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EFFECTS OF A PHYSICAL EXERCISE PROGRAM ON THE RECOVERY OF A PATIENT WITH TOTAL CALCEANUS TENDON INJURY: A CASE STUDY

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ABSTRACT

The present study sought to develop an intervention for muscle and tendon strengthening, analyze and discuss the importance of the role of Physical Education professional in the recovery of sports injuries. It was a semi-experimental Case Study. Considering the total rupture of the Achilles tendon, the patient underwent a pre- and post-test evaluation and a sequence of training, recovery and strengthening of the lower limbs. This research analyzed the importance of applying a post-surgical rehabilitation program with strengthening exercises in patients with total Achilles tendon injuries. A registration form regarding pre- and post-test measurements was used. The result obtained was a significant improvement in left foot movement, flexibility and limb strengthening. Furthermore, with the application of the tests and exercises performed in this study, the patient obtained a significant improvement in the recovery of heel movements. So, it is concluded that the Physical Education professional played a fundamental role in the patient's rehabilitation and post-surgical recovery process.

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INTRODUCTION

According to Gómez (2013), the Achilles tendon is one of the strongest and most powerful found in the human body, characterized by fibrous connective tissue, which is introduced by a muscle to a bone. It has a milky white color, strong consistency and cannot contract like a muscle. It consists of the gastrocnemius and soleus muscles and is inserted in the posterior portion of the calcaneus. It is the third most common injury to the human body, second only to rotator cuff and quadriceps injuries, and has a higher rate of events in middle-aged men who practice physical activity incorrectly or with high impact (GÓMEZ, 2013; MARQUÊS JUNIOR, 2016). There are several types of injuries that can compromise the skeletal muscle complex and its tendons (NERY, et. al., 2013). The incidence of Achilles tendon rupture has increased over the past 25 years (LANTTO, et. al., 2015). These injuries can be of traumatic origin or resulting from harmful processes, caused by prolonged suffering, intense exercise and traction or distraction forces (NERY, et. al., 2013). In some cases, the individual with tendon rupture presents sudden pain and instability in the hindfoot region, in this case, impairing plantar flexion and dorsiflexion movements, through the diagnosis it is possible to assess the degree of involvement (MARQUÊS JUNIOR, 2016). This incidence has increased remarkably in the last 50 years due to the increased interest in the practice of sports and recreational activities (PAJALA et al., 2002) usually in 75% of cases occur during sports practice and people over 30 years old, and sedentary, are more likely to injure the tendon, as they are in constant activity (overload) or lack of it (atrophy of the tendon). Stress, aging, obesity and lack of stretching before activities are groups that can also cause injury (HUFNER *et al.* 2007).

The lesion can be classified according to its chronology and evolution time, and it can be acute, subacute or chronic. According to the severity of the injury, there may be complete or partial ruptures (GÓMEZ, 2013). This rupture is considered a common clinical condition among athletes, as well as in people who are not adept at exercising (KHAN, et. al., 2000). In the athletic public there is a prevalence of 19% (LOPES, et. al., 2012) and while the non-athletic has a significant value of 24% (KUJALA; SARNA; KAPRIO, 2005). This took into account that one third of people with this condition are sedentary (ROLF, et. al., 2007). And this condition is characterized by the increased presence of fibroblasts, vascular hyperplasia, increased amount of proteoglycans and glycosaminoglycans, disorganized collagen, absence of prostaglandin cells (KHAN, et. al., 2000). The main factors that lead to tendon injuries are extrinsic factors such as training errors, inappropriate shoes and intrinsic factors such as inflexibility, weakness (ROOS, et. al., 2004). The predominant factor in the study presented was overweight, even if minimal, it may have influenced a lot at the time of the injury (GÓMEZ.

