



## ACHILLES TENDON RUPTURE. REHABILITATION TOOLS AND RECOVERY PERIODS – WHAT ARE THEY?

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### ABSTRACT

**Introduction:** The Achilles tendon rupture is one of the most common tendon injuries, typically observed in persons of active age. Treatment can be either surgical or conservative. Very often the impact of such a traumatic injury requires a prolonged period of time before the patient is fully re-socialized. **Material and Methods:** 84 patients received treatment over a period of 7 years; of those, 63 were male and 21 female, aged 29 through 68 (average age: 42.1 years). Of the patient population, 73 had received their injuries doing sports, 9 as a result of falls from heights, and 2 had inflicted self-injuries while operating cutting machinery. During the post-surgery period, the patients underwent re-habilitation: learning to walk using crutches; coping with postoperative swelling; they received treatment of postoperative lesions using physical tools and massage techniques; and underwent

mechanotherapy. The aim was maximum recovery of the motion freedom in the ankle joint and restoration of muscle strength, enabling the patients to walk properly without walking aids. **Results and Discussion:** Statistics of damages to the left/right lower extremity show a 64.8-percent prevalence of the right one. The Achilles tendon rupture was surgically restored using the Krakow technique. Cryotherapy was administered on 82.4 percent of the patients. We did not treat patients with ruptures of both Achilles tendons, nor did we observe any complications or re-ruptures when the surgical technique referred to above had been used. All patients were rated for pain using the VAS scale. Active rehabilitation started after the 4<sup>th</sup> postoperative week with personalized programs applying individual load increase determined

Article Received on  
07 Feb. 2019,

Revised on 28 Feb. 2019,  
Accepted on 21 March 2019,  
DOI: 10.20959/wjpps20194-13515

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in accordance with the patients, functional capabilities, age, locomotory culture, body weight and other indicators. Complete recovery of physical fitness was observed in 82 percent of the patients by month 4, in 16 percent by month 5, and in the remaining 2 percent, by month 6 after surgery. The medic's aim is to identify the mechanism of inflicting the damage, the time lapse since it was inflicted and the existence of any predisposing conditions. It is important to assess with a high degree of certainty the functional capabilities of each patient, as well as the proper load that can be placed on him/her at each subsequent stage. Rehabilitation methods and the preparation of individual treatment protocols occupy a crucial place in the comprehensive therapy of the damage, as well as in the re-socialization of the patients and their return to a normal routine. **Conclusions:** The treatment of this trauma is interdisciplinary with kinesitherapy being the key method for returning the patient to a normal routine. Recovery to active competitive shape usually takes about 4 to 6 months, but with high motivation and very active physical therapy the recovery period may be shortened to something like 3 months.

**KEYWORDS:** Achilles rupture, kinesitherapy, impaired function.

## INTRODUCTION

The Achilles tendon is the strongest in the human body; it has a tensile strength of up to 400 kilograms, sometimes even more. Nonetheless, it belongs to the category of the most commonly traumatized tendons.<sup>[1]</sup> The Achilles tendon rupture is a common lower extremity injury seen in the active population.<sup>[2]</sup>

When ruptured, typically the Achilles tendon snaps completely in two. Usually damage occurs when there is a sudden spike in the load the tendon bears: when sprinters take off the starting line, when the foot propels the body from the ground in a high jump, or in case of a sharp bending of the foot and lower leg backward – e.g., in case of a fall from a height. Direct injury with a cutting tool may cause partial damage to the tendon. A hemorrhage and swelling appears in the lowermost third of the lower leg. A concavity indicates the point of rupture. No plantar flexion of the foot is possible; the patient cannot stand on his/her toes. Such ruptures are more common in men, and less so in women; they can be open or closed.

Tendinopathies are challenging. The term "tendinopathy" refers to a clinical condition characterized by pain, swelling, and functional limitations of tendons and nearby structures.<sup>[3]</sup>

Tendinopathies are among the most frequent sport injuries, therefore their correct treatment is

a crucial issue in sports medicine practice. In most of the cases, these multifactorial conditions are related to overuse and characterized by activity-induced pain, local tenderness and swelling. Although tendinopathies are common, their treatment is not easy. Currently, it is generally accepted that their management should include early functional exercises.<sup>[4]</sup> Treatment can be surgical or non-surgical (conservative).<sup>[5,6,7,8,9,10,11,12,13,14,15,16]</sup> The aim of surgical treatment is to restore the anatomical integrity of the tendon. Where operative treatment is the method of choice, the incidence of re-rupture is relatively lower than in non-operative (conservative) treatment. Operative treatment enables the patient to return sooner to a sports routine, with better functionality and less shortening of the calf muscles.

