

# THE IMPORTANCE OF PHYSICAL TRAINING IN THE ADVANCEMENT OF PARACYCLISTS FROM CATEGORY H1 TO H2 – CASE STUDY

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**ABSTRACT.** Paracyclists are part of the category of athletes with lower limb disabilities that require the use of a manually operated bicycle. There are 5 classes of manual cycling, but we present only the categories relevant to the present study, namely: H1: tetraplegics with severe upper limb impairment at the level of the C6 vertebra; H2: tetraplegics with minor upper limb impairment from c7 to t3. *The purpose of this study* is to show the importance of physical training in the basic training of tetraplegic cyclists with severe upper limb impairment. *Materials and methods:* The method of bibliographical study, the method of case study, the method of observation and last but not least, the graphic method. *Results:* Following the tests performed by the authorized medical personnel of the UCI International Cycling Union, it was found that the I.O athlete can advance to H2 category due to the increase in muscle mass and the improvement of strength in the upper limbs. *Conclusions:* Following the tests and the applied program, it was found that physical training exercises are beneficial for developing upper limb strength, developing abdominal muscles and are also beneficial for producing power for smooth pedaling

**Keyword:** physical training, paracyclists, case study

## INTRODUCTION

Paracycling emerged in the 1980s, the first Paralympic cyclists were visually impaired and competed in tandem with a sighted partner (Sidwells, 2018).

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Paracycling is a branch of cycling, but it is adapted for people with various motor and locomotor disabilities (Higgins, 2018). It is governed by the International Cyclist Union (ICU) and includes road and track races (“Para-Cycling”, 2025).

The first participation in the Summer Paralympic Games took place in New York in 1984, where there were only road races for cyclists with cerebral palsy (Petersen, 2019). During the next four editions of the Paralympic Games, other events were added.

The world's top paracyclists have competed in the World Track and Road Championships since 1994, also in the Commonwealth Games, the Paralympic Games and in 2010 they participated in the World Cup (PARA, 2018).

Handcycling was included in the 2000 Sydney Paralympic Games for the first time as a demonstration event.

Cyclists are classified into three broad groups: visually impaired, cerebral palsy and physically impaired (Friel, 2018). These are further subdivided into 14 functional categories for men and women (“UCI Para-Cycling Road World Championships”, 2025). Cyclists are placed in the appropriate category according to their functional capacity as follows:

**B:** blind (tandem) B1-2

**C:** bicycle C1-5

**H:** manual bicycle H1-5

**T:** tricycle T1-2

The classification for categories H and T is made using the ASIA (American Spinal Injuries Association) assessment test/scale, a test for evaluating patients with spinal cord injuries (SCIs).

The ASIA classification has refined and improved the accuracy of assessing the SCIs patient, providing rigorous, quantifiable data, and is based on the correct recording of neurological examination data.

Physical training is the process of improving physical qualities (strength, endurance, speed and mobility) to optimize performance in a particular discipline or sporting event and to prevent injuries (High Performance Sport New Zealand, 2016). It can be general, aiming at the harmonious development of the body, or specifically, adapted to the requirements of a sports discipline.

### **Adapted physical training**

Paralympic athletes prioritize training that targets their niche (Olson, 2024). Although they can benefit from exercises for the whole body, these competitors often focus on certain parts of the body. For example, a wheelchair cyclist will focus most of their attention on exercises for the upper body.

## **MATERIAL AND METHODS**

The case study was implemented on the I.O. athlete who has a spinal cord injury at the C5-C6 level and benefits from 2 physical training sessions per week and 3 cycling sessions, 2 training sessions on a trainer and one training session on a competition bike in competition conditions (on the road).

This study is both exploratory and explanatory because it shows the importance of physical training in the basic training of tetraplegic cyclists with severe upper limb impairment, to move from category H1 to H2.

For example, below are the training sessions that took place in a weekly cycle.

