RECOVERY OF THE ACHILLES TENDON RUPTURE BY MEANS OF HYDROKINETOTHERAPEUTIC METHODS – CASE PRESENTATION

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ABSTRACT

We believe that the recovery using the great facilities offered by the aquatic environment and by the various and attractive methods of hydrokinetotherapy is, in many situations, a support which should not be ignored by the kinetotherapists. We believe that combining the specific kinetotherapy methods is much more efficient than using some isolated methods, and it is an alternative for the recovery based on the principle of individual treatment, knowing that the patients existed first and then the diseases. The objective of the research is to draft a recovery programme for Achilles tendon rupture using methods specific to hydrokinetotherapy and swimming. We supposed that by applying certain exercise systems, specific to therapeutic swimming and hydrokinetotherapy for the recovery following the Achilles tendon rupture, the recovery will be optimum. The information gathered during this experiment is a starting point in drafting the scientific foundation of the physical deficiency recovery concept using hydrokinetotherapy and especially therapeutic swimming.

Keywords: therapeutic swimming, hydrokinetotherapy, Achilles tendon rupture

INTRODUCTION

The use of water for the treatment of disease or invalidity dates back to ancient times. First the Chinese people, through their doctrine based on body positions and movements developed by Confucius, and later on the Greeks and the Romans through Euripides, Gallenus and Aurelianus, laid the foundations for the beneficial indications and applications of exercise performed in water.

Starting in the 18th century, the research in the field of hydrotherapy is intensified; the Anglo-Saxons represented by Hoffmann (1712), Pressnitz (1830) and a little later by Kneipp, stirred the interest in the use of water for therapeutic purpose.

Hydrotherapy has developed as a science starting in the 19th century and especially in the 20th century, for the treatment of the poliomyelitis sequelae. Thus, in 1924, C.Lowmann introduces a method for treating paralysis, and in 1931 Lausson publishes a treaty based on the use of hydrogymnastics in poliomyelitis. In France, Leroy lays the technical and therapeutic foundations of kineto-balneotherapy, term by means of which he defined the exercise performed in water.

At present, the aquatic environment is successfully used to support physical therapy activities and it is reckoned as a great environment by most specialists in this field: Monroke A. (1976), Koury J.M. (1996), Sbenghe, T. (1981, 1999), Cordun, M. (1999) Plas F., Hagron, E. (2001) and others. The various branches of knowledge existing throughout the world, with great similarities in their field of research make use of the great facilities offered by the aquatic environment, such as: balneoclimatotherapy, kineto-balneotherapy, hydrotherapy and aquatic therapy.

Research hypothesis

- We supposed that by applying certain systems of exercises specific to therapeutic swimming and hydrokinetotherapy for the recovery of the Achilles tendon rupture, the recovery will take place in optimum conditions.

METHODS

Research subjects and conditions

Patient B.V., male, is 37 years old. The rupture of the right Achillean tendon occurred after about one hour of playing the game (soccer) after an abrupt takeoff (the body weight being distributed mainly on the right foot).

After the surgery, a suture of the tendon was performed as well as a surgical repair on the level of the tendinous-muscular insertion on the right leg. After removing the stitches, a plaster cast (or a cast boot) is applied, the foot being in extension. 27 days later, another plaster cast (a high-heel shoe cast) is applied, the foot being in flexion. 7 days later the plaster cast is removed and the recovery programme begins.

The recovery programme

It takes place in the Olympic swimming pool in Bacau. 50m / 8 lanes / 1.80-2.30m deep/ 4 access ways with steps / side rails / a 1.20 m. edge; the diving pool 15m / 6 m deep/ 6 access ways with steps

Materials: floats / flippers / arm floats / swim vests / balls / float sticks / palm floats / rubber band / life belts.

