

Intervention through Physical Therapy in the Recovery of an Employee after Suffering a Tibial Fracture in an Accident at Work

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Abstract— Fractures are the main cause of workers' licenses especially in urban centers. Based on the importance of fractures as a cause of the licensing of company employees as well as the importance of implementing regulatory legislation on safety in work environments and the importance of the functional recovery process through physiotherapy, our study proposed this study case. In our study we described how an employee that suffered a type of work-related accident was recovered through physical therapy after defining strategies or methods during thirty days of treatment. We also verify the effectiveness of the accident prevention standards assumed by the company. The physical therapy resources used were Transcutaneous Electrical Nerve Stimulation -TENS, lymphatic drainage, laser therapy, passive mobilization, joint mobilization, kinesiotherapy and stretching. The employee that was hit by an industrial battery of one ton and eight hundred kilos, fracturing the proximal portion of his tibia, presented partially functional recovery after treatment according to the data of the joint's angular amplitude, visual analogue scale of pain, gait evaluation and muscle strength. The study suggests that Physiotherapy has a fundamental role in the physical and functional recovery of workers that suffer accidents in the workplace, positively reinforcing their psychological condition, with social support.

I. INTRODUCTION

Employees of companies need to comply with different demands, resist inadequate work conditions, experience work pressures and responsibilities imposed by the organization or structure of the work environment [1]. All companies must have employees engaged under an employment contract and follow the plans and actions to prevent accidents or illnesses according to the Labor Law in Brazil (CLT - Consolidation of Labor Laws) [1]. The main objectives of the modernization and simplification process of the Regulatory Norms (NR) of work are to stimulate business competitiveness and guarantee health and workplace safety [1,2]. There are several regulatory standards in Brazil, such as NR5 (Regulatory Norms -5),

which requires the company to implement an internal accident prevention commission (CIPA) composed of employees [2]. CIPA is responsible for collaborating in the medical control program (NR7) and health risk prevention program in the workplace (NR9). In addition to other programs all related to occupational health [2].

Studies report an average of 611,000 work-related accidents per year in Brazil of which 14,000 remain with sequelae and 2,300 employees die. [3,4]. Results show that the number of accidents at work has been decreasing. However, in urban centers, such São Paulo city, fractures continue to be the major cause of removal of employees due to sick leave [1,3,4,5].

Bone fracture is characterized by the disruption of the bone cortex, caused by the conversion of energy that is transmitted to other tissues [5,6]. The bones present in the human species are generally strong and can withstand intense impacts. However, if the impact is very intense or there is something wrong with the bone, it can fracture [5,6]. Complications of bone fractures are classified according to their severity, which can be determined through the following parameters: the history and mechanism of the trauma; vascular extremity trauma; the size of the cutaneous injuries; injury associated with tissue loss; periosteal changes, devitalization and bone necrosis; the fracture line, shattered bone and / or bone loss; contamination and compartment syndrome [7]. The fracture classification is done by adding the degree of intensity of each evaluated parameter. The classification may contribute to the elaboration or choice of the most appropriate treatment [7]. Tibial shaft fractures may be associated with important complications such as infection, pseudoarthrosis and vicious consolidation [7]. The geometric characteristics will depend on the direction in which the force was applied, its magnitude and degrees of knee flexion [7]. Based on the importance of fractures as a cause of the licensing of company employees as well as the importance of implementing regulatory legislation on safety in work environments and the importance of the functional recovery process through physiotherapy, our study proposed this study case. In our study we describe how an employee acquired and recovered from a tibial fracture through an individualized therapeutic treatment process. We also analyzed the effectiveness of the accident safety standards assumed by the company. We wait with our study to describe the functional recovery process of an employee who suffered an accident with fracture of the tibia and contribute to the knowledge about functional recovery.

II. METHODS

The retrospective descriptive case study was carried out with the beginning of the functional recovery of a tibial fracture. Data were collected from medical records and records of therapy results from its beginning to one year after the date of the accident. After being communicated about the importance of participating in a case study and the need for authorization to conduct the study, the employee signed a free and informed consent form. Then identification and anamnesis data were collected. The following criteria for the analysis of functional recovery were used: sensory evaluation, analysis of joint movement and analysis of muscle strength using the Kendall scale. Complementary laboratory data were collected from the start of treatment until the patient's recovery.

Physiotherapeutic treatment was divided into phases with well-defined objectives. At the end of one year of treatment, complete functional recovery of the patient was expected.

