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# Rehabilitation Robots Support Care from a Distance

Effective, pleasant and customised rehabilitation for children can now take place in the comfort of home, thanks to the new technologies of the Stella Maris Foundation and the BioRobotics Institute of Scuola Superiore Sant'Anna in Pisa, Italy.

**Words:** Maddalena Vario, GARR

Thanks to the latest generation of robotic platforms, more and more rehabilitation treatments can be performed directly at home in a simple and intuitive way, while at the same time, the Remote Rehabilitation Team can plan and monitor treatment. With the Tele-UPCAT and CareToy projects (both funded by the Italian Ministry of Health), it is now possible for children to get the most out of a home rehabilitation treatment. In an environment recognised as safe and comfortable, a child is able to follow his/her own rhythm and timing, which reduces costs and travel to rehabilitation centres. Access to the knowledge and experience of the Research Hospital staff at the Stella Maris Foundation Excellence Centre from anywhere in Italy ensures best practice and helps reduce mistakes. First, all data is collected during the remote observation and monitoring of the child, and then analysed by doctors with special algorithms created by Sant'Anna engineers, with the aim to make the treatments as personalised as possible.

We talked to Dr. Giuseppina Sgandurra, Scientific Director of Tele-UPCAT, and Clinical Project Manager of CareToy.

## Doctor Sgandurra, Tele-UPCAT and CareToy are changing the rules of the rehabilitation therapy, but can a parent replace a therapist?

There are some rehabilitation treatments that parents can safely do at home with their child, identifying the best time to work with them, and combining rehabilitation with a moment of relaxing and playing together. In this case, the role of the parent is not the same as the therapist, who remotely plans and monitors the activities to be performed through the technology, and guides the parent in the activities to be done with the child. In particular, we developed platforms that monitor and support parents and the child step-by-step through the treatment.

## Which technological solution did you use?

Together with the engineers of the BioRobotics Institute of the Scuola Superiore Sant'Anna, we created a platform with dedicated software that automatically alternates moments of monitoring and activity. Everything is built in a playful way. The activity involves a clumsy alien, Ubi, who invites the child to help him in the mission of conquering a world every day.

Ubi interacts with the child, asks for help and involves the little patient, with the help of the parents, who have a box with numbered objects to be used day by day. In this way, the child performs the action-observation exercises designed for him or her. In addition, the child wears sensor bracelets, actigraphs, which are the same as those used by athletes to track kilometres and calories. We were the first to have the idea of wearing these bracelets on both upper limbs, because in this way we are able to measure the difference in use between the two limbs, especially in children with hemiplegia. In fact, what we aim for is not the healing of the hemiplegic limb, but its cooperation with the healthy limb and the reduction of asymmetry between the two. These bracelets are worn not only during therapy but for 24 hours during the first three weeks of treatment and during

any subsequent treatment. We are now working on the collected data with Sant'Anna engineers who have created the algorithms.

## What was the feedback of parents and children?

It was very positive. Before conclusion of the testing, we invited all families to Stella Maris, to have a moment of sharing and discussion with the parents, children and teenagers involved who made the project a success. They were delighted to come. Our auditorium was full, and parents asked to keep them in mind for the future projects.

## Which results did you achieve? What is the next step?

We got excellent results. We enrolled children and teenagers from ten different areas of Italy and recorded significant group results, demonstrating that, thanks to technology, action observation is feasible and effective, even at home. Furthermore, each child has improved in a different way. These results open new perspectives in relation to the precision medicine, because it will be possible to intervene in an increasingly personalised way for each child. Also, the work with the engineers of the Sant'Anna BioRobotics Institute on the creation of algorithms and the collaboration with GARR on the network side provided us with the essential technological base to be able to work on data easily and be able to extract the information we need for our business.

## Let's talk now about the other project, CareToy. How does it work?

CareToy is a biomechatronic gym (equipped with diagnostic instruments) that babies at high risk of cerebral palsy can use during the first months of life. The parent switches on the computer, places the child in a prone, supine or sitting position (depending on what is planned remotely by the therapist), activates the system by pressing a button and then is free to play and interact with the child. The system, based on the scheduled activity, stimulates the child and recognises his/her responses by providing feedback.

For example, if the rehabilitator's goal is to increase the strength of the pressure that the child exerts by grabbing the game, a determined pressure is fixed by the system that, when reached, causes the game to turn on and/or emit a sound. Once the first game scenario is over, the system asks the parent if he or she wants to continue. If the answer is positive, the system goes to the next exercise, with a total of about 30 to 40 minutes of game play per day.

## Is it possible to monitor the exercises from a distance?

The CareToy system is equipped with more than 2,000 sensors that record the activity of the child. In the evening, the data is processed, compressed and automatically sent to the Stella Maris server, where the rehabilitation team, through a dedicated interface, downloads and analyses it in detail. Thanks to this daily analysis, the activities to be proposed to the child are remotely updated. We are therefore in front of an architecture of tele-rehabilitation, where data is sent online from the house of the child to the Stella Maris Foundation.

## Which results did you achieve with CareToy?

We first tested the system on pre-term babies without brain damage, from 28 to 32 weeks, then on children at risk for psychomotor delays and neurodevelopmental disorders. We collected data on more than 60 children, demonstrating that 4 weeks of treatment in the experimental group improved visual and motor development. We have now begun a new, wholly Italian project funded by the Ministry of Health, where we are testing CareToy on children with brain injuries at risk of childhood cerebral palsy.

## For more information:

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