Water temperature: 28^0 C – 28.5^0 C in the big pool; 30^0 C – 31.5^0 C in the diving pool

- The recovery programme was carried out in the period of time February-May 2012, lasting for 14 weeks, with a frequency of 3-5 sessions a week.
- The tests were carried out daily during the first week of the recovery programme, and then weekly.
- In order to get objective results of the recovery programme, we used the testing method, the method involving the goniometric determination of the ankle joint mobility, which includes the following measurements concerning the ankle joint mobility: testing the plantar flexion; testing the dorsal flexion;
- The calf and thigh perimeters were also measured.

Contents of the recovery programme

The general objectives of the recovery programme were: calming the pain and ameliorating the inflammation; recovering stability; recovering the joint mobility; recovering the sensorial-motor coordination; recovering muscle control; the patient's social and professional reintegration.

Methodological indications concerning the selection of exercises specific to swimming recommended for therapeutic purpose: the dynamic exercises consisted mainly in free active movements or active movements with weights meant to recover the ankle joint functions up to its normal values; exercises for the recovery of the calf muscles; exercises for the recovery of the thigh muscles.

The following groups of exercises specific to swimming, therapeutic swimming and hydrokinetotherapy were used: exercises on land, exercises on the side of the pool, deep-water exercises, individual and pair-work exercises, individual exercises with aids (floats, flippers, arm floats, balls, float sticks, palm floats, life belts swim vests), assisted exercises, exercises with opposition or with resistance provided by the physical therapist, exercises with weights (swim vests and/or belts, carrying different objects, sponges, swimming wearing a t-shirt), swimming with palm floats (of different sizes), swimming with flippers (of different sizes), therapeutic swimming exercises associated with other methods specific to hydrokinetotherapy, therapy by means of water sports:

DATA PRESENTATION AND ANALYSIS

The initial inspection and testing

The following photos (1-8) show the aspect of the right limb that suffered surgery on the day when the plaster cast was removed:


Photo 1


Photo 2


Photo 3


Photo 4

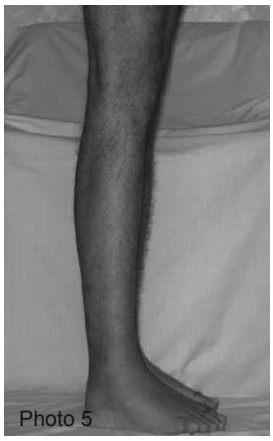
Photo 5


Photo 6


Photo 7


Photo 8

The 8 photos show for comparison the aspect of the lower limb that suffered surgery (the right one) and the healthy one from the following planes: frontal – anterior and posterior view; sagittal – interior and exterior view.

We can notice that the right calf has a tumid cyanotic aspect. The tumidity is more visible on perimalleolar level, on the dorsal side of the foot and along the Achillean tendon. In photo no.4 we can notice the disappearance of the right calf malleoli due to the acute tumidity. Palpating the area, we can feel the hypotonia of the right calf muscles and the induration of the area around the Achillean tendon.

We can see with the naked eye the difference in diameter between the limbs, both on the level of the calf and of the thigh.

The data gathered during the tests performed was centralized and processed by means of statistical-mathematical methods, determining the progress of the recovery programme.

The formulas used were processed according to Thomas J.R., Nelson J.K., (1997) and Tüdos Ş. (1993).

The results are grouped into tables for each separate test performed.

Table 1 Results of the joint testing

MONTH	Date	Right lower limb		Left lower limb	
		Ankle joint		Ankle joint	
		Flexion (^{0} radian)	Extension (^{0} radian)	Flexion (^{0} radian)	Extension (^{0} radian)
FEBRUARY	20.02.2012	117/-27	129/+39	71/+19	168/+78
	21.02.2012	105/-25	132/+42	72/+18	168/+78
	22.02.2012	109/-29	130/+40	71/+19	169/+79
	23.02.2012	110/-20	130/+40	73/+17	167/+77
	24.02.2012	104/-44	135/+45	74/+16	170/+80
	25.02.2012	105/-15	138/+48	72/+18	172/+82
	26.02.2012	106/-16	135/+45	72/+18	167/+77
MAY	6.05.2012	82/+8	151/+61	73/+17	174/+84
	13.05.2012	77/+13	153/+63	72/+18	172/+82
	20.05.2012	80/+10	150/+60	73/+17	171/+81
	27.05.2012	79/+11	150/+60	75/+15	171/+81

