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Underwater Treadmill Therapy for Dogs

A Theory and Practice Book

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Publisher:
tredition GmbH
Halenreie 40-44
22359 Hamburg
Germany

ISBN
Paperback 978-3-7482-4783-8
Hardcover 978-3-7482-4784-5
e-Book 978-3-7482-4785-2

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Preface to the 2nd edition

We appreciate the discussions as well as all the positive and negative feedback about our book. This has led us to revise parts of the content and to integrate additional topics that we intentionally left out in the first edition.

We'd like to explicitly point to the fact that the training recommendation in the second part of the book are influenced by and adapted to the respective medical findings.

New in this book:

- Use of front and back spacer
- Spondylosis

Topics that have been revised:

- Basics
- Indications
- Befor the training on the underwater treadmill Medical findings
- Getting the dog used to the underwater treadmill
- The training plan
- Disc prolapse
- Wobbler syndrome
- Degenerative myelopathy
- Medulla infarct
- Displasia of the hip joint (HD)
- Cruciate ligament rupture

Gained in practice, for use in practice: this slogan also goes for the second edition of our book. Therefore, we've kept the preface as short as possible.

Preface to the 1st edition

The Internet is full of training options, products, indications and contraindications, and success stories. Precise information on how to develop an effective training, the application of technology, and handy tips, however, are few and far between. This also goes for literature on this topic.

To put it in a nutshell, we missed detailed information when we started to work with the underwater treadmill. Our experience clearly shows the advantages of the training.

We've purposely waived the presentation of further forms of therapy. The focus is exclusively on walking in the underwater treadmill, because we almost exclusively use the underwater treadmill for aqua walking. To us, logical connections are more important than the presentation of additional forms of therapy such as cycling, jumping, isometric exercises, or underwater massage. It is the logical, clinically relevant thinking that we sorely missed at the beginning of our work.

The case of Bobby illustrates our approach. Suffering from arthrosis, Bobby should preferably walk in deep water. However, due to his limited physical fitness, he should walk in low water. We had to decide whether we chose a water level that reaches up to the middle of the thigh or to focus on the arthrosis or the limited physical fitness.

This book is divided into three parts: basics, for use in practice, from experience. The training recommendations in the second part are illustrate in tabular form and should serve as a reference book. We'd like to thank Iris Challande-Kathmann, whose book "Rehabilitation und Physiotherapie bei Hund und Katze" ("Rehabilitation and Physiotherapy for Dogs and Cats") was of great help for us when it came to making up the charts.

This book is the ideal aid for the dog-physiotherapeutic practice.

Acknowledgement

Our thanks go to all those who supported us in one way or another during the project.

Thanks to all dogs and their owners for their confidence.

Thanks to all vets and veterinarian clinics, which provided us with photo material for illustrating and clarifying the 'for the practice' part of the book. A register of illustrations can be found in the book's appendix.

Thanks to Monika Fiedler for revising the book and for the constructive discussions about the German language.

Thanks to Dr. Mima Hohmann for her professional suggestions and discussions that have enhanced this second edition.

Thanks to Tim Scheulen who translate the book.

Basics

Introduction

Nathan Zuntz (1847 – 1920), a Berlin-based psychology professor, designed the world's first treadmill in 1889. At the time, he built an adjustable and variable-speed treadmill model for examining the energy metabolism of horses. [1]

Today, there is a variety of of treadmills that are employed in areas such as rehabilitation, fitness tests, gait analysis, sports, and fitness. The market offers diverse treadmill models for different applications (see fig. 1+2).

fig. 1: Kettler treadmill model

fig. 2: Woodway treadmill model

For dogs, the manufacturers offer both conventional and underwater treadmills.

Two companies that focus on designing and producing underwater treadmills for dogs are PHYSIO-TECH® and KEIPER WATER-WALKER. The main differences between the treadmill

models offered by these enterprises include the way in which the dog enters the treadmill and the floor space requirement and the space for the frame, which is used for supporting the dogs' hindquarters. The photos in this book show the PHYSIO-TECH® model that we use in our own practice.

