



robot-assisted movement
therapy for the improvement
of trunk control and stability

hirob

A Class IIa medical device in compliance with Council Directive 93/42/EEC.

hirob

The “hirob” rehabilitation robot enables unique movement therapy for the improvement of trunk control and stability in patients with neurological deficits. Using a seat shaped like a horse’s back, the “hirob” simulates the path of motion as it would result from a horse’s walking movement and thus enables automated hippotherapy to be conducted.

The complex, three-dimensional movement which takes place in a horse’s back as the animal walks was recorded using a 3D motion analysis system and then implemented in the robot’s configuration. The resulting physiological movement pattern is used in therapy involving the “hirob”. Another special feature of the “hirob” is its therapy seat shaped like a horse’s back. This seat actively encourages the patient’s ability to maintain both the pelvis and upper body in a straight posture.

The “hirob” also makes it possible to vary the selected movement patterns (horse’s walking movement, swing movement, wave movement etc.). Additionally, the speed and intensity of the movement may be adjusted individually to the patient’s needs and physical condition. The “hirob’s” advanced and quick ability to adjust to patients and their individual condition ideally supports the therapy’s success in every phase of treatment. Therefore, it is guaranteed that the “hirob” can be used at various treatment phases: from an early therapy stage up to a chronic stage.

The precise simulation of a horse’s walking movement (as well as other movement patterns which may be individually adjusted to the patient), quick and easy patient transfer and high cost efficiency enable this effective therapy to be used for a wide range of patients.



Effects

Therapy involving the "hirob" produces:

- increased activity of the trunk and back muscles
- enhanced selective pelvis movement
- improved ability to maintain a straight pelvis and upper body posture
- improved trunk stability
- improved static and dynamic balance

This can be achieved by the dynamic, three-dimensional movement of the robot and the device's seat which is shaped like a natural horse's back (without a saddle).

Movement Individualization

During the full duration of therapy, the patient must actively react to the robot's movements. As a result, trunk stability and balance are improved. Additionally, the muscle tone in patients is influenced positively (toning of hypotonic muscles and reduction of muscle tone in the case of spasticity).

In order to adapt therapy to the individual demands of patients, the "hirob" features movement profiles which extend beyond a simulated horse's movement; for example, the movement pattern selected for multiple sclerosis patients may be completely constant. However, a movement featuring random variations may also be selected at the touch of a button.

Thus, therapy may continuously involve new stimuli, which prevents the patient's body from getting accustomed to a single movement pattern. Additionally, therapy may be supplemented, e.g. by the therapist throwing a ball for the patient to catch, the patient reaching for a hoop or stretching exercises involving a therapy stick. Individual movement patterns for various pathologies or therapy phases may be provided upon request in order to further increase the therapy's efficiency for the patient.

In addition to the movement profile, the intensity and speed of the movement may be adjusted to the patient's pathology, convalescent stage or condition on a particular day. As the movement may be adjusted continuously, therapy may be tailored specifically to suit the patient's needs.

Horseback-shaped Seat

The "hirob" features a therapy seat shaped like a horse's back which supports the patient's ability to maintain their pelvis, and, consequently, the upper body, in a straight posture.

Furthermore, muscles shortened by the usual sitting position are gently stretched and the flexibility of the hip joints is enhanced.

A straight trunk posture, improved trunk stability and regulated muscle tone also have a positive effect on manually conducted physiotherapy and ergotherapy. At times, exercises may be conducted more effectively and at an earlier stage in the overall therapy.

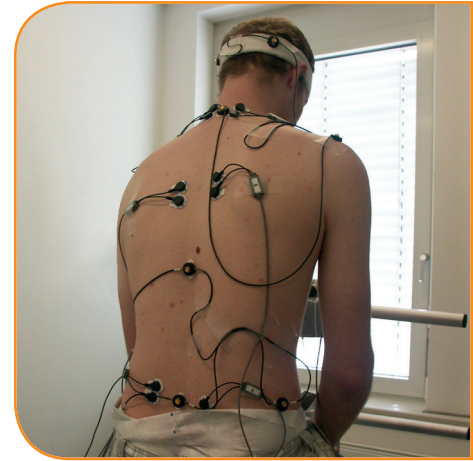


Clinical Study

In order to evaluate therapy involving the "hirob", a clinical study was conducted under the direction of Associate Professor Dr. Leopold Saltuari and Dr. Andreas Mayr at Hochzirl Hospital. Twelve patients with neurological defects which occurred following a traumatic brain injury or stroke took part in the study.

The study essentially consisted of three phases each lasting three weeks. During the first phase, the patients received conventional treatment in the rehabilitation clinic. In the second phase, an additional five therapy treatments per week, each lasting 20 minutes and featuring the "hirob", were conducted. In the last phase, the patients received conventional therapy for another three weeks, or – if they had already left the clinic – they did not receive any further treatment. At the beginning and end of each phase the patients were assessed and evaluated in order to document the individual therapy phases.

