

## Motus: A device to help people walk again

Arm swing is an integral part of the human bipedal gait because it can improve the stability and energy efficiency in human locomotion. This arm pendulum motion and linking it to the leg movement can be essential for patients to recover from any mobility problems that they may have. Right now, in rehabilitation facilities, physical therapists attach poles to the patient's hand/wrist and manually move their arms to mimic the arm swing movement, while paying attention to the movement of the legs to synchronize to it. This requires multiple physical therapists to aid one patient's recovery. Currently, no product promotes arm swing movement in gait rehabilitation. So, we propose Motus, a device that can synchronize pendulum arm swing with bipedal leg movement during gait training.

Motus can go on top of an existing treadmill with its two legs on both sides to support its weight and any other forces that are produced by the patients when being used. The main pillar at the front contains four linear actuators with threaded rods (two for each arm). One goes up and down from the pillar to control the y-axis of the arm. The second one goes in and out from the pillar to control the distance between the arms and the z-axis. This is especially useful because this accommodates the different shoulder lengths of the population. The two arms are connected to the pillar by another linear actuator and threaded rod, this one goes side to side inside the arm to control the x-axis. The tip of the arm narrows down to form a handle so that the patients can grip onto. This would be

made with softer material so that it would be comfortable for the patients to hold onto. The arm would also have an option to switch out the handle for a wrist strap option by changing the attachment, the patient would be able to put on the wrist strap and that would magnetically clip onto the handle attachment. The design would also include motion-sensing cameras, this would be on the side and the front of the design so they could track the feet of the patient to be able to link the movement of the arms in a pendulum motion at the same pace as the legs. Finally, the design has a built-in interactive screen display that can move up and down to accommodate different heights. This can help the patients see their progress like the distance and time they have walked for, and even show an immersive scenery like a beach or forest to help them keep motivated throughout their recovery process. The main materials would be aluminum for the structure of the device and abs plastic for the end of the legs, the arms, and handles.

Estimated cost for material, production and manufacturing would be \$1,500, this would include the internal components, the aluminum body, the abs plastic covering, the display screen and the technology of the motion sensor cameras. The estimated sale price would be around \$4,500.

Not only will patients with spinal cord injuries benefit from this device, but also stroke patients, paralysis patients, Parkinson's patients, etc. Patients who have no mobility or partial mobility would be able to use this device to help them recover faster by having the technology, the motion-sensor camera, to couple the patient's gait and the pendulum arm swing. They would also have the motivation

to continue to recover with a display screen that can show their progress and immerse them into a specific scenery. Since it can be placed on top of an existing treadmill, rehabilitation facilities can add to their normal setup easily. Currently, four different physical therapists are needed for one patient in gait recovery. So, this device will eliminate the need for an extra physical therapist to manually move the patient's arms and will help physical therapists focus on more patients.