It was in 1989, when the PHYSIO-TECH® founder, Günter Michel, designed his first underwater treadmill for treating his golden retriever crossbreed Pongo, who suffered from joint pain.

Now, let us go back to Nathan Zuntz. It was his fundamental idea to use the treadmill for creating a reproducible exercise situation, which is based on factors such as speed, time, and gradient angle. In combination with water and its physical properties, the treadmill is a training tool that perfectly combines conventional training theory and hydrotherapy.

With this in mind, the underwater treadmill is a training tool that is suitable for a large number of dogs. It can be used for dog physiotherapeutic treatment, including the treatment of arthrosis, spinal diseases, disc prolapse with and without motoric and/or sensory problems, and knee injuries such as cruciate ruptures. In addition, the underwater treadmill is employed when it comes to the postsurgical treatment of bone fractures, femoral head resections, joint replacements, hip and elbow dysplasia, and luxating patella. Furthermore, the training tool helps to improve endurance, muscular strength, and coordination, to reduce weight, and to maintain the physical condition.

The list of contraindications, on the other hand, is short und includes symptoms and diseases such severe pain, fever, infections, unremedied cardiac insufficiency, epilepsy, and open wounds.

How does the dog “work” on the treadmill? The treadmill effect

The major difference between walking on the treadmill and walking on the ground is how the movement is triggered.

A dog that approaches a dummy like Max as shown in the photo below is targeting an object of desire. We see that the posture of his head and body is aiming at picking up the dummy. This means that the movement of Max is influenced by the situation (to fetch the dummy), the environment (the forest, the dog handler, and the dummy thrower), and the ground (uneven forest floor). In addition, his movement pattern is adapted to his physical capabilities. He moves the way in which he is able to pick up the dummy. (see fig. 3).

fig. 3: Max approaching the dummy, dummy marked in red

Lilly on the underwater treadmill focuses on nothing, with the exception of the dog handler who stands in front of the device. The movement of the treadmill causes Lilly's movement, which is reactive. (see fig. 4).

fig. 4: The treadmill leads the left paw backwards. The next step follows reactively.

The training is based on factors such as speed, height of water, gradient and inclination angle, and length of time. All this results in a purposeful training of endurance, power, and coordination.

The extent of motion parameter can be affected through the height of water, while an increased stress/training of the hindlimbs and forelimbs can be achieved through tilting the treadmill.

The treadmill can also be used for regaining the ability to walk. The rhythmic movement on the treadmill causes a stimulation of the CPGs (Central Pattern Generators) at spinal cord level. These nerve centres are responsible for controlling the walking.

What makes these nerve centres so special is he fact that they are able to work independently from the brain. To put it simply, one can say that the walking ability is controlled by the CPGs. The brain, on the other hand, controls the movement direction and provides reasons why we walk.

It was as early as 1910, when Sherrington published his research results about his experiments with decerebrated cats, who were rudimentarily able to walk through training on the treadmill.

Today, treadmill training is an integral part of walking rehabilitation and ideal for people who suffered a stroke or a traumatic brain injury, suffer from multiple sclerosis, paraplegics, and people with other neurological disorders. To regain the ability to walk, a combination of physiological movement (with the aid of weight relief and the therapist) and the repetition of the movement is of paramount importance. The walking ability after a therapy unit is dependent on the initial condition.

Please note: the treadmill initiates and controls the movement.

What makes the training on the underwater treadmill so effective? The effect of water!

Crucial to the underwater treadmill training are the physical properties of water (cf. [3] [4])

The hydrostatic pressure

The hydrostatic pressure is the pressure that has an effect on the body. The fact is that the deeper the body is in the water, the higher is the hydrostatic pressure. This has the following effect on the body: the girth decreases, which causes a gentle lymphatic drainage. At the same time, the pulse frequency decreases. This means extra work for the heart, which has to beat more efficiently.

The buoyancy force of water

The buoyancy force of water is the force that counteracts gravity. Therefore, the body is lighter, and there is a decreased pressure exerted on the joints. The buoyancy force and the joint relief increase with the water level in the underwater treadmill; a lower water level, however, decreases the joint relief (see fig. 5). It is the buoyancy of water that makes movements that would normally hurt less painful or in fact completely painless. Also overweight dogs benefit from this effect.

