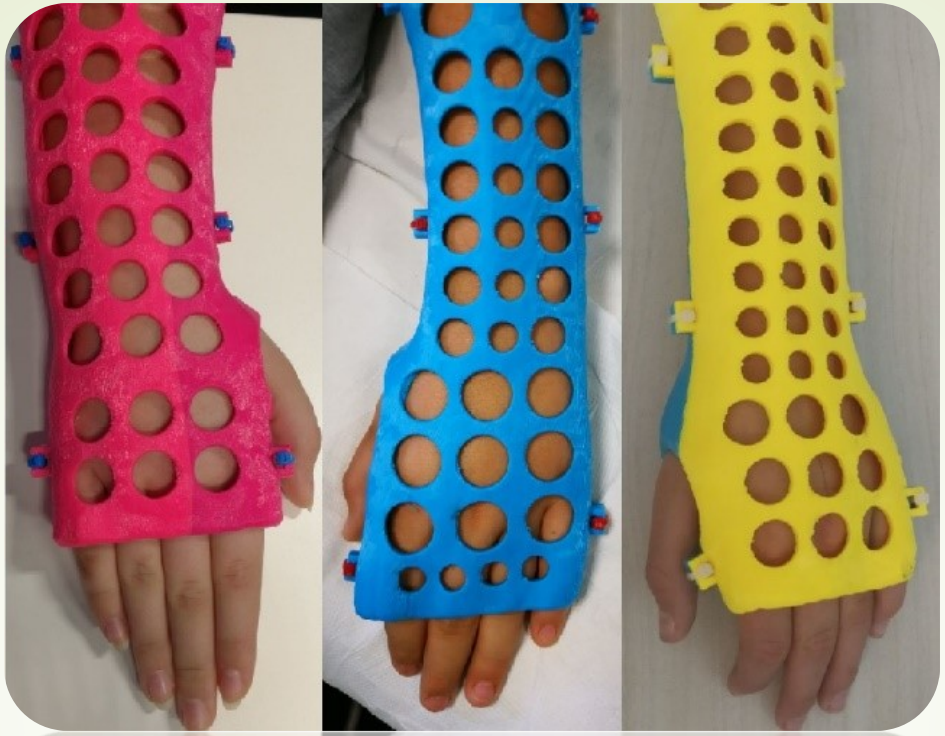


Project:Cast- Off !!!

Custom-made and adjustable 3D printed orthosis for forearm fractures

Santobono Pausilipon Onlus
fondazione

Azienda Ospedaliera di Rilievo Nazionale
SANTOBONO
PAUSILIPON

FONDAZIONE ONLUS
PIERO E LUCILLE CORTI
PER LACOR HOSPITAL

ICCI
CNR Istituto di Cristallografia

The Problem: falls from trees and boda boda accidents

Dr. Ndayisaba Sylvester reports for the last 7 months, the following numbers, including fractures of the radius, ulna and humerus in children 1 yr to 15 years:
May 2018 - 34 fractures
June 2018- 32 fractures
July 2018- 30 fractures
August - 26
September- 30
October - 33
November - 31
December- 30
An estimated number of 300 arm fractures are cared for at Lacor in one year.

Complications of plaster treatment

- Not reusable
- Difficulty in cleaning
- Skin irritation
- Infections
- Muscular hypotrophy
- Too much weight
- Too big

Not always very happy !

Aims of the Project:

- Acquire anthropometric information about target population
  - Measure the forearm of 60 children aged 5-15 years
- Perform statistic analysis in order to define 4-5 standard sizes suitable for each age and sex
- Produce 3D printed adaptable and reusable cast in sizeable number

Treatable fractures

- The cast were used for greenstick middle-third forearm fractures
- 40 patients in school-age were already treated
- All kinds of not-exposed fractures of the forearm could be considered