It is noteworthy that in the diagnosis of this injury, individuals have severe pain in the heel region, inability to bear load and difficulty walking. In some cases, the plantar flexion will be totally compromised. Physical examination reveals edema (accumulation of fluid in the subcutaneous tissue) or ecchymosis (blood stain on the skin), often within 2 to 6 cm near the insertion site. In fact, one of the most used tests is the Thompson test, due to its ease of execution and reliability (PETRILLO *et al.* 2013). The case study corresponds to a 27-year-old man who presented a ruptured Achilles tendon on October 5, 2019, during a soccer match, which caused an injury to his left foot. He was taken to the health post, with pain in the back of the ankle, with mild sensitivity in the left leg associated with mild edema and bruises in the ankle. The Thompson assessment was performed by the physician, in which he characterized the total rupture of the Achilles tendon. The participant in this study has no health problems, he is just overweight. Soon after diagnosis, immediate surgery (Krackow) was indicated to repair the Achilles tendon (tenorrhaphy). After the surgery was performed, the foot was immobilized with a splint, then discharged to perform basic care: how to protect healing,

The aim of this study was to analyze the importance of applying a post-surgical rehabilitation program with strengthening exercises in patients with total Achilles tendon injuries, with the specific objectives of evaluating the flexibility of the lower limbs, before and after the intervention of the strengthening process. A schedule of exercises forstrengthening and intervention was carried out, taking place twice a week, over a period of sixmonths and for muscle and tendon mobility every three months. It was also checked the effect of the intervention schedule on Achilles tendonrecovery.

METHODOLOGY

This is a case study, with the main objective of explaining, describing and exploring the phenomenon investigated here. It is characterized by being a detailed and exhaustive study of a few, or even a single object (as presented in this study), providing in-depth knowledge (YIN, 2009).

The study participant who voluntarily agreed to participate in the study signed the Informed Consent Form to start data collection. The sample was selected for convenience, in view of its proximity to the participant. This research was carried out with one participant. Data collection was performed at the GT Fitness gym, and because of the pandemic (COVID-19), the intervention program was applied at the patient's home, both located in Guaratuba/PR. This study was approved under Opinion No. 4,269,118, and complied with ethical principles. In the first days, after surgery, he was concerned with basic care (saline solution and gauze) represented in figure 1 and figure 2. Only one day he needed to take pain medication, walking with crutches and plaster. By the 8th day, he was able to move his foot in dorsi and plantar flexion. On the 12th day, the cast was removed, and it remained only for the dressings and continued with the plantar exercise. With the total removal of the stitches on the 36th day, he was allowed to use the orthopedic boot, consequently, he only used a crutch. After 10 days, he was able to walk only with his boot, as shown in figure 3. When he completed 61 days after surgery, he returned to the gym to train upper limbs, as he was not yet released to start strengthening his lower limbs again. One day after returning to activities, he was able to take his first steps without the boot, but he only walked around the house, so that nothing more serious would happen. Finally, for the 78th day, the physiotherapy sessions were released, at first there were 10, but after the end of them, another 20 sessions were passed, already allowing for the work of strengthening the lower limbs, but because of the pandemic (COVID-19), it was not possible to perform physiotherapy, so it continued only with the strengthening schedule. Figure 4 represents the completely healed scarring. then it just proceeded with the strengthening schedule. Figure 4 represents the completely healed scarring. then it just proceeded with the strengthening schedule. Figure 4 representsthecompletelyhealedscarring.

Source: Authors (2021)

Figure 1. First day of hospital discharge

***Source**: Authors (2021)*

Figure 2. Procedure for cleaning the Stitches

Source: Authors (2021)

Figure 3. First contact with the orthopedic boot

Source: Authors (2021)

Figure 4. Surgery fully healed

The intervention was carried out for six months, initially every day, at the gym (while it was open), after which it was carried out at the participant's home. But after two months, there was a restructuring in the schedule planning, changing to only three times a week (Monday, Wednesday and Friday), with a duration of 1 hour each session.

Before the application of the program, a warm-up and stretching was always performed before the main training. The main training always consisted of flexibility and strengthening exercises every day, so that I could develop the goal with greater excellence. Flexibility exercises were always performed with the aid of an elastic band, always starting from the lightest, until reaching the heaviest. A Swiss ball for solo pilates was also used, with stretching exercises. Strength training consisted of using a jump, step, soccer ball, traction belt, rope, weights and washers. Always focusing on stretching and strengthening the lower limbs, more specifically, the posterior portion of the thigh and calf. The series depended a lot on the exercises (4x10 or by time). The intensity increased according to what the participant could stand, always starting from the lightest, to what the participant could withstand. But never going too far, so that no injuries occur. The individual was released to perform physiotherapy after the 78th post-injury.

