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Innovating with TeReFa: telerehabilitation for all

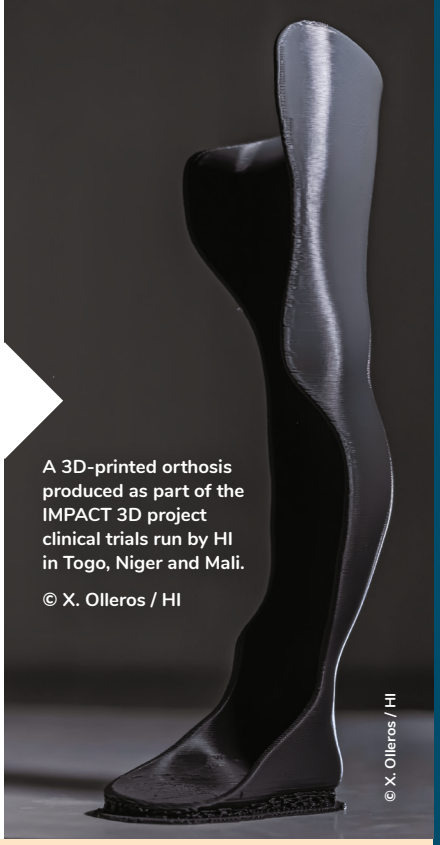
“One of the biggest challenges in any humanitarian crisis is to provide the most vulnerable and isolated people with access to care. Thanks to digital technologies combined with the added value of 3D printing, we can care for people with physical disabilities, together with our partners, in complex and remote environments, and produce and supply quality prostheses and orthoses for less."

Isabelle Urseau, Director of Rehabilitation

handicap international humanity &inclusion

Since 1982, HI has improved access to orthopaedic devices and rehabilitation services worldwide. It started by providing bamboo prostheses to Cambodian people living in refugee camps in Thailand, and has always taken a pragmatic and innovative approach, using existing materials and expertise while pursuing a policy of continuous research, testing, and the adaptation of its activities to reach the vulnerable and and needy isolated people.

New digital technologies have become more accessible and affordable in recent years and HI aims to unlock their potential to improve access to rehabilitation services.



A 3D-printed orthosis produced as part of the IMPACT 3D project clinical trials run by HI in Togo, Niger and Mali.

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WHAT IS TELEREHABILITATION AND 3D PRINTING?

/ Telerehabilitation is the use of digital technology to facilitate remote access to rehabilitation services.

/ HI has developed and tested a process using a portable 3D scanner to digitally mold patients for orthoses or prostheses. Health workers receive basic training from HI experts to operate scanners in remote areas.

/ We then use computer-aided design technology and a 3D printer to produce custom-made devices from lightweight filament. The devices can be produced at a separate location without the presence of the patient.

/ This process requires fewer resources – health facilities, human input, equipment – and produces devices quickly.

/ We use digital innovation to interact with beneficiaries using video communication technology. HI's teams and partners communicate with beneficiaries before producing the device. The next step might to be help them learn to walk again with their new prosthesis or orthosis. Professionals can also use this technology to follow up beneficiaries, assess improvements in mobility and autonomy, and answer any questions or resolve any technical problems they may have.

THE INNOVATION CYCLE

/ HI takes a pragmatic and continuous-learning approach to innovation. Since 2016, we have conducted four scientific studies into the potential of telerehabilitation and 3D technology. We also work with leading universities, private companies, and civil society to benefit from and contribute to the latest technological, clinical, and social expertise.

/ We run clinical trials and pilot projects in six different countries, including Uganda, Togo and Madagascar, to confirm our hypothesis that digital technologies can be used to produce affordable, quality prostheses and orthoses, including in challenging environments.