### **Physical training workout:**

#### ***Workout no. 1***

- from the sitting position in the wheelchair, perform forward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform backward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform overhead arm raises – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform lateral arm extensions – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform chest throws with a 3 kg medicine ball, 4 sets x 25 repetitions with a 1-minute break between sets
- from the sitting position in the wheelchair, perform overhead throws with a 1 kg medicine ball 3 kg, 4 sets x 25 reps with 1 minute rest between sets
- from the sitting position in the wheelchair perform lateral throws with a 3 kg medicine ball, 4 sets x 20 reps on each side with a 1minute rest between sets
- from the sitting position in the wheelchair perform lateral swings with 3 kg dumbbells, 4 sets x 15 reps with a 1minute rest between sets
- from the sitting position in the wheelchair perform forward swings with 3 kg dumbbells, 4 sets x 15 reps with a 1minute rest between sets
- from the sitting position in the wheelchair perform overhead arm raises with a “Z” bar, with a load of 12 kg, 3 sets x 12 reps with a 1minute rest between sets.
- from the supine position, perform passive thigh flexion on abdomen – 5 sets x 20 repetitions with a 1-minute break between sets

#### ***Workout no. 2***

- from the sitting position in the wheelchair, perform forward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets

- from the sitting position in the wheelchair, perform Backward arm rotations – 2 sets x 10 reps with a 30-second break between sets
- from the sitting position in the wheelchair, perform overhead arm raises – 2 sets x 10 reps with a 30-second break between sets
- from the sitting position in the wheelchair, perform lateral arm extensions – 2 sets x 10 reps with a 30-second break between sets
- from the sitting position in the wheelchair, perform chest throws with a 3 kg medicine ball, 4 sets x 25 reps with a 1-minute break between sets
- from the sitting position in the wheelchair, perform overhead throws with a 3 kg medicine ball, 4 sets x 25 reps with a 1-minute break between sets
- from the sitting position in the wheelchair, perform lateral throws with a 3 kg medicine ball, 4 sets x 20 reps on each side with a 1-minute break between sets
- from lying on the back on the training bench, perform the flexion and extension of the arms in the elbow joint with the right bar and a load of 25 kg, perform 4 sets x 12 repetitions, with a 1-minute break between sets
- from sitting on the training bench, with the backrest tilted at 45°, perform the forearm flexion on the arm, with the “Z” bar and a load of 20 kg 5 sets x 15 repetitions, with a 1-minute break between sets
- from sitting on the training bench, with the backrest tilted at 45°, perform the forearm extension on the arm, with 8 kg dumbbells, 5 sets x 15 repetitions, with a 1-minute break between sets
- from lying on the back, perform passive thigh flexion on the abdomen – 5 sets x 20 repetitions with a 1-minute break between sets

## **Cycling training**

### ***The training 1***

- from the sitting position in the wheelchair, perform forward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform backward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform overhead arm raises – 2 sets x 10 repetitions with a 30-second break between sets
- on the trainer, 10 minutes pedaling at a speed of 10km/h, 20 minutes pedaling at a constant speed of 18km/h, 10 minutes pedaling at a constant speed of 22km/h, 20 minutes pedaling at a constant speed of 18km/h, 5 minutes pedaling at a constant speed of 25km/h, 10 minutes pedaling at a speed of 10km/h.

### ***Workout 2***

- from the sitting position in the wheelchair, perform forward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform backward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting in the wheelchair, perform overhead arm raises – 2 sets x 10 repetitions with a 30-second break between sets
- on the trainer, 10 minutes pedaling at a speed of 10km/h, 15 minutes pedaling at a constant speed of 15km/h, 10 minutes pedaling at a constant speed of 12km/h, 15 minutes pedaling at a constant speed of 15km/h, 10 minutes pedaling at a constant speed of 12km/h, 10 minutes pedaling at a speed of 10km/h.

### ***Workout 3***

- from the sitting position in the wheelchair, perform forward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform backward arm rotations – 2 sets x 10 repetitions with a 30-second break between sets
- from the sitting position in the wheelchair, perform overhead arm raises – 2 sets x 10 repetitions with a 30-second break between sets
- on the competition bike, under competition conditions, pedal for 160 minutes at an average speed of 20km/h and a maximum speed of 40km/h

### **Participants**

I.O. is a 47-year-old male athlete, and he has spinal cord injury at the C5-C6 level, with complete type A spinal cord section as well as complete loss of trunk stability. Participation in the study mentioned above was voluntary.

### **Procedure**

The ASIA test scale was used, which involves the use of a force intensity rating scale with grades from 0 to 5, on muscle groups important to the practiced sport.

**0**=absent intensity, no palpable or visible contraction is detected

**1**=very weak intensity, visible or palpable contraction in the form of intramuscular tensions and/or at the insertion tendon level

**2**=weak intensity, voluntary movement is performed with full amplitude in the absence of gravity

**3**=medium intensity, full amplitude of movement against gravitational force. Segmental muscle strength is of “non-functional” intensity, unable to “lock” the joint in a functional kinetic chain

**4**=good intensity, full amplitude of movement performed antigravitational and against moderate resistance.

**5**=normal intensity, full range of motion, performed against gravity and normal resistance considering the age, sex and general development of the individual.