DATA COLLECT: Data collection was carried out from September to April 2020/2021 the data were collected by the academic of the Bachelor of Physical Education course at IELUSC Faculty Rafaela MacioskiBisoni, supervised by Professor MarildaMorais da Costa and co-supervised by Professor Alisson Padilha de Lima. After approval by the person in charge of the academy for the release of space for the academy and the participant. The Informed Consent Term - TCLE was made available for participant's signature. After meeting the ethical criteria, the dates for carrying out data collection were outlined.

RESEARCH INSTRUMENTS: Form carried out with the participant with basic data and important questions for the relevance of the study, such as: anthropometric data and measurements, schedule of strengthening exercises, flexitest (ARAÚJO, 2002). An adipometer was used and the 1978 Pollock test (seven skinfolds) was performed to obtain anthropometric data, diameter, to obtain the participant's bone weight, a tape measure to obtain height and body measurements (torso, waist, abdomen , thigh, calf, biceps, forearm, hip), and a scale to obtain the weight (MCARDLE, 2003).

RESULTS

An individual, male, 27 years old, black, complete higher education, electrical engineer, single, does not use medication, smokes and drinks socially participated in this research. Because the patient had a complete rupture of the Achilles tendon during asoccer match, Flexitestwas applied, obtaining results and data with a significantimprovement in the work developed, from the six months of intervention ofstrengthening and stretching exercises.We noticed that there was a significant improvement in relation to the patient's body composition, as shown in table 1.

Table 1. Body composition of a man with Achilles tendon injury

Body composition	Pre	After 3 Months	Post 6 Months
Body mass (kg)	96.7	90	87
height (cm)	1.81	1.81	1.81
*BMI (Kg/m2)	96.7	90	90.8
Body fat (%)	20.38	18.78	17.34
Fat Weight (Kg)	19.71	16.90	15.75
Residual Weight (Kg)	23.30	21.69	20.96
Bone Weight (Kg)	17.17	17.17	17.17
Muscle Weight (Kg)	36.50	34.22	39.66

Source: Authors (2021). *BMI: Body Mass Index.

Table 2. Effects of a physical exercise program on the flexibility of a man with total Achilles tendon injury

Flexitest	Pre	After 3 Months	Post 6 Months
Lower members	17	18	22
Trunk	4	5	7
Upper limbs	14	16	17
Total Score	35	39	46

Source: Authors (2021)

Figure 5. Execution of the movement of Dorsiflexion pre-protocol

Figure 6. Execution of the movement of Dorsiflexion post-protocol

Figure 7. Execution of the pre-protocol Plantiflexion movement

The body mass index is one of the main indicators used to carry out the nutritional classification of obesity and thinness.

Source: Authors (2021) Source: Authors (2021)

Figure 8. Execution of the Post-protocol Plantiflexion movement

However, other indicators of body composition, such as the ratio between lean mass, fat mass, bone weight, residual weight and body water, could be used to determine the influence on the occurrence of injuries (SILVA et al. 2019; JÚNIOR et al, 2016; COIMBRA et al, 2002). We can see a significant improvement after the intervention with the strengthening and flexibility schedule. According to figures 5, 6, 7 and 8 below, we can prove that the proposed exercises had a satisfactory result.

DISCUSSION

The aim of this study was to analyze the importance of applying a post-surgical rehabilitation program with strengthening exercises in patients with total Achilles tendon injuries. And analyze and verify the effect of the intervention schedule on Achilles tendon recovery. According to the study by Maffulli, et al. (2004) calcaneal tendinopathy is very common in amateur or professional athletes. The etiology of tendinopathy is not well known, but many factors play an important role in its pathophysiology. The break classification is partial or total. In the total rupture of the Achilles tendon, the tissues rupture completely, that is, the tendon is completely separated into two parts, leading to compromised movement capacity, and automatically to the surgical case. As for partial rupture, the tendon does not rupture completely, there is only an incomplete rupture, which can vary greatly in severity according to the extent of the trauma, in this study the tendon rupture was total (MAFFULLI, *et al.* 2013).