Table 2 Results for the calf and thigh diameter

MONTH	Data	Perimeter		Perimeter	
		Calf (cm.)	Thigh (cm.)	Calf (cm.)	Thigh (cm.)
FEBRUARY	20.02.2012	38	64	41	63
	21.02.2012	38	64	41	63
	22.02.2012	38	64	41	63
	23.02.2012	38	64	41	63
	24.02.2012	38	64	41	63
	25.02.2012	38	64	41	63
	26.02.2012	38	64	41	63
MAY	6.05.2012	41	65	42.5	64.5
	13.05.2012	41	65	42.5	64
	20.05.2012	41	65	43	64
	27.05.2012	41	65	43	64

INTERPRETATION OF THE RESULTS

The testing performed in February

The results analysis shows the slight progress recorded for the right ankle joint mobility: 9^0 for flexion; 6^0 for extension.

We can notice that on the first three days after removing the plaster cast the joint maintained its rigidity.

The difference in mobility between the two ankle joints is as follows: 34^0 for flexion; 32^0 for extension.

We can also notice the 3-cm difference between the calves of the two limbs. We notice that the right thigh perimeter is 1 cm bigger, fact also due to the recovery exercises performed with the plaster cast on, thus maintaining its muscle mass.

The testing performed in May

The results analysis shows the progress recorded for the right ankle joint mobility: 1^0 for flexion; 5^0 for extension.

The difference in mobility between the two ankle joints is as follows: 4^0 for flexion (1^0 improvement); 21^0 for extension (5^0 improvement).

We can also notice the 2cm difference between the calves of the two limbs. We see that the right thigh perimeter is 1 cm bigger.

Comparison between the initial and the final tests

Table 3 Comparative results of the joint testing and of the limb perimeter recorded in May and in February

MONTH	Date	Right lower limb				Left lower limb			
		Ankle joint		Perimeter		Ankle joint		Perimeter	
		Flexion (^{0} radian)	Extension (^{0} radian)	Calf (cm.)	Thigh (cm.)	Flexion (^{0} radian)	Extension (^{0} radian)	Calf (cm.)	Thigh (cm.)
FEB	26.02.2012	106 -16	135 +45	38	64	72 +18	167 +77	41	63
MAY	27.05.2012	79 +11	150 +60	41	65	75 +15	171 +81	43	64

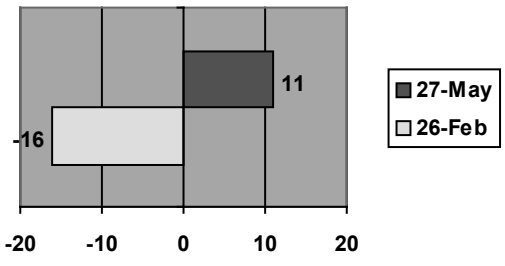

Figure1
Graphical representation of the progress in the right ankle joint mobility - flexion, February - May 2012

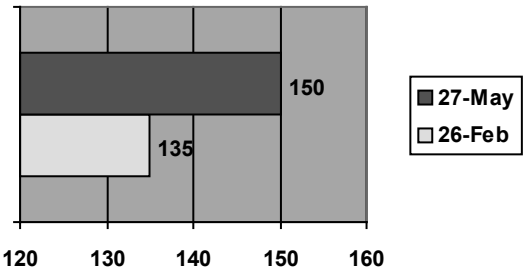

Figure 2.
Graphical representation of the progress in the right ankle joint mobility - extension, February - May 2012