III. CASE REPORT

Patient J.G.A, 37 years old, male, with the position of administrator of a logistics company, was victim of an accident in his work environment, requiring emergency medical assistance. The accident occurred in June 2018 when the employee left his office to carry out what he calls "field work" or supervise the work of the team that dealt with the handling of machinery and equipment. According to his report, the company is dedicated to the transport of equipment or machines with heavy loads and the transport also takes place inside the company's own yard. In the company's yard there are metal tracks that facilitate intersectoral transport. It was during the attempt to help the team that a battery of approximately one ton and eight hundred kilograms (1.8 T), containing industrial acid, fell on the employee, causing serious injuries to the proximal portion of the right tibia. According to the victim's words, "I work a lot because I like it and I'm exacerbated, work for me is the most important thing, I work 12 hours a day because I like it and I always do this outside activity, I wanted to help. Then the worker was removed to the traumatic orthopedic emergency service, where he underwent a surgical procedure with insertion of osteosynthesis, plate and screw in the proximal region of the right tibia (Fig.1). After the post-surgical hospitalization period (12 days), the worker was transferred to a private physiotherapy clinic in Niterói RJ on 07/11/2018. The patient was received by the physiotherapy department of the clinic, showing dislocation and fracture of the proximal portion of the right tibia. The patient reported that he remained hospitalized for nine days and that only on the tenth day the surgical procedure was performed. The main complaints of the patient in the physiotherapy sector of the clinic were the sensations of pain and difficulties in moving the knee. The patient is not a smoker and does not use alcohol. He is not hypertensive and does not have diabetes. The injured employee was speculated by the researchers if he felt harmed by the company for admitting that the employee left his activity in the administration office to attend other functions even without training. The employee replied that the company provided all the support from the treatment to his return to work. It was clear to the interviewers that the employee shied away from questions when speculated about the company's security policy and the issuance of the Work Accident Report (CAT), whether he had access to INSS benefits, whether his work permit was paid by social

security (INSS - National Institute of Social Security) or not. It was asked if the worker made any kind of agreement with the company and that this agreement proposed the maintenance of the salary during the period of restoration of his health. It was asked whether the employee received the monetary value of his unemployment insurance or the Severance Pay Fund (FGTS). The worker always responded to change the subject, with periods of silence after short, incomplete answers, which forced researchers to change their question. There was clearly a lack of information in the answers given by the employee. He tried to avoid questioning. In the initial clinical evaluation of the patient, it was possible to verify, through physical examination, the presence of generalized edema in the right knee. The range of motion for knee flexion found was grade 0. There was a deficit of muscle strength in the entire right lower limb being classified as grade 1, according to the Manual Strength Scale for flexion movement (hamstring muscles) and knee extension (quadriceps muscle) [8]. Arthrogenic muscle inhibition of the quadriceps muscle and joint block for flexion with a rigid "final sensation" in the right knee were identified. The patient reported feeling intense pain when trying to contract the quadriceps muscles, classified as intense according to the Visual Analog Pain Scale [9]. The patient needed orthoses (two Canadian crutches) to move from place to place. The Romberg test was performed and showed a positive result for equilibrium deficit and there was also a reduction in strength in the upper limbs, which showed grade 4 according to the Manual Strength Scale [8]. Based on the data found through the initial clinical evaluation, the following short-term treatment objectives were established: pain reduction; reduction of edema and prevention of scar adhesion. Physiotherapeutic resources such as high frequency stimulation (TENS), were used on the right lower limb, on the right knee, for 20 minutes; cryotherapy on the right knee for 20 minutes with TENS. We tried to combine the depression of the sensitivity of the pain receptors and the containment of the edema caused by the postoperative. Manual lymphatic drainage was performed on the right lower limb; The laser (J/cm²) was applied by the punctual technique and passive scar mobilization was performed. This physiotherapy procedure was planned for the first ten days and extended for the next ten days. A new evaluation of the patient allowed the elaboration of new objectives, such as: to increase muscular strength in lower limb muscles, mainly ischio - tibial muscles, quadriceps muscles, hip adductors and abductors; increase the range of motion of the hip and right knee joint for flexion and full extension; improve gait, seeking basic functional recovery of gait and functional independence of the