For Park *et al.* (2020) there is no clear consensus on the ideal treatment for acute Achilles tendon rupture, and it is known that studies have demonstrated the critical role of functional rehabilitation in the treatment of torn tendons. However, there is a consensus that surgical treatment is still considered a more reliable treatment option in case of acute Achilles tendon rupture. Wren (2001) reported that the high incidence of rupture in this tendon is also related to individuals who are normally sedentary, and involved in an intermittent and strenuous physical activity. In the case of this study, the participant was overweight (according to table 1), and had been exercising at the gym every day and playing soccer once a week, but the injury may have been caused by other variables that were not considered in this study. Quemelo (2019) says that in acute injuries, there is an incidence of 31 cases for every 10,000 inhabitants per year, in people between 37 and 44 years old, in males. The two forms of recovery are conservative treatment, which immobilizes for 4 weeks and has early rehabilitation. Or surgical treatment, which can take an open or invasive approach. The patient in question was 27 years old, male, who had to undergo surgery to recover the Achilles tendon, an injury that occurred during a soccer match, information that corroborates the statement by Gomes (2013) that the risk factors that cause Achilles tendon injury occurs in sports activities performed many times on weekends, in this sense the injury generation mechanisms are due to direct trauma to the tendon.

According to Wiegerinck, *et al.* (2013) eccentric exercises for insertional Achilles tendinopathy did not show satisfactory results, while ESWT (extracorporeal shock wave therapy) was better according to a systematic review. In the case study, the patient whose tear was complete had a three-month recovery period before being released to start the exercise schedule, which lasted six months. But that he would be able to return to playing football after the first ten physiotherapy sessions, it was estimated that he would take three months to return, however, due to the closing of the establishments on behalf of COVID-19, in 2020 this period was extended. Currently, the postoperative treatment of acute Achilles tendon rupture remains controversial (HUANG, et. al., 2015). Among the recurrent complications can be found a deficit of strength, as well as ruptures and a decrease in the plantarflexor function, that is, the gait loses the ability to elevate the heel (PORTER, et. al., 2015). The participant did not lose the plantarflexor function, but improved with more than 100% (strength and flexibility). In addition, she felt she could walk and run more easily after the intervention of the physical education professional, following and performing the exercises.

In the study by Porter, et al. (2015) presents two groups that they classify as aggressive and conventional, where, respectively, one received physical therapy soon after redoing the tendon ligament and the other rested for 28 days before starting the process. The aggressive compared to the conventional one had a higher ATRS (Achilles Tendon Rupture Score), however, lower verbal pain score, lower consumption of pain medication and return to work earlier, greater strength in the Achilles tendon, greater degree of heel elevation, re-rupture rate was 5% and 5%, strength deficit was 42% and 5%, and overall complication rate was 11% and 15%. Compared to the article above, there was a longer delay in relation to physical therapy, as he was released 78 days after the surgery, because it was performed in another state and by SUS.

According to Horstmann et al. (2013) and Rompe et al. (2007) compared eccentric training with a group over a 12-week period. In the study by Horstmann et al. (2013) they performed 3 sessions per week, totaling 36 workouts, including only runners, while Rompe et al. (2007) were 2 training sessions per day, that is, 168 training sessions, studying athletes and non-athletes. Obtaining a relationship between the studies, there was a decrease in pain and a significant increase in eccentric and concentric strength in ankle plantar flexion (HORSTMANN *et al.* 2013). Silbernagel et al. (2007) observed and evaluated the effect of continuing or not physical activity (running and plyometric exercises) during a 12-week to 6-month daily strengthening program for Achilles tendon rehabilitation. Both performed the same training, being combined exercises and exercises alone.