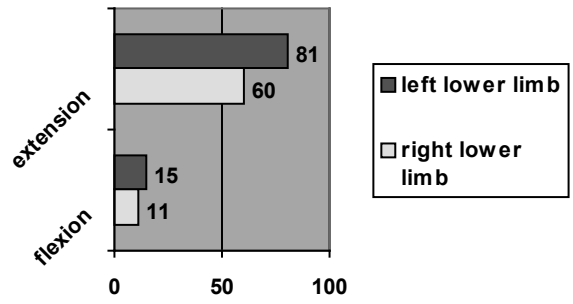

Figure 3
Graphical representation of the difference in mobility between the two ankle joints, February - May 2012

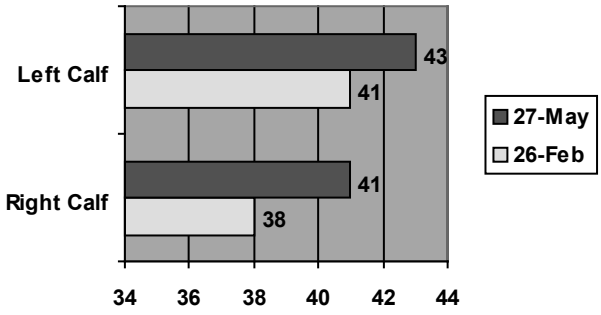

Figure 4.
Graphical representation of the progress in calf perimeter, February - May 2012

Evolution of walking and of the muscle force recovery

Walking without aids was possible at the end of the first week of recovery, with small unsteady steps. In order to prevent any possible relapse of the Achilles tendon rupture, walking was performed with the aid of two crutches for three more weeks and then two more weeks with only one crutch.

The evolution of walking was variable and unpredictable due to the persistent fluctuating tumefaction, the right ankle malleoli being visible only at the end of April.

Walking without aids started at the beginning of April, a limp persisting for a long time.

As to the recovery of muscle strength, materialized in standing on one foot, it was possible at the end of March, the delay being caused by the subject's fear for a possible relapse of the rupture. Standing on one foot and tiptoeing on the right foot were possible in water, which offers better conditions.

In May, the limp became slighter and walking got its harmonious form.

CONCLUSIONS

The immediate effects of the aquatic environment were felt on psychological level, swimming and diving offering a very high degree of freedom after a long period of partial immobilization.

Another greater advantage of swimming is that it increases the effort capacity and stimulates the great functions of the body.

The decrease of body weight in water, due to Archimedes' force, allowed the quick recovery of walking coordination, starting with walking in deep water and then in shallower and shallower water (the shallow pool has a sloped bottom and it allows the subject to submerge from chest level up to the pelvis level).

The effects of the hydrostatic pressure and of the warm water also contributed to reducing the tumefaction by stimulating the peripheral circulation.

The analysis of the results recorded along the whole recovery period shows us the progress in the right ankle joint mobility: 27^0 for flexion (4^0difference) and 15^0 for extension (21^0difference). It also shows us that the water recovery programme was efficient for the recovery of the joint mobility.

As to the recovery of the short muscle mass on the level of the lower limbs we notice that: the perimeter of the right calf increased by 3 cm. (38 - 41) and that of the right calf by 2 cm (41 - 43). We can also notice the 2-cm difference between the calves of the two limbs and we notice that the perimeter of the right thigh is 1 cm bigger.

The positive evolution of walking, which greatly contributed to the patient's social and professional reintegration, allowed him to walk without aids starting with the beginning of April.

We believe that the positive results recorded are greatly due to the facilities offered by the aquatic environment:

- The physical ones – diminishing the body weight, unloading the spine, using hydrostatic buoyancy in order to ease the movement, etc.
- The physiological ones – the positive influence on circulation, due to the horizontal position and to the pressure on capillaries, the stimulation of blood barorereceptors which leads to a better body awareness, the stimulation of the breathing function, etc.

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