The risk of re-rupture is higher in non-operative treatment, which includes either placing the limb in a cast or the use of splints, as well as rehabilitation<sup>[17,18,19]</sup> and physical therapy.<sup>[20]</sup> Besides the initial operative or non-operative treatment, rehabilitation of patients plays a crucial role for tendon healing and long-term outcome.<sup>[21]</sup>

Trauma treatment is interdisciplinary, as it involves traumatologists, echographers, physical therapists, and rehabilitators. For experts in physical therapy, it is especially important to know the answers to questions like: what are the causes of an Achilles tendon rupture? What are the mechanisms of damage and what do we aim to achieve by our choice of tools and methods of rehabilitation in the postoperative period?

According to Habetsa *et al.*, Achilles tendinopathy (AT) can cause long-term absence from sports participation, and shows high recurrence rates. It is important that the decision to return to sport (RTS) is made carefully, based on sharply delimited criteria.<sup>[22,23]</sup>

The purpose of rehabilitation in cases of Achilles tendon rupture is to restore the tendon to its normal length and tension.

## **MATERIAL AND METHODS**

Patients with such injuries are most common during the warmer months. Of the patients studied for the purposes of this paper, 44.02% received their injuries in the summer, and 21.2%, in the spring and fall. 84 patients received treatment over a period of 7 years; of those, 63 were male and 21 female, aged 29 through 68 (average age: 42.1 years). Of the entire population, 73 had received their injuries during sports activities, 9 as a result of falls from heights, and 2 had inflicted self-injuries while operating cutting machinery. They were diag-

nosed through anamnestic data, clinically, and by instrumental methods: sonography, MRI (magnetic resonance imaging). We prepared a personalized rehabilitation plan for each patient on the basis of their local status and functional capabilities, while strictly adhering to the timeline for therapeutic behavior following the operative/non-operative intervention administered.

### **I. Postoperative rehabilitation period: immobilization**

1. Rest: aims to provide sufficient time for healing while avoiding recurrent damage;
2. Placement of orthotic booth on postoperative day 1: 20° to 45° for plantar flexion in the ankle joint for three weeks (differences in degrees depend on the extent of the rupture);
3. The patient learns to walk with two walking aids (crutches) to restore autonomous mobility;
4. Stitches are removed on postoperative day 14.

**II. Early post-immobilization period** – postoperative day 21: aims to improve the functionality of the limb that has undergone surgery.

The objectives of the rehabilitation plan are.

1. Dealing, as early as possible, with the post-immobilization shock;
2. Reducing pain;
3. Improving blood and lymph circulation in the limb;
4. Gradual improvement of the mobility of the ankle and knee joints;
5. Gradual increase of muscle strength;
6. Passive methods: massage, PIR (post-isometric relaxation), passive exercise, aimed at increasing limb mobility;

The means and methods we have used are.

1. Cryotherapy, administered on 82.4% of all patients;
2. Analytical therapeutic massage on the entire lower limb in 100% of the cases, as well as gentle massage of the postoperative scar tissue;
3. We have also used methods of proprioceptive neuromuscular facilitation;
4. The rehabilitation plan included active exercise with a gradual increase of the load for all muscle groups from all starting positions: for the lower limbs – foot, lower leg, thigh and gluteus muscles;
5. Mechanotherapy for the ankle and knee joints;

6. Exercise using devices: elastic band, wall bars, medicine ball, weights, etc., from various starting positions;
7. Physical means of getting rid of postoperative scar tissue:
  - Low intensity magnetic field in the following dosage: 14,000 A/ m, 10 Hz, 15-20 min., 0.2 sec., 15-20 sessions;
  - Phonophoresis with fibrinolytic medication: 0.5-0.8 W/ cm<sup>2</sup>, 15-20 sessions;
  - Laser therapy.

### **III. Period of removal of the orthotic booth – postoperative day 45.**

Aim: maximum recovery of the locomotory function of the limb that has undergone surgery.

Objectives.

1. Walking with the use of walking aids and partial weight bearing while marking the gait function;
2. Attaining 90<sup>0</sup> flexion of the ankle joint from day 35 (by a 5° increase every 3 days);
3. Exercises against resistance to increase muscle strength and the endurance of the affected limb;
4. Mechanotherapy: exercise bike with gradual increase of ankle and knee joint pressure.

Means and methods: as in the early postoperative period, but gradually increasing in volume and load on the affected limb.

### **IV. Active rehabilitation (late postoperative) period – day 60**

Aim: to prepare the patient for return to the normal work environment and daily routine.

Objectives.

1. Gradual transition towards walking with a single aid and then, without any walking aids;
2. Maximum recovery of the extent of joint mobility in the limb that has undergone surgery;
3. Recovery of muscular strength and recovery of a proper gait function without walking aids;
4. Giving the patient instructions to gradually increase the effort, speed.

### **Methods and Means**

1. Exercises against resistance to increase muscle strength and the endurance of the affected limb;
2. Mechanotherapy: exercise bike with gradual increase of pressure; treadmill – slanting

upwards with gradual increase of speed of motion (increase of dorsiflexion);

3. Exercises while standing upright and walking: using wall bars, unsupported, standing on tiptoes/heels;

4. Improving the elasticity of the operative scar and other softy tissues involved in the operation – working on postoperative and posttraumatic lesions.

