

Wearable gait exoskeletons

For the therapy of neuromuscular diseases

Maintaining walking ability is key for the survival of children affected by Neuro-muscular Diseases (NMD). There is currently no etiological treatment for the majority of these affections, although several clinical trials on drugs are on the way, but at present with no definitive result. The current multidisciplinary treatment of NMD focuses on maintaining the physical state of the patient, delaying the onset of musculoskeletal complications derived from the progressive weakness and loss of mobility. Joint deformities, muscle spasms, osteoporosis and scoliosis – among others – contribute to a decaying life quality and to accelerating the deterioration of the respiratory function, yielding a short life expectancy in most diseases. Neuromuscular diseases affect 4 million children in the World, 800,000 children in Europe.

Wearable Gait Exoskeletons are the therapeutic solution that clinicians are demanding to improve the therapy of these patients, and they are simultaneously the technical aid that affected families are demanding to restore the life quality of their children. When attached non-invasively to the legs and trunk of the patient, the robotic device provides locomotion, neuro-muscular rehabilitation, and spatial mobility.

Marsi Bionics is the first Global Company commercialising paediatric wearable exoskeletons. Model

ATLAS2020, ready for release, targets paraparetic children (having all four limbs paralysed). The exoskeleton is composed of 10 motors providing force and motion to the joints of the patient, a number of sensors acquiring the state of the user and of the robot itself, and an on-board controller ensuring adequate locomotion. Variable-stiffness joints at the knee ensure efficient adaptation to natural ground by mimicking the performance of human musculo-tendinous system and minimise power consumption. ATLAS2020 is assisted by a supporting frame that provides postural balance during walking, standing up and sitting down manoeuvres.

Model ATLAS2030 is the evolution of ATLAS2020, targeting diseases that show a progressively deterioration of strength and mobility. The exoskeleton will assist the patient as needed, thus adapting to the variable symptoms of NMDs. EXO-TRAINER project, financed by ECHORD++ (an FP7-EC funded initiative, www.echord.eu), will demonstrate ATLAS has no negative impact on NMD-affected patients (not causing fatigue, nor skin-injuries or pain) and that it really allows them walking. For this purpose, Marsi Bionics is working together with renowned roboticists at the Centre for Automation and Robotics (CSIC) to optimise the robotic technology, and with children's hospitals of reference worldwide like Sant Joan de Deu Children's Hospital. Medical doctors are involved in the whole project



workplan providing their knowledge, expertise, and assessment, and certifying the resulting exoskeleton in a clinical trial. Focus will be on children with Spinal Muscular Atrophy (SMA), first cause of infant mortality in rich countries. Tests will involve 8 children during 3 months, taking us to technology readiness for CE labelling.

Wearable Gait Exoskeletons will have an impact on children's quality of life and life expectancy. Moreover, the new therapy can potentially reduce the welfare costs to families, estimated at €25,000 per year, per family and even reduce the cost to the National Healthcare Systems by an improved and personalised therapy.



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