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REHABILITATION PROTOCOL AFTER PERCUTANEOUS ACHILLES TENDON SUTURE

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SUMMARY

Introduction

The Achilles tendon is the most commonly injured tendon of our body. The main goal of treating a ruptured Achilles tendon is to restore its function effectively and safely. Up to date there is no consensus on the method of treatment of the ruptured Achilles tendon, however in most cases patients are treated surgically.

Aim

The aim of this study is to present a rehabilitation protocol after percutaneous Achilles tendon suture.

Material and methods

The presented rehabilitation program lasts about 12 months and consists of five stages. Stage I, initial rehabilitation, lasting two weeks, involves anticoagulant exercises. Stage II, lasting up to week 6, assumes full weight bearing of the operated limb in the cam Walker. In the third stage, 4 weeks after surgery, exercises in water conditions are included. Stage IV, lasting from week 6 after surgery, assumes full weight bearing in normal shoes with a 2 cm heel pad and progressive muscle strengthening. Stage V, starting after 3 months, consists of functional deficits elimination depending on the needs. Functional

POSTĘPOWANIE FIZJOTERAPEUTYCZNE PO PRZEZSKÓRNYM SZYCIU ŚCIĘGNA ACHILLESA

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STRESZCZENIE

Wprowadzenie

Ścięgno Achillesa jest najczęściej uszkadzanym ścięgnem. Celem leczenia zerwanego ścięgna Achillesa jest efektywne i bezpieczne przywrócenie jego funkcji. Jak dotąd nie ma konsensusu, co do metody leczenia zerwanego ścięgna Achillesa, jednakże w większości przypadków pacjenci leczeni są operacyjnie.

Cel

W niniejszej pracy przedstawiamy wyniki prowadzonego programu postępowania fizjoterapeutycznego po operacyjnym szyciu zerwanego ścięgna Achillesa metodą jego przezskórnego szycia.

Materiał i metody

Prezentowany program rehabilitacyjny trwa około 12 miesięcy i składa się z pięciu etapów. Etap I, wstępnej rehabilitacji, trwający 2 tygodnie polega na ćwiczeniach przeciwzakrzepowych. Etap II, trwający do 6 tygodnia, zakłada obciążanie kończyny w pełnym zakresie w bucie ortopedycznym typu Walker. W III etapie, po 4 tygodniach od operacji, włączane są ćwiczenia w warunkach wodnych. Etap IV, trwający od 6 tygodnia od operacji, zakłada pełne obciążanie kończyny z 2 cm podkładką oraz progresywne wzmacnianie mięśni. Etap V rozpoczyna się po 3 miesiącach od operacji i polega na

assessment was based on a battery of functional and isokinetic tests.

Results
The process of returning to sport and full physical activity takes about 8 months. After this time, the player returns to training in the club.

Discussion and conclusions
Comparing available subjective data, patient functions and return to sport, the protocol proposed by us is in line with the currently accepted rehabilitation trends in the world.

Key words: percutaneous Achilles tendon sewing, rehabilitation program, improvement

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eliminowaniu deficytów funkcjonalnych w zależności od potrzeb. Diagnozowane jest to na podstawie przeprowadzonej oceny biomechanicznej, składającej się z zestawu testów funkcjonalnych oraz izokinetycznych.

Wyniki
Proces powrotu do sportu oraz pełnej aktywności fizycznej trwa około 8 miesięcy. Po tym czasie zawodnik wraca do treningów w klubie.

Dyskusja i wnioski
Porównując dostępne dane odczuć subiektywnych, funkcji pacjenta oraz powrotu do sportu proponowany przez nas protokół jest zgodny z obecnie przyjmowanymi trendami rehabilitacyjnymi na świecie.

Słowa kluczowe: przezskórne szycie ścięgna Achillesa, program rehabilitacyjny, usprawnianie

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Introduction

Achilles tendon is the thickest and the strongest tendon of the human body, although it is the most often completely ruptured tendon in our bodies. Achilles tendon rupture most often occurs during sport activities, which with increased physical activity of middle-aged people gives in recent years an increased number of this type of injury (Järvinen *et al.* 2005; Movin *et al.* 2005;Leppilahti *et al.* 1996; Möller *et al.* 2001; Maffulli *et al.* 1999; Möller *et al.* 1996). It is recognized that this is the most frequently torn tendon in the human body (Järvinen *et al.* 2005; Movin *et al.* 2005). The rupture of the Achilles tendon causes sudden, severe pain and weakening of the calf muscle strength, which results in the inability to rise on the toes.

