

Investigation of Preventive Measures for Injuries in Handcycle Training of Disabled Skiers

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Introduction

There are many athletes in Japan who have won prizes in the Paralympic Winter Games alpine skiing events. They also use handcycle as summer training. However, it was found that there were cases of injury during that handcycle training. This issue needs to be addressed as soon as possible. Some prior studies [1-3] have mentioned how to operate more efficiently, how power can be exerted, and so on. However, there are no studies that mention injury in the handcycle. This study will address the factors that contribute to injuries sustained by disabled skiers during handcycle training. In addition, measures to prevent these injuries will be discussed.

Subjects

The subjects of this study are four disabled skiers who compete in alpine events during the winter season. Among the subjects were winter Paralympic prize winners. Their disabilities are spinal cord injury and spina bifida.

Methods

The study was described orally and in writing. If they were willing to cooperate in the study, they were asked to sign a consent form. Then, I took a video of them training. The survey was conducted in Japan in September 2022. The videos were analyzed using motion analysis software (myDartfish Pro S, Dartfish Japan Co., Ltd.). Finally, the subjects were interviewed about injuries sustained during training.

Results

The interview survey revealed that two skiers had been injured during hand cycle training. Therefore, I analyzed in detail the movements and postures of skiers who had been injured and those who had never been injured. The results showed that the male skier with the acromion injury had an angle of 38.6° to the crank when the thigh area was 0°. On the other hand, the male skier who had never been injured before had an angle of 59.5° (Figure 1). Furthermore, skiers who claimed tension around the shoulders were found to pedal the handlebars with a rounded back. In particular, the female skier was training with their chins sticking out (Figure 2).



Note: The injured skier is left.

Figure 1: Comparison of crank angles.



Note: The injured skier is left.

Figure 2: Comparison of posture during training.

Conclusion

It focused on crank angle and training posture in this study. Iwasaki [4] states that the crank should be set below the acromion from a performance perspective. However, it is not yet known what the best angle to the crank is when the thigh position, or the seat portion of the chair, is set at 0° . This will need to be investigated in more detail in the future. The only thing that can be said is that it is important to be able to make settings that match the user at the time of the fitting. The risk of injury may be reduced by setting up hand cycles based on a prior understanding of individual disabilities and movement characteristics with regard to posture during training. The software “rysis” [5] is

used to measure the sitting posture of people with disabilities. This is an ISO-compliant 2D image analysis software. However, this software measures the posture at rest. Thus, the posture during exercise is not taken into account.

The setting of the tools used for the handcycle should be based on detailed data during the operation. Otherwise, the number of cases of injuries sustained when using handcycles will not decrease in the future. The research on occupational and environmental health has shown the importance of improving the environment and primary prevention. Kogi [6] provides opportunities and shows how to strengthen primary prevention with regard to occupational and environmental health. However, the concept of preventing or avoiding

injury is not widespread in the sports field. There are few studies on cases in which injuries could have been avoided or prevented in advance. It is important to find methods of improvement for injuries and accidents, but it is also important to collect good practices and apply them to sports science research.

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