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## THE APPLICATION OF AQUATIC EXERCISES FOR THE PURPOSE OF PHYSICAL PREPARATION FOR CHILDREN DIAGNOSED WITH OSTEOGENESIS IMPERFECTA

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### Abstract

*Problem statement.* The advantages of using the aquatic environment are known for recovering from various diseases. When referring to children diagnosed with osteogenesis imperfecta, exercises in water can be considered the best solution in the attempt of improving their physical condition.

*The aim of the research.* This paper aims to present the theoretical and methodological program that has been practically applied on one of the children from our country, suffering from osteogenesis imperfecta.

*Objectives.* Structuring an adapted aquatic training program for improving the effort and movement capacity of children suffering from osteogenesis imperfecta, in parallel with increasing self-confidence and improving the mental tonus.

*Methods of research.* The paper is based on the case study method, because the incidence of this disease in the population is 1/15000 - 1/20000 people. For acquiring the theoretical knowledge and the methodology of action in the aquatic environment, the bibliographic study method was used. The subject practiced aquatic exercises for 3 months, the assessment of the progress being made on the basis of personal records.

*Conclusions.* By applying the adapted exercises program into the aquatic environment, a significant improvement of the effort and movement capacity of the subject was observed. In parallel with motric development, there were improvements determined, both within the functional and the mental sphere.

*Key words:* physical exercises in water, adapted training, aquatic environment, osteogenesis imperfecta.

### Introduction

The advantages of the aquatic environment utilization, in the recovery of various diseases and deficiencies are well known and studied. When referring to osteogenesis imperfecta (OI), the aquatic medium represents the optimum environment for improving physical condition of children diagnosed with OI. And more specifically speaking, by applying the therapeutic swimming, a general as well as a specific improvement across all human body apparatus is being accomplished. Periodically practiced over a greater period than 20 minutes, at a moderate intensity of 120 bpm, an improvement of the oxygen consumption capacity is being achieved, as well as the development of the lungs and the cardiovascular system, all together with body shaping and optimum muscle tone (Vasile L., 2013).

After studying the specialty literature, we can affirm that studies that are based on OI laid emphasizes, from the first existing studies, on the medical part and rarely on the physical activity part. From our point of view, physical activity represents the most important basis for improving the condition of children diagnosed with OI.

Muscle activity is one of the fundamental human

needs (Vasile L., 2013), the more so as talking of OI. Bone fragility of children with OI can be supported by a high level of muscle tone, which brings a considerable improvement in performing the basic movements with minimal risk of accidents, and also helps in obtaining the orthostatism position. In the case of severe types of

OI, both the orthostatism position and walking are impossible without the existence of an activity that improves the muscle tone. A muscle activity can be achieved, of course, with a training program oriented in that direction. Exercises represent instruments of training that ensure the creation of a training content (Vasile L., 2013). These may be general with global character, or specific and oriented to a clear direction (eg technical elements specific to procedures swimming).

In the case of children diagnosed with OI, a program that seeks an improvement in the muscle tone is mandatory from our point of view. Besides all the physical benefits previously listed, developing a positive thinking and also social integration, are two important aspects that need to be taken into account on the score of specific training process, adapted for children with OI.

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## Methods

Therapeutic swimming represents one of the main methods of approach in the process of physical training of children diagnosed with OI. In an organized framework, with specialized personnel, following the aquatic programs applied on a subject of 12 years old, with OI, significant changes in bone density level were accomplished and also, overall, the fat percentage undergo positive changes.

Therapeutic swimming is a complex activity through which the somatic system (the structure and strength of the locomotive apparatus), the functional systems (cardiovascular, respiratory, endocrine-metabolic systems) as well as the psychological system (informational, decisional, energy, attitudinal- motivational systems) are being solicited (Vasile L., 2013). Improving these systems represents a guaranteed success in the improvement process of physical training of children diagnosed with OI.

The process of learning and application of physical training program started, as the specialty literature recommends, from two basic and mandatory principles that need to be kept in mind: the principle of progressivity (from simple to complex and from easy to hard) and the principle of individualization. Taking into account the OI particularities and characteristics of our subject, we created a training program which started from an elementary base, namely the aquatic environment accommodation. Referring to a young subject, completely unadapted to the dry medium (due to lack of walking and of dynamic activities performed from the orthostatism position), the adaptation to aquatic medium required special attention in this case. The whole process of adaptation to aquatic environment was based on games, because we are discussing about a 12 year old subject. Our recommendation, regardless of the subject's age, is to start from the premise that any subject can overcome the psychological threshold of accommodating with the aquatic environment through games. Moreover, since the first lessons we applied the principle of interactive learning. This principle focuses on group learning (Ciolca E., 2012), which brought the fast social integration of the subject into a group of children, having almost same age. This way, it was achieved a fast social integration, which has significantly reduced the period of adaptation to the aquatic environment, increasing its personal motivation.