Achilles tendon rupture most often is located 2 to 5 cm above the heel spur (Skiba *et al.* 2006). This location of the rupture concerns 96% of patients. In the rare cases (about 2%) of avulsion rupture are also reported, as well as ruptures in the proximal part of the tendon (about 2%) (Skiba *et al.* 2006). Most often, Achilles tendon rupture occurs first stage of sprinting or jumping, when patient pushes off with the weight-bearing forefoot (Olsson 2013).

The most commonly chosen method of treatment of Achilles tendon rupture in active people is the surgery. The efforts to reduce problems with wound healing resulted in the development of the technique of minimally invasive Achilles tendon suture by Ma and Griffith in 1977 (Ma, Griffith 1977). The minimally invasive method of suture involves the approximation of Achilles tendon stumps in the absence of surgical violation of the tendon and skin. Ma and Griffith›s technique has been modified many times, which led to reduce the risk of sural

nerve injury and increase the strength of the applied suture. (McMahon *et al.* 2011, Carmont, Maffulli 2008,Sadoghi *et al.* 2012)

Aim

In this paper, we present the results of treatment with a rehabilitation protocol after percutaneous Achilles tendon suture. In the surgical technique Bunnel suture is used, which results in the suture resistance at the level of 220N.

Material and methods

Rehabilitation protocol

Rehabilitation after percutaneous Achilles tendon suture lasts approximately 12 months. This is a key period for the future function of the operated limb, because after this time no improvement in the strength and endurance of the calf muscles is observed, regardless of the training (Möller *et al.* 2001). The purpose of the rehabilitation is to return to full physical activity. At each stage of the rehabilitation, constant control of the physiotherapist over its course is important. The physiotherapist determines the intensity and range of exercises. The crucial is communication with the surgeon and treating orthopedist on an ongoing basis.

We divide the rehabilitation protocol into stages, determined by the time from the surgery.

Stage I – 0–14 days

After the surgery, the operated limb is immobilized in a cam Walker in the maximum plantar flexion of the operated foot (Figure 1).

The day after the surgery, the physiotherapist presents the patient with initial rehabilitation. At this stage, anticoagulant, anti-oedema and activation exercises for the thigh muscles, the iliac girdle muscles and the torso muscles are implemented. In the assistance of a physiotherapist, the patient learns to walk with the help of elbow crutches with the contact of the operated limb with the ground. Patient leaves the hospital the day after the surgery. During the first 2 weeks patient performs exercises by himself at home.

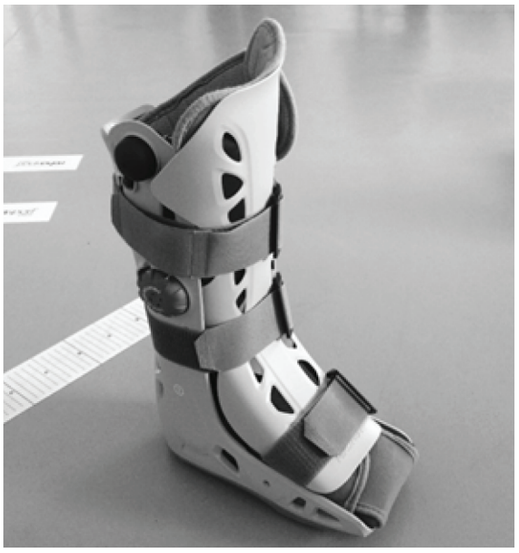

Figure 1. Cam Walker orthosis.

Stage II – 3–4 weeks

2 weeks after the surgery, a medical checkup takes place. After healing the wounds, the sutures are removed (Figure 2), and the proper rehabilitation begins.

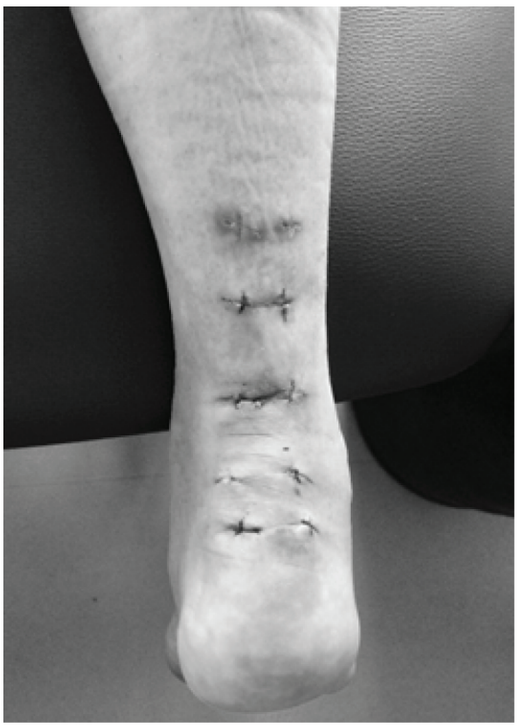

Figure 2. Area around the Achilles tendon after removing the stitches.