The muscle strength of the triceps surae, in its concentric-eccentric contraction, had a significant increase in the 6th week for the CG (concentric group). But concentric strengthening did not work well in any of the groups. The EG (Eccentric group) had a significant decrease in dorsiflexion amplitude in the 6th week and 6th month. According to these studies, and comparing with the study presented in this article, the participant obtained significant and very positive improvement in a matter of 2 months using the protocol,

FINAL CONSIDERATIONS

Considering the application of the tests and exercises presented in this study, the patient obtained a significant improvement in the recovery of heel movements, as well as a reduction in body weight. Therefore, it reinforces the importance of applying a physical exercise program in order to recover the injured part, and in this way help you to return to your daily activities more immediately, thus obtaining satisfactory results. It is concluded that the Physical Education professional has a fundamental role in the rehabilitation and post-surgical recovery process, both of the Achilles tendon. And it is recommended to carry out further studies to further deepen the topic discussed and have better results with a professional.

REFERENCES

ARAÚJO, CGS Flexitest - a complete method to assess flexibility. Publisher: Editora Manole, 2002.

COIMBRA, IB; et al. Brazilian Consensus for the treatment of Osteoarthritis (Osteoarthrosis). Rev Bras Rheumatol. 42(6): 371-4, 2002. Available at:https://www.scielo.br/j/rbr/a/F39L TRWZ985dP VQTpYPcvfJ/?format=pdf&lang=ptAccessed on: Jul 1, 2021.

COOK, JL, KHAN, KM, MAFFULLI, N., & PURDAM C. Overuse tendinosis, not tendinitis part 2: applying the new approach to patellar tendinopathy. The Physician and sportsmedicine, 28(6), 31–46, 2000.

Available in: https://pubmed.ncbi.nlm.nih.gov/20086644/ Accessed on: 07 Jul 2021.

GÓMEZ, YR Rehabilitation case study of Achilles taping by neuromuscular tenorrhaphy. FIEP BULLETIN, Colombia, v. 83, 2013. Available at:http://www.fiepbulletin.net/ index.php/ fiepbulletin/article/download/2776/5408. Accessed on: Jun 30, 2021.

GUTIERRES, M. SaúdeBemEstar: Achilles tendon rupture or rotation. Available in:https://www.saudebemestar.pt/pt/cl inica/ ortopedia / ruptura-do-tendao-de-aquiles/.Accessed on: June 1 2020.

HORSTMANN, T.; *et al.* Whole-body vibration versus eccentric training or a qait-and-see approach to chronic Achilles tendinopathy: a randomized clinical trial. Journal of Orthopedic Sports Physical Therapy, 43(11), 794-803, 2013. Available at:

https://pubmed.ncbi.nlm.nih.gov/24175595/ Accessed on: Jul 1, 2021.

HUANG, J.; et al. Rehabilitation regimen after surgical treatment of acute Achilles tendon tears: a systematic review with meta-analysis. Am J Sports Med. Apr;43(4):1008-16, 2015. Available at: https:// pubmed. ncbi. nlm.nih.gov/24793572/ Accessed on: 07 Jul 2021.

HUANG, X.; et al. Augmented Repair Of Acute Achilles tendon rupture using an allograft tendon weaving technique. J Foot Ankle -

Surg; 54: 1004-9, 2015. Available at:https://pubmed.ncbi. nlm.nih. gov/ 26015299/ Accessed on: 07 Jul 2021.

HUFNER, T.; KRETEK, C.; KNOBLOCH, K. Achilles tendon rupture -early functional and surgical options with special emphasis on rehabilitation issues. Fuss Sprung, no. 5, p. 269-277, 2007. Available at:https://europepmc.org/article/med/17385103 Accessed on: March 1, 2021.

KANGAS, J.; et al. Achilles tendon elongation after rupture repair: a randomized comparison of 2 postoperative regimens. Am J Sports Med; 35:59–64,2007. Available in:https://pubmed.ncbi.nlm.nih.gov/16973901/ Accessed on: 07 Jul 2021.

KUJALA, L.; SARNA, S.; KAPRIO, J. Cumulative incidence of Achilles and tendon rupture tendinopathy in male former elite athletes. Clin J Med Sport; 15: 133 - 5, 2005.