In the process of adaptation, the emphasis was set both on encouraging the subject and on its emotional factors. Encouraging plays an important role in the sporting activity, whether it comes from

the coach, either from partners or spectators; it stimulates the sportsperson in a great measure, especially if we take into account the affective energy caused by the race conditions (Berbecaru C., 2008). The influence of the emotional factors related to success and failure living tells us that the memory of an activity crowned by success is usually mobilizing, as well as the representation of an easy failure. On the contrary, the representation of a serious failure demobilizes, and can even stop the activity (Berbecaru C., 2008). Here it is also underlined that, on the score of some experimental researches, it was shown that physical effort possibilities of the subjects, are influenced by the training degree of experience partners. This was shown in our particular case in which the subject has considerably reduced the adaptation period with the aquatic environment, because it came in contact with subjects who were already adapted to it. In conclusion, we recommend to all specialized persons, to achieve the accommodation with the aquatic environment by integrating the subject into a group that has already achieved this kind of activity.

Another very important aspect in creating the training program, is being represented by the days and the interval in which the activity itself took place. Athletes reach a higher level of effort capacity in the time of day when they usually train. The training schedule should remain as much as possible, constant, because its frequent change determines the change of the evolution rhythm of effort capacity (Teodorescu S., 2009). Therefore, the program was structured in three lessons per week (Monday, Wednesday and Friday) one hour and a half. I considered mandatory for every workout to be preceded by a day of rest, maximizing in this way the results of this program. As it is recommended, the effort spent was progressive, the loading was minimum, the volume was gradual without special solicitation on the subject (McLeod I, 2010). A gradual increase in the number of exercises was followed up, permanently taking into account the subject condition.

The weekly program was consisted of one technical training, one volume training and one specific strength training, after achieving the adaptation to the aquatic environment. What is important to be known is that the training loading was progressive, both as period and as applied elements.

The materials used in the adapted training program for children diagnosed with OI were: raft, swim fins, wand, T-shirt, elastic band and adapted aquatic bicycle.

## 60 WEEKS PROGRAM

	WEEK 1	WEEK 2	WEEK 3	WEEK 4
<b>M</b>	-water adaptation through games at the edge of the pool -successive entries in water up to waist -freestyle kicks - seating on the edge time 30 min	-exhales in water through mouth and nose -freestyle kicks - seating on the edge -freestyle kicks from swim ring with movement, assisted by the kineto therapist - 150 m time 45 min	-total immersion with underwater exhale -freestyle kicks from swim ring with movement, unassisted by the kinetotherapist, with exhale in water through mouth - 200 m time 50 min	-total immersion with underwater exhale -freestyle kicks from swim ring with movement, unassisted by the kinetotherapist, with exhale in water through mouth - 200 m - 100 m assisted backstroke kicks time 55 min
<b>W</b>	-water adaptation through games at the edge of the pool -successive entries in water up to neck -exhales in water through mouth and nose -freestyle kicks - seating on the edge time 40 min	-total immersion with underwater exhale -freestyle kicks from swim ring with movement, assisted by the kineto therapist, with exhale in water through mouth - 150 m time 45 min	-total immersion with underwater exhale -freestyle kicks from swim ring with movement, unassisted by the kinetotherapist, with exhale in water through mouth - 200 m time 50 min	--freestyle kicks from swim ring with movement, unassisted by the kinetotherapist, with exhale in water through mouth - 200 m -100 m unassisted backstroke kicks -50m freestyle kicks 1 wand time 55 min
<b>F</b>	-exhales in water through mouth and nose - freestyle kicks -seating on the edge -freestyle kicks from swim ring with movement, assisted by the kineto therapist - 150 m time 45 min	-total immersion with underwater exhale -freestyle kicks from swim ring with movement, assisted by the kineto therapist, with exhale in water through mouth - 150 m time 45 min	-total immersion with underwater exhale -freestyle kicks from swim ring with movement, unassisted by the kinetotherapist, with exhale in water through mouth -200 m -100 m assisted backstroke kicks time 55 min	--freestyle kicks from swim ring with movement, unassisted by the kinetotherapist, with exhale in water through mouth - 200 m -100 m unassisted backstroke kicks -50m freestyle kicks 1 wand time 55 min