The immobilization of the operated limb is maintained in the cam Walker with a 3 cm heel lift. The patient is able to weight bear as tolerated. When the correct limb function is restored and the patient›s gait pattern is proper, full weight bearing of the operated limb is recommended. This stage is preceded by an accurate gait analysis.

Manual therapy in this stage consists mainly in the loosening of the foot, proximal attachment of the triceps surae muscle and the hamstring muscles. The physiotherapist also focuses on gentle manual therapy in the area of the upper and lower ankle joint and the tarsal joints, as well as on the anti-swelling therapy of the entire operated limb.

The physiotherapist introduces more difficult exercises in the closed kinetic chain of the operated lower limb.

It is also short feet exercise (SFE) program implemented. Exercises in the SFE therapy were adopted by physiotherapists Janda and VaVrov (Olson 2013) and consist of the exercises of feet muscles, which allows to curve the longitudinal arch of the foot and is considered the first step in sensomotor training (Figure 3).

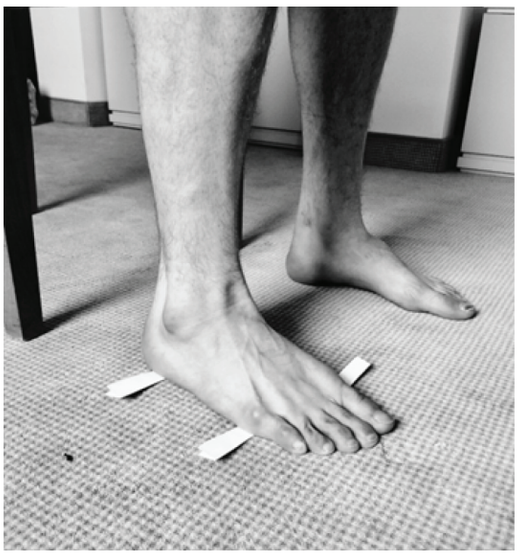

Figure 3. Patient prepared for training a short foot.

During this period, the patient also independently performs the active movements of the dorsal flexion and plantar flexion in terms of tissue resistance. It is allowed to ride a stationary bike with cam Walker.

Stage III – 4 – 5 weeks

After the wounds are fully healed and proper patients function is restored, it is possible to start rehabilitation in the water environment. The patient starts exercises with flexion and extension movements in the hip, knee and ankle joints at the edge of the pool (exercise commonly called a 'bicycle'). In the next stage, patient carries out locomotion movements in deep water, up to the introduction of lower limb work elements and the torso of swimming training.

The therapist in this stage begins therapy to make the scars and surrounding tissues more flexible.

This stage overlaps with subsequent stages, and exercises in the pool can be carried out until the end of rehabilitation.

Stage IV – 6th week – 3 months

In the absence of pain of to the operated Achilles tendon, after the medical follow-up, immobilization from the operated limb is removed. The heel lift is retained, but smaller – 2 cm. The therapist initiates a manual therapy aimed at increasing the dorsiflexion range of the ankle joint movement. Particularly great attention is paid to the restoration of a correct gait pattern. More advanced exercises are carried out within the calf muscles, including the introduction of external resistance. The patient begins proprioceptive exercise on a stable ground. The exercises in the biokinetic chain of the operated lower limb and torso are still being carried out.

In the following weeks gone by, the therapist still attaches great importance to the scope of the dorsiflexion and to the flexibility of the tissues of the operated area. Through the use of joint techniques, the interosseous sliding is needed for the proper movement of the ankle joint. The progress of exercises aimed at encapsulating strength, stimulation of more muscle fibers

and proprioceptive exercises is still taking place. At the end of this stage, the patient begins to perform functional and plyometric exercises aimed at returning to the pre-injury practiced activity.

This stage lasts, depending on the patient, for about 6–12 months, smoothly moving into the next one.

Stage V – 3 – 12 months

After about 3 months of surgery, biomechanical functional assessment (BFA) is performed. The time of the assessment is very individual and depends on the activity that the patient had presented before the procedure, involvement in the rehabilitation process and the purpose for which the patient seeks. The BFA consists of:

- assessment of the performance quality of basic traffic patterns according to the modified FMS (Functional Movement Screen) evaluation protocol
- assessment of reaction of ground forces on pressure in a dynamic test using the GAMMA system
- a series of functional tests: weight-bearing lunge test, star test (SEBT Test – star excrusion balance test).