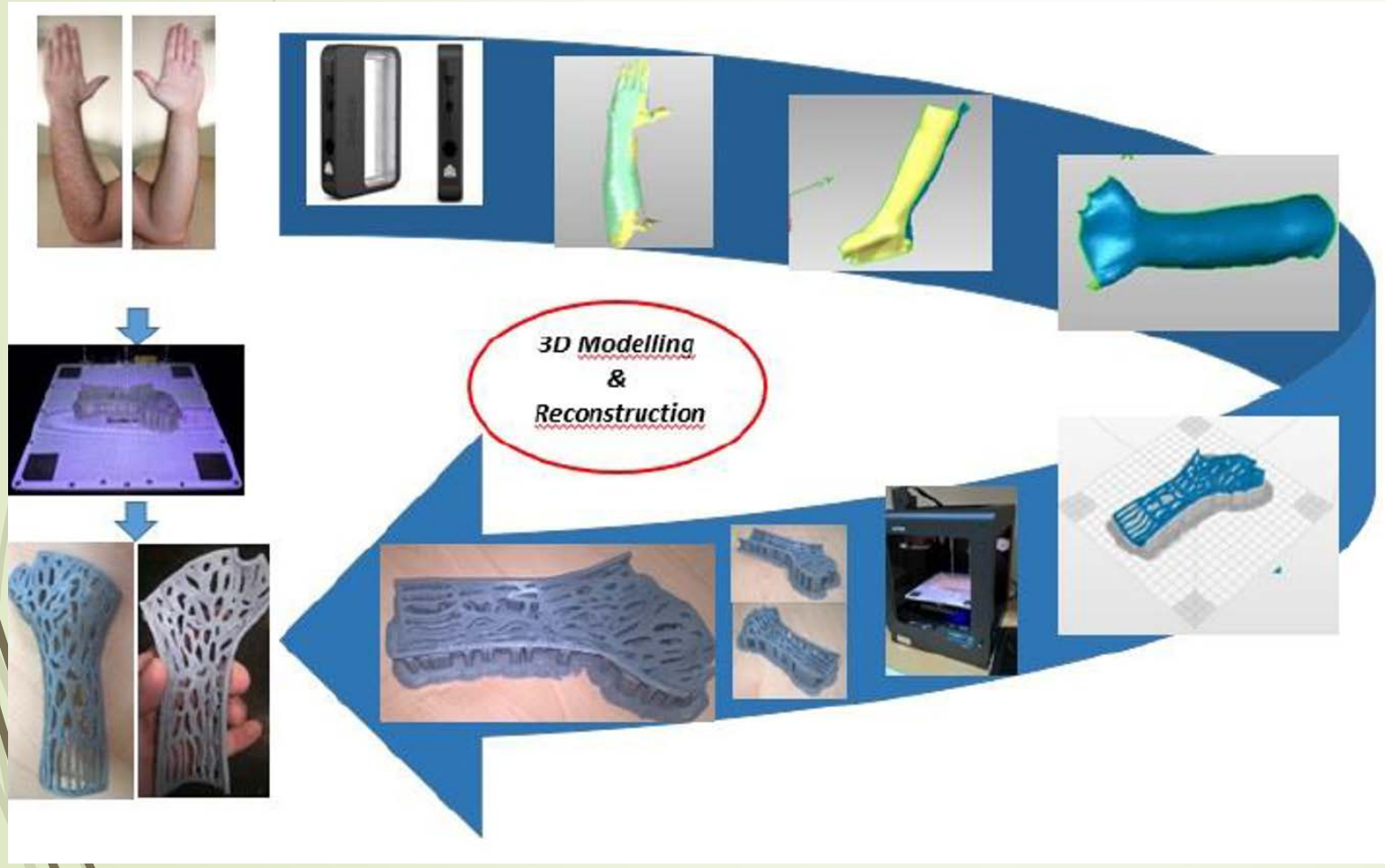
3D printing for immobilitation: other example of 3d printed cast