### Materials

ASIA test scale, stopwatches, break test, wheelchair, trainer, 3kg medicine ball, Z bar, 8kg dumbbells, straight bar, training bench, Polar pulse tester, bibliographic study, observation method.

### RESULTS

According to ICU regulations, the testing was carried out by ICU physiotherapists at the end of one of the international competitions in which athlete I.O. participated, results that are confidential for both the athlete and the public.

The sports results had improvements in terms of time spent during international races in both the 21km and 50km races.

**Table 1.** Diameter of the brachii biceps

Name and surname	Diameter of the brachii biceps		
	Initial	Intermediary	Final
	Left/right	Left/right	Left/right
<b>I.O.</b>	32/30	33/31	34/32

### DISCUSSION

The current analysis highlights a clear dichotomy between the empirical approach of amateurs and the methodological rigor of professionalism in cycling. A major barrier to the progress of recreational athletes remains their confinement within the “gray zone” of intensity—a phenomenon that reinforces the necessity of adopting the polarized training model advocated by Friel. In contrast to suboptimal, unorganized effort, polarization ensures a distinct demarcation between recovery and the stimulation of upper physiological thresholds, transforming training from a mere accumulation of mileage into a true engine of performance.

This methodological evolution is intrinsically linked to the technical progress of the racing bicycle. As Higgins (2018) emphasizes, technological innovation has redefined the bicycle, transforming it from a rudimentary vehicle into a sophisticated speed machine. In this context, performance is no longer an exclusively biological attribute but the result of a synergy between physiology and engineering. This is particularly evident in para-cycling, where modern functional classification systems (High Performance Sport New Zealand, 2016) and the professionalization of the discipline noted by Olson (2024) have shifted the focus from social integration toward biomechanical excellence. Thus, physical limitations are no longer viewed as deficiencies, but as optimization parameters within a “laboratory” where the boundary between human and machine becomes increasingly blurred.

However, this race toward optimizing every watt produced raises ethical and pragmatic questions regarding the essence of the sport. The critique provided by Petersen (2019) serves as a necessary counter-argument, reminding us that excessive standardization and high equipment costs may eclipse the human and recreational dimensions of cycling. Ultimately, while the tactics described by Sidwells—such as “chess on wheels” and the dynamics of drafting—underscore the technical complexity of this individual sport played as a team, long-term success depends on the fragile balance between scientific rigor and the intrinsic pleasure of riding.

## **CONCLUSIONS**

Following the tests and the applied program, it was found that physical training exercises are beneficial for the development of upper limb strength, the development of abdominal muscles and is also beneficial to produce power for smooth pedaling.

Physical training exercises also brought considerable benefits in cycling races, because athlete I.O. finished the races in the H2 category approximately 30 minutes faster than in the H1 category.

Physical training led to an increase in muscle mass, at the level of the biceps brachii muscle, increasing by 1cm every 3 months.

Physical training led to the physiological adaptation of strength development in endurance mode.

## **AUTHOR CONTRIBUTIONS**

Author 1, author 2, contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. All authors have read and agreed to the published version of the manuscript.

## REFERENCES

- Friel, J. (2018). *The cyclist's training bible: The world's most comprehensive training guide*. VeloPress.
- Higgins, N. (2018). *Racing bicycles: The illustrated story of road cycling*. Laurence King Publishing.
- High Performance Sport New Zealand. (2016). *Para-cycling: Paralympic sport information*.
- Olson, E. (2024). *Para cycling (Paralympic sports)*. Library Binding.
- PARA. (2018, January 01). *About para-cycling*. UCI. <https://www.uci.org/article/about-para-cycling/1jAdxOlnpTBxQc0x7RPqno>
- Para-cycling. (2025, August 26). In *Wikipedia*. <https://en.wikipedia.org/wiki/Para-cycling>
- Petersen, G. (2019). *Liber la pedalat*. Pilot Books.
- Sidwells, C. (2018). *The call of the road: The history of cycle road racing*. William Collins.
- UCI Para-cycling Road World Championships. (2025, August 26). In *Wikipedia*. [https://en.wikipedia.org/wiki/UCI\\_Para-cycling\\_Road\\_World\\_Championships](https://en.wikipedia.org/wiki/UCI_Para-cycling_Road_World_Championships).