**WEEK 60**

	<b>WEEK 28</b>	<b>WEEK 29</b>	<b>WEEK 30</b>	<b>WEEK 31</b>
<b>M</b>	- technics training 1000m - play 20 min	- 20 min mobility exercises with stick - technics training freestyle/ backstroke style 1000m -100m butterfly kicks/ freestyle kicks - butterfly strokes - play 20 min	- 20 min mobility exercises with stick - technics training freestyle/ backstroke style 1000m -100m butterfly kicks/freestyle kicks - butterfly strokes - play 20 min	- 20 min mobility exercises with stick - technics training freestyle/ backstroke style 1000m -100m butterfly kicks/ freestyle kicks - butterfly strokes - play 20 min
<b>W</b>	3 x 45sec. seating on the edge of the pool freestyle strokes -3x 30sec. idem. backstroke strokes -100m freestyle gliding -800m freestyle -150m optionally	3 x 45sec. seating on the edge of the pool freestyle strokes -3x 30sec. idem. backstroke strokes -100m freestyle gliding -800m freestyle -150m optionally	3 x 45sec. seating on the edge of the pool freestyle strokes -3x 30sec. idem. backstroke strokes -100m freestyle gliding -800m freestyle -150m optionally	3 x 45sec. seating on the edge of the pool freestyle strokes -3x 30sec. idem. backstroke strokes -100m freestyle gliding -800m freestyle -150m optionally
<b>F</b>	with the feet on the pool ladder 4x20 lifts on toes and 4x30 triple flexion -with hands on the breakwater and immersed in water up to neck 4x20 abduction/ adduction of lower limbs -400m freestyle/ backstroke kicks -400m freestyle/ backstroke -200m optionally	with the feet on the pool ladder 4x40 lifts on toes and 4x40 triple flexion -with hands on the breakwater and immersed in water up to neck 4x40 abduction / adduction of lower limbs -400m freestyle/ backstroke kicks -400m freestyle/ backstroke -200m optionally	with the feet on the pool ladder 4x40 lifts on toes and 4x40 triple flexion - with hands on the breakwater and immersed in water up to neck 4x40 abduction/ adduction of lower limbs -400m freestyle/ backstroke kicks -400m freestyle/ backstroke -200m optionally	with the feet on the pool ladder 4x40 lifts on toes and 4x40 triple flexion - with hands on the breakwater and immersed in water up to neck 4x40 abduction/ adduction of lower limbs -400m freestyle/ backstroke kicks -400m freestyle/ backstroke -200m optionally

M	- mobility with elastic band -300m freestyle -technics for freestyle / backstroke / butterfly 1700m -10 min. strenght with elastic band at the side of the pool - 20 flipflops in water -10min bicycle (minimum resistance)
W	-200m freestyle -3 x 60sec. seating on the edge of the pool freestyle strokes -3x 40sec. idem. backstroke strokes - 2x1000m swim with fins (short brake between repetitions) -10min bicycle ( minimum resistance )
F	-200m freestyle -supine at the edge of the pool – triple flexions of the lower limb ( 4 series x 30 left repetitions – idem for right limb) - with the feet on the pool ladder 4x40 lifts on toes and 4x50 triple flexion - with hands on the breakwater and immersed in water up to neck 4x10 abduction / adduction of lower limbs (with resistance – elastic band around the tighs) -250m freestyle with t-shirt -8x50m freestyle kicks -100m relaxing - backstroke -250m freestyle with t-shirt -4x25m backstroke kicks -relaxing 100m backstroke -200m freestyle -10min. bicycle ( minimum resistance )

After comparing the initial densitometry made also in the begginig of the 60 weeks program with the one after the training program was acomplished, it was achieved a 7% increase in the percentage of bone density.

The most important aspect from our point of view is that throughout the course of the 60 weeks training, the subject hasn't suffered any fractures, which was regularly happening before the implementation of the program.

## Results

In the case above, the achieved progress with the 12 year old subject has been remarkable. After following the training programs for 60 weeks the subject was able to sustain a continuous effort of 2000m with fins, which means that in the next period he will be able to perform the 2000m test that examines the subject's aerobic capacity. We can say that the subject along with the support from a team of professionals, can aim to the National Paralympic Swimming Lot of Romania. In terms of evaluation using the Tanita SC-240 scale or the following aspects were observed:

- ✓ the fat mass of the subject was reduced by 7%, by following the training program;
- ✓ the muscle mass was increased by 6.3%.

The evaluation was made in the begginig of the 60 weeks program and after sixty weeks.

## Conclusions

The aquatic environment is the ideal environment to realize a training program for the development of children's exercise capacity (Marinescu G., 2008).

Swimming is part of the physical therapy treatment and represents one of the most important means to create a training program in the aquatic environment (Vasile L., 2013).

Pool therapy improves endurance of children with OI (Chiasson R., 2004).

We recommend to all specialized persons to achieve the adaptation with the aquatic medium, by including the subject into a group that already has performed this kind of activity. It was observed



that this way, the adaptation was possible much more quickly and the subject gained self-confidence.

On the score of the training programs, considerable improvements from the psychological point of view were achieved, and the subject managed to find a personal motivation to push him overcome his own condition.

After completing the 60 weeks training program, the subject can perform the 2000m test with paws, to assess its effort capacity, which enables the possibility of evaluating the strain capacity through a direct method.

On the score of the training programs, the subject achieved improvements in the percentage of fat mass as well as in the percentage of muscle mass; these came closer to the limits recommended by specialists for its age and particularities. Along with these, it was also achieved a 7 percent increase of the bone density.

By analyzing the results of the conducted tests, it was found that the exercises performed in the aquatic environment bring physical and psychological benefits to people suffering from OI, helping them improve their quality of life.

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