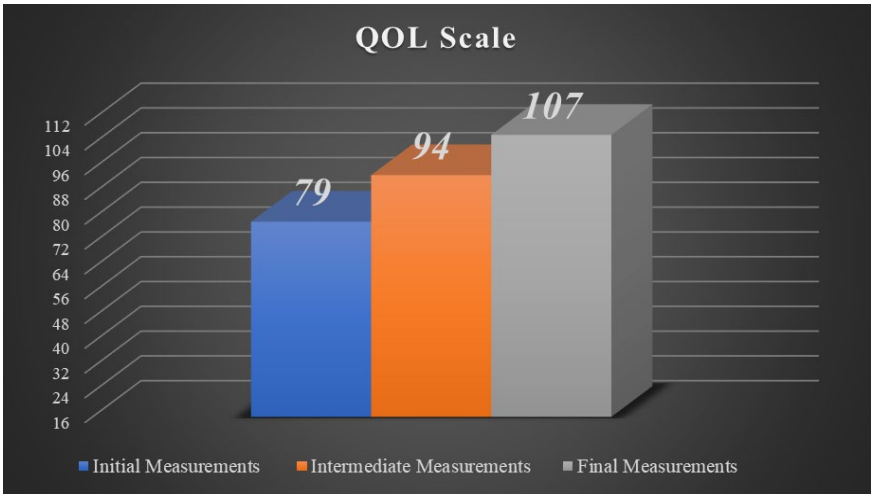

Figure 5. Evolution of QOL Scale

Figure 5 shows the values of the scale that evaluates the quality of life. The values obtained at the first assessment suggest a limitation of social, cultural and sports activities, jeopardizing the athlete's quality of life. Due to the disappearance of pain and the resumption of normal walking, most of the activities were resumed in the 2nd stage of recovery, less those related to the sports side, which were resumed after the 12 weeks of recovery. The maximum score that could be obtained within this scale was 112, the last assessment carried out in the last week of control presented a score of 107, reporting a high index of the quality of social, cultural and sports life.

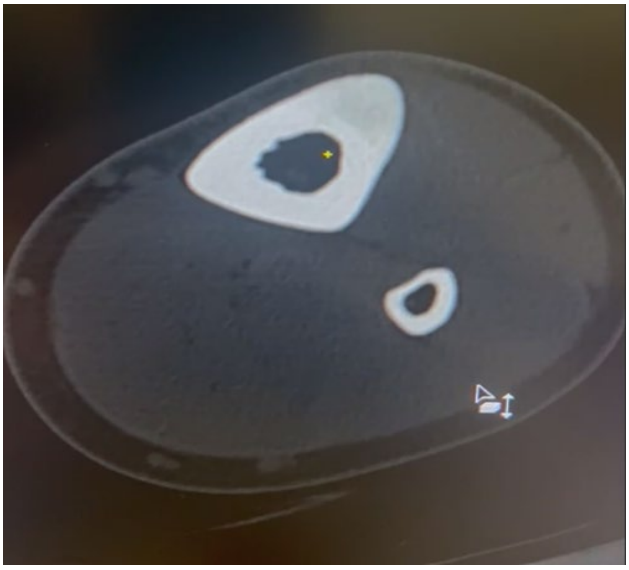

Figure 6. CT scan

A CT image of an axial section of the tibia is shown in Figure 6. This scan was performed at the conclusion of the recovery plan for the athlete to be cleared to play. The answer was positive because the stress fracture consolidated and the bone density was normal on the traumatized path.

Discussions

Recovery from stress fractures has several key components that have been identified in other studies. First of all, the elimination of the risk factors that led to the appearance of the pathology, then the reduction of the activities that exert a high pressure on the pathological bone, at the same time the healthy lifestyle must be an option to be taken into account [16].

Secondly, the integration of the patient in an early recovery plan, adapted to his needs, makes one of the most important parameters which is defined as the quality of life index to be closely monitored. This marker has been optimized to facilitate autonomy and to increase the self-confidence that the patient needs. We can see from the collected data a considerable improvement in the quality of life of the athlete in question.

The second parameter that we monitored during the recovery period was the degree of pain, at the beginning of the recovery, this inconvenience caused significant dysfunction, later, at the beginning of week 5, the pain was no longer felt which led to the healing process in a new stage.

Aquatic recovery or hydrokinetic therapy was the technique that we established to be the central element of the therapeutic plan because it allowed the unloading of weight in the water, facilitated exercises to maintain joint suppleness and maintained muscle strength on both the upper and lower groups. At the level of the affected limb, it promoted resistance exercises on all involved muscle groups and favored bone strengthening.

The kinetotherapeutic exercises were used from the first stage of recovery, they were adapted according to the sports pathology, they presented a good muscle response, and through the mechanical work performed, we facilitated the osteocytic balance that led to the repair of the fracture produced in the past.

Conclusions

Each patient must be approached differently depending on the particularities they present. In the case of a performance athlete, recovery times must be streamlined so that he returns to the playing surface as quickly as possible.

The exercises must present a degree of difficulty proportional to the level of training present in each individual. Any technique or therapy used must be taken into account to speed up the recovery process, without the risk of disrupting the proper course of bone consolidation.

The hydrokinetotherapy applied during the recovery demonstrated its effectiveness, while the techniques and methods described in the recovery plan formed a unitary whole that served the same purpose, namely, the optimal recovery of the stress fracture.

Stress fractures are a complex condition that requires an approach from a multidisciplinary team based on a specialist doctor, physiotherapist, nutritionist, to combine medical diagnosis, methods and techniques specific to balneo-physio-kinesitherapy with nutritional recommendations in order to ensure a successful medical procedure.

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