LANTTO, I.; et al. Epidemiology of Achilles Tendon Ruptures: increasing incidence over the 33-year period. Scand J Med SciSports, 25(1):133–8, 2015.

Available in: https://pubmed.ncbi.nlm.nih.gov/24862178/ Accessed on: Jul 1, 2021.

LONG, UG; PETRILLO, S.; MAFFULLI, N.; DENARO, V. Acute achilles having rupture in athletes. Foot Ankle Clin, v. 18, p. 319-38, 2013.

LOPES, AD; et al. What are the main running-related musculoskeletal injuries? A systematic review. 42:891-905, Sports Med., May; [Epub ahead of print], 2012.

MARQUES JUNIOR, NK; BARBOSA, O. Achilles tendon injury in a volleyball athlete: experience report. RBPFEX - Brazilian Journal of Exercise Prescription and Physiology, vol. 10, no. 57, p. 29-66, May 9, 2016.

MCARDLE, WD KATCH, FI; KATCH, VL Exercise Physiology. 5. ed Rio de Janeiro: Guanabara, 2003.

MAFFULLI, N.; SHARMA, P.; LUSCOMBE, KL Achilles tendinopathy: aetiology and management. JR Soc Med, v. 97, n.10, p. 472-6, Oct., 2004.

Available in: https://www.ncbi.nlm.ni h.gov/pmc/article s/PMC 1079614/Accessed on: June 12 2020.

NERY, CAS; et al. Assessment of isokinetic muscle strength of the foot and ankle after surgical treatment of Achilles tendon injuries, using short peroneal tendon transfer. Rev Bras Ortop., (7):503-12, 2013.

PAJALA, A. et al. Rerupture and deep infection following treatment of total Achilles tendon rupture. J Bone Joint Surg Am, v, 84-A, n. 11, p. 2016-21, Nov., 2002. Available at:http://www.ncbi .nlm.nih.gov/pubmed/12429764.Accessed on: June 12 2020.

PARK, SH; et al. Treatment of Achilles AchillesTendon Rupture. ClinOrthoSurg. Mar;12(1):1-8, 2020. Available at:https://ecios.org/search. php?where=aview&id=10. 4055/cios.2020.12. 1.1&code=0157CIOS &vmode=REFAccessed on: 07 Jul 2021.

PORTER, MD; SHADBOLT, B. Randomized controlled accelerated rehabilitation versus standard protocol after surgical repair of Achilles tendon rupture. ANZ J Surg., 2015.

ROLF, C.; MOVENDO, T. Etiology, histopathology, and outcome of surgery in achillodynia. Foot Ankle Int; 18: 565 - 9, 2007.

RUPPE, JD; NAFE, B.; FURIA, J.P; and MAFFULLI, N. Eccentric loading, shock treatment, or a wait-and-see policy for tendinopathy of the main body of tendoachillis. The American Journal of Sports Medicine, 35(3), 374-383, 2007.

ROOS, E.; ENGSTRON, M.; LAGERSQUIST, A.; et al. Clinical improvement after 6 weeks of eccentricity in patients with middle portion, Achilles tendinopathy and a randomized trial with one year of follow-up. Scand, J. Med. Sept. Sports, 14, 2004.

SILBERNAGEL, KG; et al. Continued sports activity, using a pain monitoring model, during rehabilitation in patients with Achilles tendinopathy. The American Journal of Sports Medicine, 35(6), 897-906, 2007.

SILVA JG; et al. Body composition and the occurrence of pressure injuries: an integrative review. Rev baianainfirm.; 33: 28790, 2019.

WIEGERINCK, JI; et al. Treatment for insertional Achilles tendinopathy: a systematic review. Knee Surg Sports TraumatolArthrosc., v. 21, no. 6, p.1345–55, 2013.

WREN, T; et al. Mechanical properties of the human Achilles tendon. ClinBiomech; 16:245-51, 2001.

YIN, RK Case study research, design and methods (applied social research methods). Thousand Oaks. California: Sage Publications, 2009. Available at: https://journals .nipissingu.ca/ index.php/cjar/article/view/73 Accessed on: 07 Jul 2021.

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