Amphibian skin

Exovite

Osteoid

Production process



- Forearm scan
- Forearm measurement
- CAD processing
- Printing
- Installation

Scan: Sense 3D Scanner

Sense 3D scanner Tech specs

Supported operating systems
64-bit Windows 8 or later

Scan volume
Min: 0.2m x 0.2m x 0.2m
Max: 2m x 2m x 2m

Dimensions
5.08(w) x 7.08(h) x 1.3(d) inches
12.9(w) x 17.8(h) x 3.3(d) cm

Operating range
Min: 0.2m
Max: 1.6m

Depth image size
640(w) x 480(h) px

Color image size
1920(w) x 1080(h) px

Field of view
Horizontal: 45°
Vertical: 57.5°
Diagonal: 69°

Spatial x/y resolution @ 0.5m
0.9mm

Depth resolution @ 0.5m
1mm

Operating temperature
10-40° C

Data interface
USB 3.0

USB cord length
6 feet

Maximal image throughput
30 fps

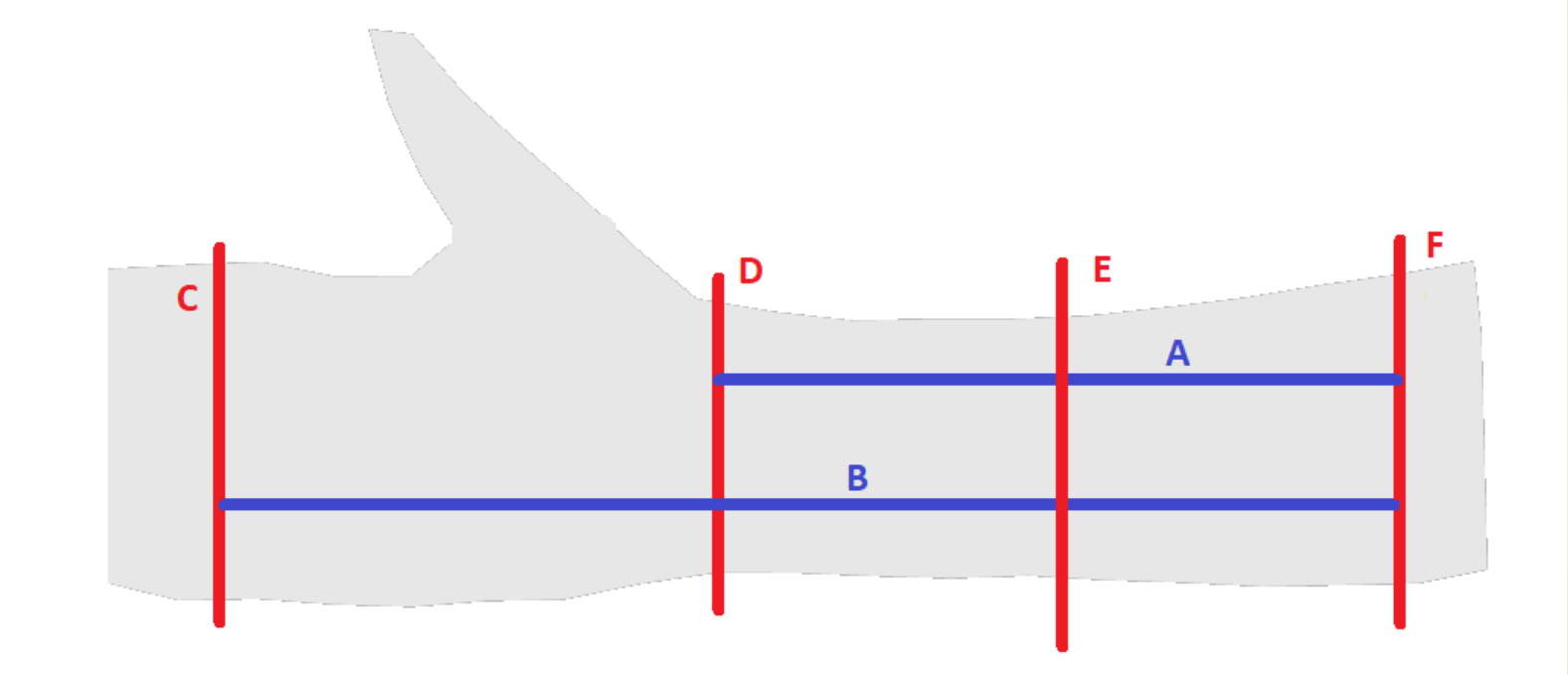
Hardware recommendations
Intel® Core i5™ 5th Gen or equivalent processor (click here for details)
RAM: 2 GB minimum
1280 x 1024 minimum screen resolution
4 GB available hard disk space

Warranty
1 year

Anthropometric acquisition: Patient positioning and scanning

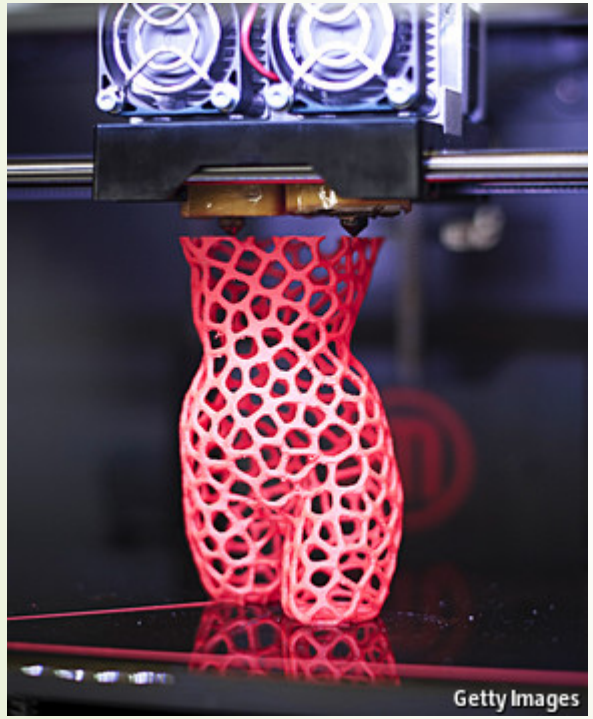
- The acquisition of measures is critical in order to produce a set of adaptable cast
- Place the patient, sit or stretched, with fingers tips directed upwards, inch stretced and the handbreadth directed to him;
- Lock the fingers with a finger trap to keep it vertical;
- Scan the forearm turning around the patient
- Time required ~10min