patient. Passive joint mobilization (arthro- and osteokinematics) was performed on the right knee. The knee osteo-kinematic movements (flexion and extension) respected the patient's perception and tolerance of pain; the arthro-kinematic movements (sliding, rotation and traction) were carefully performed to avoid the risk of severe pain in hypersensitive regions that were identified in post-operative recovery. Osteokinematics movements were also for extension and flexion, adduction and abduction, medial rotation, and lateral hip rotation, bilateral. In addition, passive mobilization of the patella and myofascial release of the thigh and right leg muscles. There was also intervention with passive stretching of the posterior and anterior thigh and leg muscles, bilaterally, in addition to the continuity of treatment with high frequency stimulation (TENS) and laser (J/cm²). This treatment phase was completed in 30 days and the observations noted in the medical record. The purpose of the treatment was to make the patient gain more functionality and independence even with the severity of the injury presented. After 45 days of treatment, it was found that the prescription and physical therapy treatment partially achieved the proposed objectives. The new clinic evaluation was satisfactory with results that demonstrated more functional independence for walking and changes in posture. Then, new guidelines were added, such as assisted and resisted kinesiotherapy, partial weight unloading, assisted walking and independent walking aiming at removing the orthoses. According to the patient's evolution, the exercise loads were gradually increased new exercises could be prescribed. The patient's discipline helped a lot in his evolution. The patient systematically performed the activities at home, which were prescribed by the physiotherapist, mainly aiming at the total flexion of the right knee. The muscle strength progressed to the grade 4 in the manual strength test for knee flexion, and his angle of joint amplitude for knee flexion was already at 90 °, allowing more independence in activities of daily living. On 12/06/2019 the patient returned to work activities, but still maintaining the physiotherapy treatment physiotherapy for muscle strengthening and improve coordination and proprioception of the right lower limb. When comparing the data between the first clinical evaluation (July 2018) and the last clinical evaluation (December 2019), the patient presented an evolution in joint amplitude for knee flexion from 0 degrees to 90 degrees; muscle strength from grade 1 (vastus lateralis, vastus intermediate, rectus femoris and vastus medial, semimembranaceous, semitendinosus and biceps femoris) to grade 4; pain level rated from 10 (intense) to 2 (mild), according to the Visual Analogue Scale and the gait that was initially performed with the help of two Canadian

crutches in December was no longer necessary. Joint amplitude reached functional levels with changes in gait and posture, increased muscle strength and analgesia. The patient's gait was functionally organized, without the use of orthosis. In the following months, the patient completely abandoned assistance or contact with physiotherapists. After a few months, the researchers contacted the patient and new information was obtained. The patient said that he abandoned the treatment because he was having a lot of work at the company and thought he could improve naturally. However, the patient also reported that after a few months he had difficulties to completely recover his movements and the pain intensified. He also said that he tried to make an appointment with his doctor, but it was not possible. A clinical evaluation was made by another doctor who identified the bad positioning of the screws and the presence of excess scar tissue at the surgery site. The employee had to undergo a second surgery. Currently, he did not use the physiotherapy services of the initial clinic and even after the second surgery, he still reports difficulties in performing the movements and many pains.



Fig. 1: Conventional radiograph image taken after placing the osteosynthesis.

IV. DISCUSSION

Bone fractures are difficult to treat because loads, compression and joint movements make it difficult to analyze the affected segment [7,8]. Imaging tests such as radiation (X-ray) and computed tomography are necessary, which can expose the dimensions of the fracture and what should be researched in the physical evaluation. In addition, they help in the prescription of treatment and in setting goals [10]. Evaluation with anamnesis and functional physical examination is also essential for the development of a functional recovery plan [10]. The physiotherapist must have full knowledge of biomechanics and bone formation [11]. A study reports that cryotherapy associated with TENS has an analgesic effect, but the