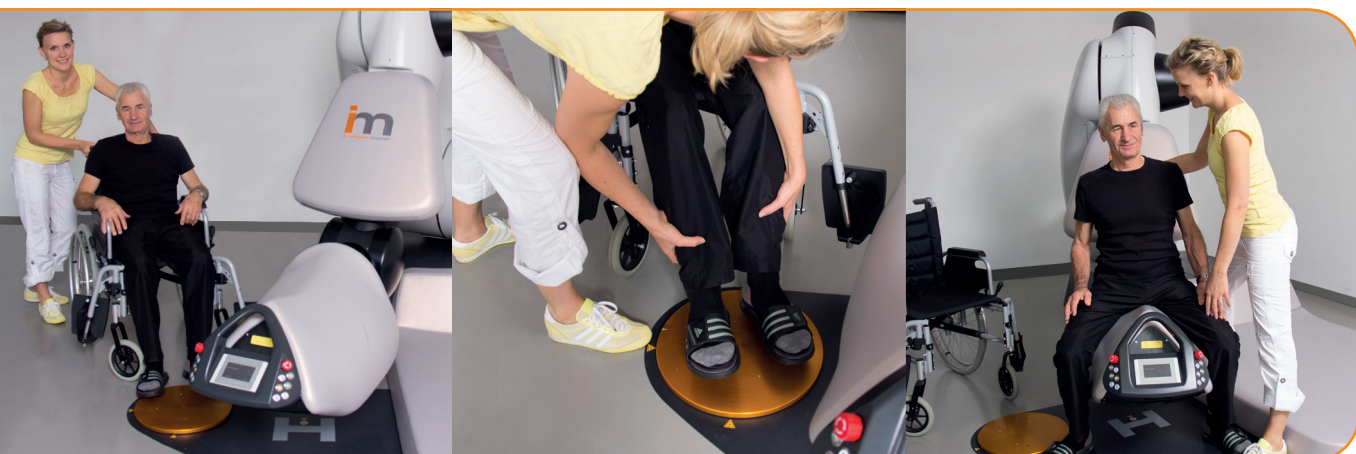
Out of 12 patients, 11 showed significant improvements in terms of trunk stability, as well as increased back muscle activity, enhanced ability to maintain the pelvis and upper body in a straight posture and an improved selective pelvic movement.



Simple and Cost-efficient Therapy

Compared to conventional hippotherapy, therapy involving the "hirob" is not only more attractive for its lower operating costs, but also staff costs are significantly reduced. Instead of three or four staff members, only one therapist is needed to conduct the therapy. In addition, high costs for patient transport are eliminated.

Only one therapist is required to conduct the therapy and to transfer the patient. To enable the patient to sit on the therapy seat, the robot moves to the so-called Transfer Position, which makes it easy and safe to lift the patient from the wheelchair and to turn him/her to sit on the robot's seat; the rotating plate integrated into the device supports the therapist in completing this task. The respective heights for Transfer and Therapy Position may be stored for each patient individually. This enables the patient to be transferred safely and quickly onto and from the robot, as well as for therapy to be given at a height which is comfortable for each individual patient.



Indications

Essentially, a therapy session involving the "hirob" is indicated for all pathologies causing trunk instability. A clinical study confirmed very positive effects in patients suffering from neurological deficits, e.g. after a stroke or traumatic brain injury. The therapy has also led to very positive results in patients with multiple sclerosis and children with cerebral palsy.

Other potential fields of application for the "hirob" include patients suffering from Parkinson's disease, paraplegia or orthopedic diseases. Clinical studies which attest positive effects in patients with these pathologies are currently being planned.

Range of Application

Therapy involving the "hirob" is feasible during almost the full duration of rehabilitation. Based on the model which defines the different phases of neurological rehabilitation (developed by the Union of German Pension Insurance Institutions (VDR) in 1995), the "hirob" may be used when treating patients in phases B to E. Currently, therapy involving the "hirob" is mainly indicated for patients in phases C and D.

Phase	B	C	D	E
Description of phase	Patient may still receive intensive care treatment.	Patient may take part in therapy but still remains in high-maintenance medical care.	Rehabilitation phase after concluding the early mobilization stage (corresponds to the medical rehabilitation phase in the non-neurological field).	Follow-up rehabilitation treatments and rehabilitation for the job.
Therapy involving the "hirob"		Application in phases C, D and E, in certain cases also in phase B.		

Therapy may be started when the patient no longer needs artificial respiration. As the speed and intensity of the therapy movement is continuously adjustable, patients may already receive treatment at an early stage of rehabilitation (patients in phase B).

Currently, the "hirob" is mainly used during in-patient rehabilitation treatment for patients with a stable circulatory system. This is usually the case four weeks after the acute event (patients in phase C or D).

In addition, regular therapy involving the "hirob" during outpatient follow-up treatment may lead to improvements in patients (patients in phase E).



"The three-dimensional movement of the horseback-shaped seat leads to improved trunk and pelvis control, and forces the patient to maintain his/her pelvis in a straight posture in order to maintain balance. The prospective study we conducted enabled us to prove that within three weeks of therapy involving the "hirob", results in the trunk control test improved significantly. This therapy supports patients in the process of regaining the ability to walk as standing and walking without assistance require efficient trunk and pelvis control."

Dr. Leopold Saltuari, Associate Professor, Head of the Acute Neurological Rehabilitation Unit, Hochzirl Hospital



"What I like best about the "hirob" is the short time it takes to set up and to transfer patients to the therapy position. The "hirob" may be adjusted quickly and precisely to the patient's needs. We are able to start using the "hirob" at an early therapy stage, as the speed and intensity of the movement may be selected according to the individual needs of the patient treated."

**Dr. Andreas Mayr,
Head of Therapy, Hochzirl Hospital**



"I was diagnosed with Guillain-Barré syndrome. As a result, until just recently I was completely unable to walk. Since starting therapy with the "hirob" one week ago, I have made great progress, and I am already capable of walking a few steps. I can feel that particularly my back and abdominal muscles have greatly benefited from daily therapy sessions involving the "hirob". I would definitely recommend this therapy; it has helped me a lot."

**Josefine Rungger,
Patient at Hochzirl Hospital**

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