7. Physical therapy

- Low intensity magnetic field – 14,000 A/m, 10 Hz, 15-20 min., 0.2 sec., 15-20 sessions.

- Phonophoresis with fibrinolytic medication 0.5-0.8 W/cm<sup>2</sup>, 15-20 sessions.

The period continues until the patient has fully recovered.

## RESULTS

Statistics of damages to the left/right lower extremity show a 64.8% prevalence of the right one. The Achilles tendon rupture was surgically restored using the Krakow technique. FiberWire<sup>®</sup> non-absorbable suture was used. Cryotherapy was administered on 82.4 percent of the patients. We did not treat patients with ruptures of both Achilles tendons, nor did we observe any complications or re-ruptures when the surgical technique referred to above had been used. All patients were rated for pain using the VAS scale.

Active rehabilitation started after the 4<sup>th</sup> postoperative week with personalized programs and individual load determined in accordance with the patients' functional capabilities, age, locomotory culture, body weight and other indicators.

The circumference of the ankle joint in centimeters was measured; it was shown to deviate by 1 through 4 cm compared with the healthy limb.

On postoperative day 45: dorsal flexion 5-10<sup>0</sup>, plantar flexion 25<sup>0</sup> in 48 patients; dorsal flexion 15<sup>0</sup>, plantar flexion 30<sup>0</sup> in 36 patients.

On postoperative day 60: dorsal flexion 20<sup>0</sup>, plantar flexion 45<sup>0</sup> in 98 patients; dorsal flexion 15<sup>0</sup>, plantar flexion 35<sup>0</sup> in 36 patients.

Complete recovery of physical fitness was observed in 82 percent of the patients by month 4, in 16 percent by month 5, and in the remaining 2 percent, by month 6 after surgery.

**Clinical case studies**

**D.P., 44 yr.-old, IT specialist:** left Achilles tendon rupture inflicted during a game of volleyball.



**Fig. 1 Achilles tendon rupture**



**Fig. 2 Postoperative day 2**



**Fig. 3 Postoperative day 2, with orthotic booth at 20°**



**Fig. 4** Postoperative day 2, walking on his own with walking aids.

On postoperative day 60: dorsal flexion  $20^{\circ}$ , plantar flexion  $45^{\circ}$ ; patient walking on his own.  
Ankle joint circumference: no difference between limbs.



**Fig. 5** Full plantar flexion.



**Fig. 6: Full dorsiflexion.**

**Y.V., 55 yr.-old**, former ballet dancer: left Achilles tendon rupture inflicted during a game of football.



**Fig 7: On postoperative day 12, with orthotic booth, plantar flexion at 20°**

On postoperative day 60: dorsiflexion 15°, plantar flexion 35°, patient walking on his own.  
Ankle joint circumference: +0.5 cm for affected limb.

**I.H., 53 yr.-old:** right Achilles tendon rupture inflicted during a game of football.



**Fig 8:** With plantar/dorsal flexion apparatus on postoperative day 60.



**Fig 9:** With plantar/dorsal flexion apparatus on postoperative day 60.



**Fig 10: Treadmill, on postoperative day 60**

## **DISCUSSION**

Traumas to Achilles tendon are a serious therapeutic and social challenge as they mostly affect young individuals in active age.

The medic's aim is to identify the mechanism of inflicting the damage, the time lapse since it was inflicted and the existence of any predisposing conditions. Typically no X-ray imaging is necessary. Ultrasound and MRI are methods that can help with diagnosing the damage. These tests may also indicate the best method of treatment. Specialized examination by an orthopaedist-traumatologist will inform the most appropriate follow-up action, whereby measures must be undertaken at the earliest possibility. The risk of re-rupture is greater in cases where non-operative treatment is administered. Non-operative treatment is advisable for individuals who do not engage in sports and have generally lower physical activity as they will obtain less benefit from operative treatment. As prolonged immobilization may lead to more palpable muscle weakness, it is important to accurately assess the functional capabilities of every patient as well as the proper load to be placed on him/her in each subsequent phase of the treatment. The rehabilitation methods and the development of individual treatment protocols occupy an extremely prominent place within the overall therapy in cases of such injuries, and in the re-socialization of the patients.

## CONCLUSION

Asymmetrical strains in the limbs are common during a sports game and athletes should develop the calf muscle in such a way as to protect it from asymmetrical strains as could lead to a rupture of the Achilles tendon.

The treatment of this type of trauma is interdisciplinary, with kinesitherapy being the key method of restoring the patient to his/her normal routine. Recovery to active competitive shape usually takes about 4 to 6 months, but with high motivation and very active physical therapy the recovery period may be shortened to something like 3 months.

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