

Armeo®Spring

1. Background information

After an injury, functional recovery takes place; on one hand, due to spontaneous recovery, on the other, therapy induced. However, the original level of function can usually not be re-achieved. The goal of the most efficient therapy solution is to bring back basic function faster, and to achieve a better long-term outcome. Scientific evidence shows that the key factors to successful recovery are:

- Functional training
- Active participation
- Self-initiated movements
- Training intensity: repetitions x effort
- Motivation
- Feedback

Armeo®Spring therapy is for individuals who have suffered strokes, traumatic brain injuries or neurological disorders resulting in hand or arm impairment. It supports the intensive task-oriented therapy of upper extremities. The advantages of the therapy are:

- Arm Weight Support in an extensive 3D workspace
- Augmented Performance Feedback with motivating exercises to train activities of daily living (ADLs)
- Repetitive training of goal-oriented movements
- Improved therapy efficiency
- Assessment Tools for an objective analysis and documentation of the patient's progress



2. What is the Armeo®Spring?

The ArmeoSpring is specifically suited for patients who are beginning to regain active movement of the arm and hand, and has already proved to be successful in many clinics worldwide. It is based on research and development conducted under Prof. D. Reinkensmeyer at the University of California, Irvine (UCI) and at the Rehabilitation Institute of Chicago (RIC).

The ArmeoSpring must only be used with patients with stable vital functions and whose arm can be properly fitted to the orthosis. The age of the patient to be treated is not relevant. The primary aim of rehabilitation for patients with partial arm paralysis is to maintain and restore their motor skills, which entails learning new movement processes and improving their coordination skills. Another goal is to prevent the risk of patients losing the capacity of the muscles in their paralyzed limbs from lack of use, along with secondary effects such as spasticity and joint contractures. The ArmeoSpring's purpose is to support functional therapy for patients who have lost function of or have restricted function in their upper extremities caused by cerebral, neurogenic, spinal, muscular or bone-related disorders. Taking into account the contraindications and every patient's individual profile, the ArmeoSpring is used in the case of:

- Stroke
- Multiple sclerosis (MS)
- Cerebral palsy (CP)
- Follow-up care after brain tumor operations
- Spinal cord injuries (SCI)
- Traumatic brain injury (TBI)
- Endoprostheses; follow-up care for elbow and shoulder endoprostheses
- Muscular atrophy
- Muscle weakness due to lack of mobility
- Hemiplegic patients

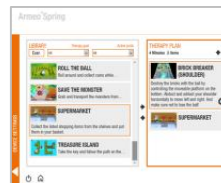
3. What does the Armeo®Spring consist of?

Arm Movement



- Exoskeleton

Individual Settings



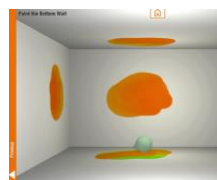
- Arm Weight Support
- 3D Workspace
- Exercises

Patient's Performance



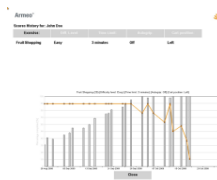
- Augmented Performance Feedback

Assessments



- A-ROM
- A-MOVE
- A-GOAL

Patient's Data



- Scores
- Reporting Tools

The ArmeoSpring consists of an exoskeleton (with 3 joints and 6 degrees of freedom), which is linked to a software on a screen. You can adjust the exoskeleton and several software parameters individually to your patients' needs and according to the therapeutic goal of the patient.

The exoskeleton will “guide” or “control” the **Arm movement**, that means, the movement that we want the patient to do. For safety reasons you have create some safety zones in the beginning.

Several **individual settings** can be adjusted or selected, like the arm weight support which supports the movement of the patient against gravity during the movement, the 3D workspace or several exercises according to the patient's ability.

Moreover, the ArmeoSpring (exoskeleton) has sensors which measure the **patient's performance**. Patient performance and feedback are shown on the screen within Augmented Performance Feedback exercises. The software contains an extensive library of game-like movement exercises supported by a virtual-reality training environment that is both motivating and informative, clearly displaying the functional task along with immediate performance feedback.

Besides functional exercises, the system also provides **Assessments** designed to assess the motor ability and coordination of patients. Built-in sensors record the active arm movement at each joint during all therapy sessions and the performance data is stored in the computer, where it can be used to assess and document the patient's progress, to determine the next appropriate challenge and to promote the optimum therapy and best possible outcomes.

All these details (**Training Data**) will be saved in the reporting tool, which you can export.

4. How are we going to use the Armeo®Spring in a training session?

1 Prepare Patient and Armeo

- 1.1 Personal Data in Software
- 1.2 Adjustment Exoskeleton
- 1.3 Arm Weight Support

First we will need to **Prepare the Patient and the ArmeoSpring**, making the movement axis of the device match that of the patient and thus, ensure good arm movement. **Personal data** like user name and impaired arm will be put into the software. The anatomical joints should match the mechanical joints. Therefore, the **adjustment of the exoskeleton** should be done in following order: shoulder – wrist – elbow. The lower arm length and upper arm length will be put into the software.

Additionally, **arm weight support** will be selected and put into the software. The arm weight support should be sufficient enough for the patient to be able to perform specific tasks without compensatory movements while allowing many repetitions and yet kept to a minimum to ensure a challenging training session.

2 Session Setup

- 2.1 Define 3D Workspace (A-ROM, A-MOVE)
- 2.2 Create TherapyPlan

Then we will prepare the session (**Session setup**). This session setup procedure will be done a systematic way, step by step, to make it time efficient and to avoid missing a step. To **define the 3D workspace**, you have to conduct the initial assessments A-ROM (1D workspace) and A-MOVE (2D, 3D workspace). If you **create the therapy plan**, select appropriate **exercises** aligned with training goals or the patient's ability (1D/2D/3D, included joints, movements) as well as appropriate exercise parameters (difficulty level, duration, visual detail). **Assessment** tools may also be included in the therapy plan.

3 Training

- 3.1 Exercises
- 3.2 Assessments (optional)

Once all is ready, we will start **Training** according to the selected therapy plan, which can also include assessments along with the exercises.

4 Bring the Patient out

Once the training session is finished, we **Bring the Patient out of the ArmeoSpring**.