EXAMPLE OF A HEALTH CARE PATHWAY FOR A PATIENT IN NEED OF A PROSTHESIS:

- Arrival of the patient at the healthcare centre
- Individualized clinical examination*
- Fitting indication (type of orthopaedic device required) according to fitting standards*
- A mobile device is used to scan a residual limb (3D image is created)
- The socket is produced with a 3D printer**
- The prosthesis or orthosis is assembled and delivered to the patient
- Prothesis fitting is carried out to make any necessary modifications*
- Patient receives rehabilitation services*

* Steps performed using telemedicine with the support of a local health worker

** Steps performed remotely

Prosthetics and orthotics are still produced today in the same way as they were 20 years ago. They remain inaccessible to most patients. According to figures from the World Health Organization, 80 percent of people with disabilities live in developing countries while only 5 to 15 percent have access to mobility aids, devices, and assistive technologies.

Millions of people therefore live with a physical disability that could be mitigated or treated with an appropriate orthosis or prosthesis. Mobility and autonomy can be restored to a surprising degree. A person equipped with adapted prostheses may no longer need a wheelchair or even crutches, and a child with polio-related leg deformities could learn to run again, helping prevent the psychological, social, and economic stigma he or she might otherwise suffer.

MAIN RESULTS AND ADDED VALUE OF TELEREHABILITATION AND 3D PRINTING

/ 3D-printed prostheses and orthoses meet structural and mechanical requirements (ISO standards)

/ The 3D process has a positive impact on patients; it takes less time to personalise, and patients are satisfied with 3D-printed orthoses and prostheses

/ 3D solutions do not require the same health infrastructure, human resources or equipment needed to produce conventional prostheses and orthoses

/ Cost-effectiveness: there is a limited difference between the cost of producing conventional prostheses and 3D printing in a humanitarian context

/ Telerehabilitation to clinically assess, measure and adjust prostheses remotely with the support of a technician has achieved positive results

/ Telerehabilitation makes up for a shortage of professionals, brings experts closer to patients, and improves information and communication on rehabilitation solutions

/ Access to rehabilitation services and prosthetic and orthotic solutions increases functional autonomy, reduces vulnerability, minimises the risk of exclusion and improves quality of life for the target population.

5 PROJECTS IN...

humanitarian and development contexts and refugee camps.

HI's prosthetist and orthotist examines the scan of a four-year-old boy's legs.
Lomé, Togo.
© X. Olleros / HI

5 COUNTRIES

Togo, Madagascar, Mali, Niger, and Uganda

An orthotist prepares to 3D-print an orthosis.
Lomé, Togo.
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234 PATIENTS TREATED

OF WHICH:
150 patients provided with **orthoses** and rehabilitation services
84 patients provided with **prostheses** and rehabilitation services

An orthotist and a printing technician supervise the printing of an orthosis.
Lomé, Togo.
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HI at a glance:

COUNTRIES WHERE WE WORK*

58 COUNTRIES

*April 2020

DIRECT BENEFICIARIES IN 2019

2 871 722 PEOPLE,

(people receiving goods or services from a project implemented by HI or its operational partners in 2019)

STAFF MEMBERS** WORLDWIDE IN 2019

4 237 EMPLOYEES,

** Expressed as annual full-time equivalents.

OF WHICH:

3 401 national staff members in the field

347 international staff members in the field

"TESTIMONIAL"

Tabita, 11 years old
South Sudan

Tabita, eleven, was born in South Sudan. She now lives with her family in the Omugo refugee camp in Uganda. She developed well until the age of three, but the polio virus seriously affected her legs which became so weak she could neither walk nor stand.
HI's team provided her with crutches so she could continue going to school. She is now one of the beneficiaries of the TeReFA project. HI's prosthetics and orthotics technical advisor scanned Tabita's lower limbs before 3D-printing knee and ankle orthoses to support her lower limbs.

"TESTIMONIAL"

Geraldo, 6 years old
Lomé, Togo

Geraldo has a bone deformity that will cause him serious mobility problems and pain as he grows unless it is corrected with a repositioning splint. He is one of a hundred people taking part in a large-scale clinical trial implemented by HI in West Africa. In 2017 and 2018, HI and its partners used state-of-the-art digital modeling and 3D printing technology to trial custom-made orthopaedic devices including splints on children and adults in Togo, Mali, and Niger.

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