The frictional resistance of water

The frictional resistance of water is the resistance that makes water work against the movement of the body. Due to the water density, the resistance that works against the movement of the body is four times higher compared to walking on the ground. This effect can be reinforced through extending the tread and through accelerating the movement.

Note: the larger the walking area, the higher the frictional resistance, and the faster the movement, the more exhausting the exercise.

The effects of the frictional resistance also include the strengthening of the musculature.

In addition, the water produces vortexes that massage the skin.

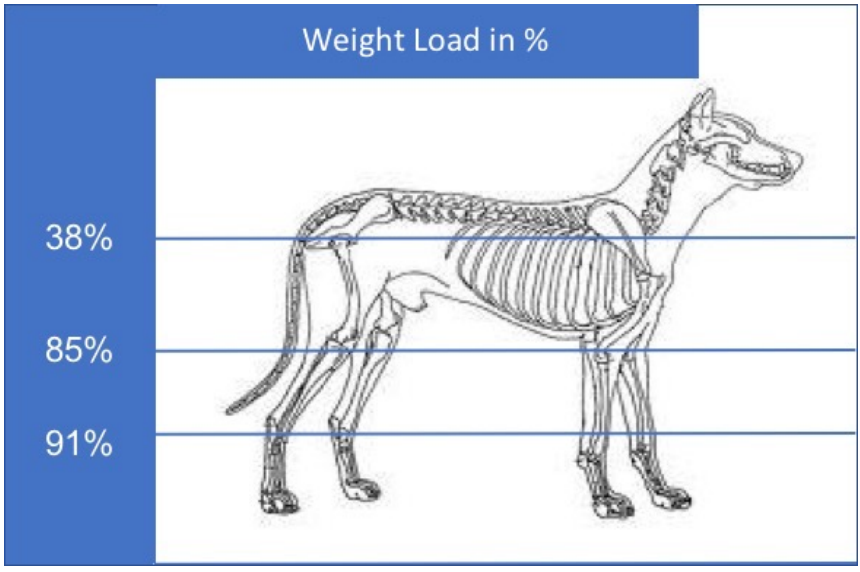

fig. 5: weight load in % in relation to water depth

Temperature

It depends on the temperature whether we assess something as cold, hot, or indifferent.

We tend to freeze in cold water, the muscle tension increases, and there is a narrowing of the blood vessels. In warm water, however, the muscles relax and the blood vessels dilate.

Please Note: movement prevents that cooler water is perceived as cold and at the same time that hot water is wearisome.

We recommend a therapy water temperature that ranges from 25°C to 28°C.

A temperature of 35°C and higher heats the body too fast, which stresses the cardiovascular system.

The properties of water make the treadmill training more effective.

Please note: a water temperature of 35°C or higher stresses he cardiovascular system.

This is a contraindication for cardiac dogs.

Please Note: a high water level stresses the circulation, intensifies the training, and relieves the joints.

The underwater treadmill and its technical capabilities

Fig. 6 shows the essential elements of the underwater treadmill.

The treadmill, which is part of the water basin, can be operated at different speeds (0.6 to 5.5 km/h) as well as with different gradient and inclination angles. Some systems allow the adjustment of the treadmill at a height of 48 cm (see fig. 7). Other models are electrically height-adjustable up to a height of 77 cm. This option allows the therapeutic treatment of small dogs at a back-saving height. In the large therapy basin, it is possible to treat big dogs such as Saint Bernard in shoulder-high water (fig. 9). The dog can be supported by means of a walking frame, which is fixed to the underwater treadmill's upper frame. Thus, it is possible to relieve the hindlimb, while at the same time manually controlling the dog's gait pattern (see fig. 10).

In 2015, Ursula Tönisen (www.hundekrankengymnastik-wesel.de) designed a spacer (see fig.11+12) for the underwater treadmill. This device helps to optimally position the dog in the basin, thus ensuring an extensive gait.

Further therapeutic options include the counter current (see fig.13) and underwater massage systems.