

Game Based Physiotherapy for Treatment of Children with Juvenile Idiopathic Scoliosis

P. Feistritzer-Gröbl¹, A. Nischelwitzer², V. Saraph³, H. Holzer⁴

¹Department of Physiotherapy, FH Joanneum, Graz, Austria. ¹petra.feistritzer-groeb1@fh-joanneum.at

²Department of Information Management, FH Joanneum, Graz, Austria. ²alexander.nischelwitzer@fh-joanneum.at

³Department of Adolescent Surgery, Medical University, Graz, Austria. ³vinay.saraph@meduni-graz.at

⁴Institute of Sports science, KF University, Graz, Austria. ⁴hans-peter.holzer@uni-graz.at

Introduction

The performance of daily exercises of patients with “juvenile idiopathic scoliosis” (JIS) during the home-based exercise period is difficult to monitor, therefore the collection of evidence is a challenge. Although a correct execution of these exercises are of particular importance for the treatment of JIS there is, until now, no easy tool to monitor and guide these home-exercises [1]. Furthermore, because such exercises have to be performed many times in the same way, they tend to be boring. This may lead to a negligent execution of the home-based exercises, consequently reducing their therapeutic effect.

The aim of this study was to develop a computer game to guide, monitor and evaluate therapeutic exercises along with a way to strengthen the motivation of children with JIS.

Methods

Software and interfaces of a 3D input device were used to detect and measure smallest movements within a predefined, body fixed, 3D space. As input device a Sony© Gametrak for Playstation II© with two strings were used. One string was fixed on the body (near the COG) to get the “stabilisation point” and the movement of the trunk, the other string was fixed on leg or arm depending on the exercise used (in figure 2, the string was fixed at the ankle). To maintain motivation three different game screens have been developed (see Figure 1).

To play one of these games you have to move your arm or leg within the predefined *Movement Space* and get points for reaching special targets. When playing the game the exact movements of the extremities in respect to a body fixed “stabilisation point” can be measured along with additional parameters like exercise time or time outside the *Movement Space* (MS).

During the performance of an exercise the game offers feedback information to keep the right position: should one part of the body (arm, leg) go beyond the *Movement Space*, the game stops and indicates the position of the correct movement. As soon as the arm or leg is once again within the *Movement Space* the game continues.



Figure 1. Game interfaces (Bee, Helicopter and Balloon).

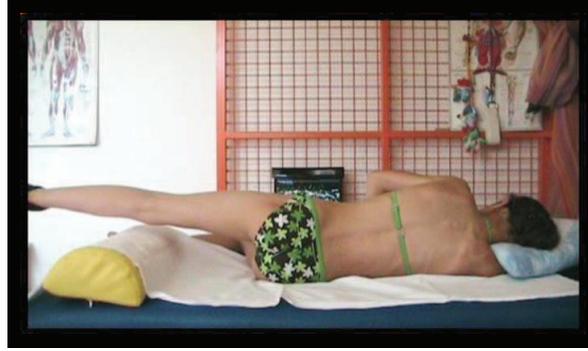


Figure 2. Standardized exercise of Schroth concept *MUSCLECYLINDER IN SIDEPOSITION*.

In this way the children are guided to perform their exercises in a precise way. Additionally, more data are recorded for further evaluation by the therapist. Furthermore, the level of difficulty can be adjusted by the therapist to the individual skill of the child.

A single case study was performed with a 12 year old girl with *JIS*, which exercised six months according to the Schroth concept [2]; two standardized exercises of this concept (*MUSCLECYLINDER IN SIDEPOSITION*, *MUSCLECYLINDER IN STANCE*) were carried out guided by the game (see Figure 2).

Results & Discussion

The available computer game for patients with *JIS* seems suitable for evaluating therapeutic exercises. The collected quantitative data give valuable information on the exercise regime and can be used to monitor and evaluate treatment process. Due to the real time Feedback of precise performance of exercises, exercise times are used more efficiently.

In this single case Study a Cobb curve (measured in brace) of 22 deg. (thoracic curve left convex) and 26 deg. (lumbar curve right convex) could be reduced to 16 deg. respectively 20deg.

A randomized study with the same target group is currently carried out to evaluate possibly different results of treatment with or without computer game.

Ethical statement

The experiment was approved by the ethical committee of the Medical University in Graz, Austria. Date: 18.03.2011, EK-Number:23-235 ex 10/11.

References

1. Negrini, S., Zaina, F., Romano, M., Negrini, A., Parzini, S. (2008). Specific exercises reduce brace prescription in adolescent idiopathic scoliosis: a prospective controlled cohort study with worst-case analysis. *Rehabil Med* **40**, 451-455.
2. Lehnert-Schroth, C. (2007). *Dreidimensionale Skoliosebehandlung: Atmungs- Orthopädie System Schroth* (7th ed.). München, Urban & Fischer.