effectiveness is not clear [12]. In our study the initial procedures were chosen to reduce the patient's pain to ensure the proper and efficient application of subsequent procedures. The presence of pain causes arthrogenic muscle inhibition, weakness and joint instability [12]. The techniques chosen for the treatment of the patient were based on the anatomy and biomechanics of the knee respecting the patient's pain threshold which proved to be effective. After the first 10 days of treatment the patient showed improvement in the level of pain, absence of edema and less arthrogenic muscle inhibition. The patient sought his functional recovery respecting all conducts at this stage of treatment. Thus, it was possible to deal with variations in techniques so that new objectives could be achieved. The techniques selected for this case were arthrocinematic and osteokinematic mobilization of the joint and elongation of the posterior thigh muscles. Range of motion is defined as the mobility capacity of a joint determined by bone structures and tissues in this region [13]. Joint mobilization is one of the most used techniques in kinesiotherapy in the treatment of joint mobility restriction [13]. At the end of the 30 days of treatment, the patient had less tension and less retracted muscles due to the application of the passive stretching technique. There was an improvement in joint movements due to the mobilizations performed. Passive mobilizations were made with the aim of improving arthrocinematic movements, improving the flexion of the patient's knee, stimulating the rotation and medial flexion movements of the tibia. This training was performed several times with the patient in the prone position, evolving to the supine position. During the execution of the arthrocinematic movements, it was possible to observe evidence of a possible rigid block in the injured region. Arthrocinematic work improved the performance of osteokinematic movements and thus included muscle strengthening in the treatment. There was a gradual acquisition of strength that allowed the patient to leave the orthoses. Great care was taken to remove the orthoses. Before the patient had to gain confidence and security. The patient walked without crutches, but this process was extremely respected and included several positive verbal stimuli. After 45 days of treatment, the patient was still in the clinic being treated with assisted and resisted kinesiotherapy, partial weight unloading, assisted walking and independent walking for removing the orthoses. During the treatment of the patient, there was an improvement in muscle strengthening and increased functional independence, however, he still had a rigid joint block that seemed to be possible to correct only with surgery. In strengthening training, all exercises were planned and performed according to the characteristics of the injury. All work was done first on an open kinetic

chain (CCA) and evolved into a closed kinetic chain (CCF). Special attention was focused on soft tissues for functional movement recovery. Myofascial release is a procedure similar to massage, which involves manual contact with the patient [13]. No treatment followed an existing protocol. For each stage, a different protocol of techniques was developed based on the evidence of the effectiveness of the conducts. Continuous physical therapy is essential for the patient's functional recovery. A clinical evaluation, prescription and execution, added to the home orientation of specific exercises or directed to the recovery of injuries and function, contribute to positive responses to treatment [13]. About the fact that the employee does not speculate about the record of the accident suffered in the Work Accident Report (CAT) by the company or does not adequately answer questions about his access to INSS benefits, if his work permit has been paid by O INSS or if the company kept its salary or if the FGTS was collected, it demonstrated that the employee avoided being questioned and tried to protect the company. The employee demonstrated that he assumed specific roles for his position and other functions typical of other positions to avoid resigning the position. We must remember that the employee suffered an accident while acting as an assistant in the transportation of cargo at the shipyard, even without receiving prior training. This leads us to reflect on how flexible the employee allows himself to be, exploited in the performance of functions other than his own, because he is afraid of being unemployed. The employee seems to imagine that he must do everything for the company, everything must be part of his obligation as an employee or subordinate. The employee's need to defend or protect the company during the interview suggests the notion of culture as a network which makes employees in general assume the company's interactive standards that can represent greater security, regularity and identity as an employee [14]. Thus, for the worker to "belong" and "remain" in the company, he must accept and share his norms, values and interaction patterns [14]. We know that organizations and society are still a long way from enforcing the ethical values that must regulate actions and guarantee the safety of employees in the institutions [14]. The adoption of the current neoliberal economic model brought with it the loss of the employee's rights, the reduction of the role of the State that started to transfer all responsibility to the employee who is now without support to be inserted or to remain in the productive system [15]. Thus, the worker is an orphan of the State [15]. The employee, submitting to the rules and exploitation or will be unemployed [14,15]. The employee learns that he must do everything for the company even if it affects physical integrity or health, everything must be done for the

company's project [15]. It is in this contractual employment relationship that employee rights weaken (all rights are applied only when there is regulation and inspection) and are transformed into exchange values, between money and products [15]. The biggest negative aspect that modern times have brought us seems to be the lack of an assessment of reality in the face of inhuman actions imposed by the rules of the consumer market [15, 16]. Today there is an uncritical population, everything seems to be possible even in the different forms of explicit totalitarianism [16].

V. CONCLUSION

There was a functional recovery of the patient favoring the return to activities. The recovery was seen a consequence of measures taken through the initial assessment and pre-defined objectives. The prescription, the physiotherapeutic plan and the execution of the treatment with objectives made possible the functional evolution of the patient. The response to the proposed physiotherapeutic treatment, culminated in the patient's functional recovery and his return to his activities.

The social inclusion of the patient after treatment occurred gradually after gaining some self-confidence and to experience his independence.

There are several factors that cannot be neglected in relation to physical therapy treatment: pain, physical discomfort and psychological impairments. These factors affect the ability to roam freely, to solve problems, to regain self-confidence, to gain self-esteem and to make constant comparisons with conditions before treatment.

Physiotherapy has a fundamental role in the individual's physical and functional recovery and reinforces the psychological condition. Individualized treatment and frequent patient evaluations favored his recovery.

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