After approximately 6 months, the battery of tests also includes isokinetic assessment using the Biodex dynamometer (Figure 4) and functional tests: heel rise endurance test and single leg hop for distance.

In the case of deficits in the strength and/or endurance parameters of the examined muscle groups, asymmetries in limb loading, disturbances of basic movement patterns or deviations in functional tests, the rehabilitation plan could be modified and focused to improve the worst parameters.

The re-assessment is carried out every 4 weeks, which gives a real chance to observe changes in the training. After a positive biomechanical functional assessment the physiotherapist establishes the final plan and end point of rehabilitation. Then, sport training is introduced, fully preparing to return to full fitness and pre-injury activity. This will be helpful in running exercises in a straight line, dynamic changes in the direction of the run, and oblique and single-track plyometry (jumping training). Progressive controlled training of practiced discipline in sportsmen is introduced.

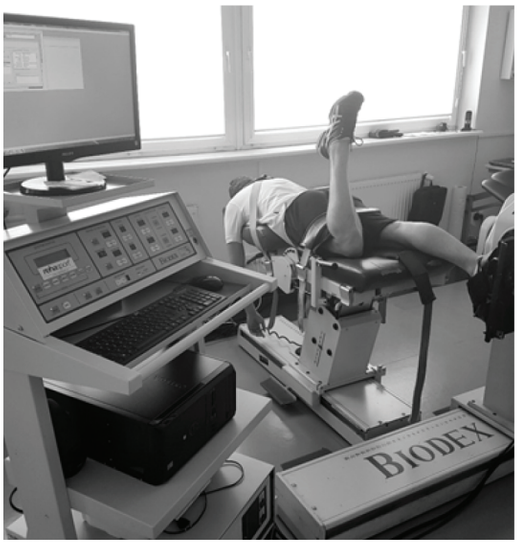

Figure 4. Patient prepared for isokinetic assessment.

Results

The process of returning to sport and full physical activity takes about 8 weeks after obtaining a positive biomechanical functional assessment. After this time, the player returns to training in the club.

Discussion and conclusions

In this study we present the rehabilitation protocol after percutaneous Achilles tendon suture. This program has evolved over several years and is based on experience in everyday work with patients, including professional athletes. A thorough analysis of the problems often encountered by patients after Achilles tendon suture and the results of functional and isokinetic assessment allowed to create this program. In order to minimize the extension of the operated Achilles tendon, as well as the decrease in calf muscle strength, we use a heel lift for a period of about 3 months. Quick implementation of weight-bearing of the operated limb and

the use of a cam Walker makes it easier for patients and allows to return to their daily activities, and also gives better conditions for healing Achilles (Olsson 2013). Moving without elbow crutches in a similar way to walking does significantly reduce the problem of a disturbed walking pattern when the full weight-bearing of the operated limb without orthosis is introduced. An individualized rehabilitation program, focusing on the return of strength and endurance parameters of the calf muscle and the correct movement patterns, gives a chance to reduce the negative effects of injury. Mini-invasive percutaneous suture with smaller, several-millimeter, postoperative scars, in relation to the tendon suture by the 'open method', gives a lower risk of postoperative adhesions, and therefore a faster restoration of the full range of motion (McMahon *et al.* 2011). This minimizes the limits of the skin›s sliding and fascia relative to the operated tendon. Accelerated healing of such scars also allows you to quickly weight-bearing and training in the water.

The program described above is not limited by rigid frames, it could be modified and changed depending on the condition and needs of the patient. However, we must remember that rehabilitation is in line with the physiological processes of tendon regeneration and tissue healing. A comprehensive approach to the problem guarantees, as far as possible, a return to pre-injury activity. In our study from 2018, among patients rehabilitated according to the described program, we noticed a statistically significant improvement in the patient›s condition, measured according to the subjective ATRS scale (Achilles tendon Total Rupture Score) (Bąkowski *et al.* 2017). In addition, 86% of patients in the studied group returned to full physical activity (Bąkowski *et al.* 2017, Bąkowski *et al.* 2017). So far, it has been observed that the percentage of patients who return to full physical activity ranges from 49% to 82% (Olsson *et al.* 2011, Bąkowski *et al.* 2017). Analyzing the available research in the world, the return to sports takes from 5.2 to 7.5 months (Olsson *et al.* 2011, Bąkowski *et al.* 2017). On the other hand, return to full pre-injury activity for about 9 months. Comparing the available data of the return to sport, the protocol we propose is in line with the currently accepted rehabilitation trends in the world.

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