Anthropometric acquisition: Reference sections

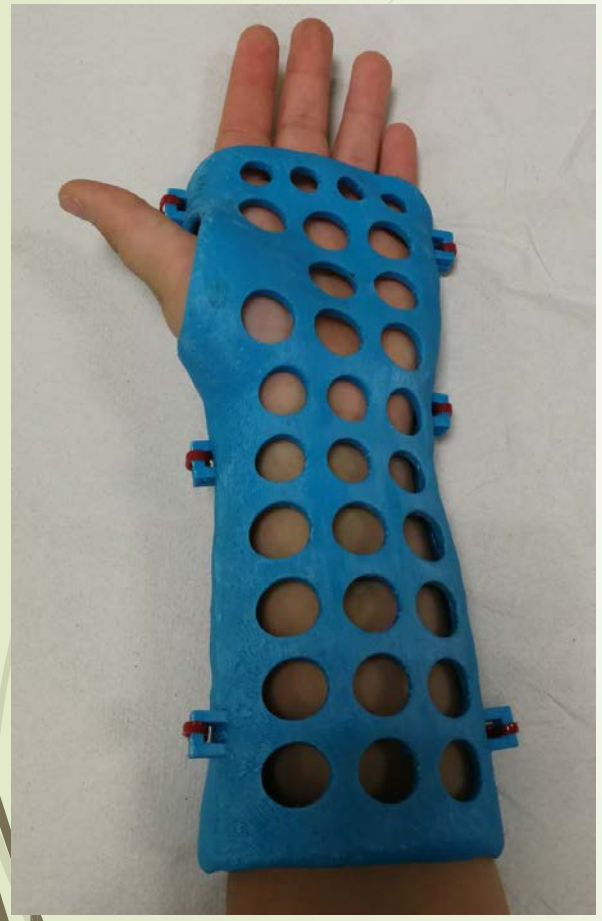


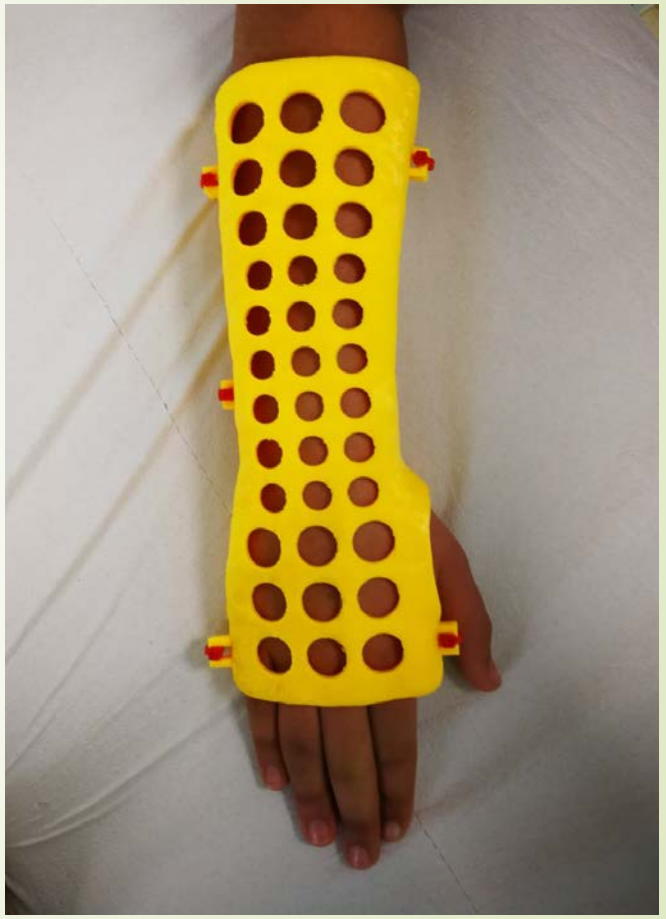
- **A**: Forearm length (ulna);
- **B**: Forearm+hand length;
- **C**: Hand circumference;
- **D**: Wrist circumference;
- **E**: Mid-arm circumference;
- **F**: Elbow circumference.

The 3 D printer



Examples of treated patients





Future developments

- After surgery orthosis
- Full arm orthosis
- Orthosis for hip dysplasia