

## Danish Hospitals Invest in the Best 3D printing Solutions for Audiology.

Rigshospitalet, Department of Otorhinolaryngology, Head and Neck Surgery & Audiology, is based in Copenhagen, the capital region of Denmark. The department consists of two dedicated audiology labs within the Bispebjerg and Gentofte Hospitals. These work closely together in the development of cutting edge hearing solutions for patients.

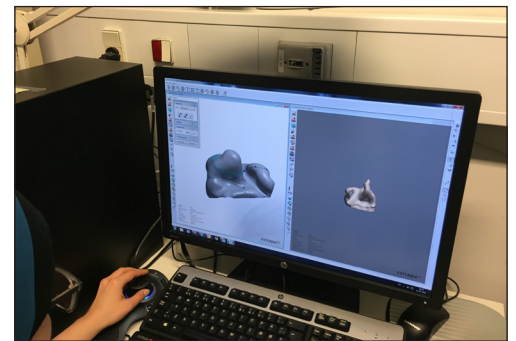
### Why look at 3D printing?

As hospitals specialising in audiology research and hearing device development, the teams at Bispebjerg and Gentofte Hospitals had seen the development of hearing technology from early bulky hearing aids through to modern, almost invisible in-ear devices.

The potential to make smaller, less intrusive and higher performing devices was always the aim of the team, and a huge part of that was the development of better fitting devices. 3D printing and ear scanning technology is the latest development, allowing audiologists to create devices exclusively for that patient and their individual needs.

Many businesses including the biggest names in the industry are already seeing the benefits that 3D printing is bringing to their patients, so it was the next logical step for the hospitals.

***“3D printing brings the ability to produce custom hearing aids that not only fit and perform better, but also take a fraction of the time to manufacture” - Erik Kjærboel, M. Sc. E.E. Rigshospitalet***



Scans being manipulated ready for printing.



Soft silicone otoplastics molded from E-Silicone cocoon molds.

### Rigshospitalet

**Industry:**  
Audiology

**Machine:**  
Perfactory DDSP

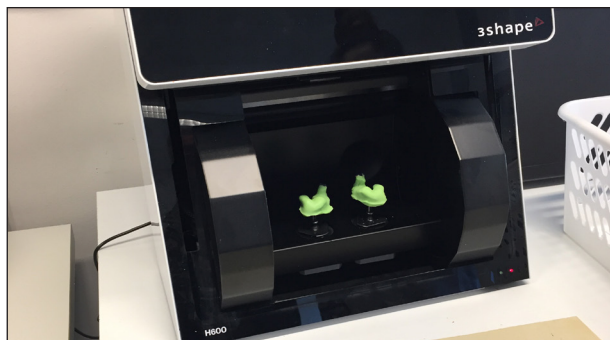
**Materials :**  
E-Shell 300, E-Silicone

## Why EnvisionTEC?

The hospital teams looked at a number of manufacturers and engaged with r.a.p.s, a local distributor to look at their different options. They required two machines for the two sites. A pre-requisite was that they should be compatible with 3Shape scanners and software, plus CAMbridge.

The r.a.p.s team demonstrated a number of EnvisionTEC solutions including a range of audiology focused desktop and large frame 3D printers. They also showed the team the range of audiology focused materials available.

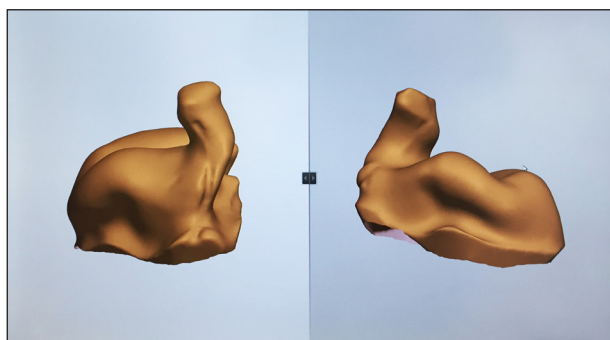
The hospital team were particularly impressed with the materials range and the speed and quality of the printed hearing aid shells. After discussion it was decided to invest in two DDSP machines, one for each hospital.



A wax impression of the patients ear is taken and scanned using a 3Shape scanner.

## Results

The team now produces, or receives wax impressions of the patients ear. These are converted to digital files using the in house 3Shape scanner and manipulated in 3Shape EarMouldDesigner. Finally these files are tweaked in CAMbridge and sent to the printer. The resulting printed hearing appliances are then post processed and finally adjusted to the patient.



Scans are then sent to CAMbridge software for correction and tweaks.

***“The speed and accuracy of the EnvisionTEC machines allows us to provide a much better product to our patients in a fraction of the time it would have taken with traditional methods.”***

- Erik Kjærbøl, M. Sc. E.E. Rigshospitalet

Using the printer the team produce both end use shells in EnvisionTEC's E-Shell 300 and cocoon molds with the E-Silicone material. This allows for the production of soft silicon ear pieces. The team annually produces 4000 hard molds and about 1250 soft molds.



3D printed shells and molds are then printed.

The switch to 3D printing has resulted in a much faster turn around for patients, with devices available within a few days as opposed to weeks. The use of the highly accurate EnvisionTEC printer has also resulted in better fitting appliances that are more comfortable for the wearer.

An additional benefit is the ability to build hearing devices in a range of colors. This allows appliances to be built to the exact requirements of the patient, and even be made more fun and appealing to children.

## EnvisionTEC, the perfect choice for audiology.

From the beginning, EnvisionTEC has been the 3D printer of choice for audiologists and hearing aid manufacturers. A number of key players in the industry rely on EnvisionTEC printers and materials to produce thousands of custom devices annually.

In all EnvisionTEC offers more than 16 biomedically approved materials with various skin-tone colors, along with red, blue, pink, tan, mocca, beige, cocoa, brown, black, white, rose clear and crystal clear. Below are EnvisionTEC's core audiology focused materials:

- **E-Clear series** - A liquid photopolymer that produces strong, tough, water-resistant parts especially for applications in the custom hearing device market.
- **E-Shell 200** - a low viscosity liquid photopolymer that produces strong, tough, water-resistant ABS like parts with high detail that are Class IIa biocompatible according to ISO 10993/Medical Product Law and are CE certified for use as hearing aid products, otoplastics, and medical devices.
- **E-Shell 300** - A Material series designed especially for applications in the hearing aid industries and is distinguished for rigidity and durability. It is CE certified and Class-IIa biocompatible according to ISO 10993 (Medical Product Law) for hearing aid shells and otoplastics.
- **E-Shell 500** - Designed especially for applications in the Hearing Aid industries and is distinguished for soft durability.
- **E-Shell 600** - For use on Perfactory UV machines only. EnvisionTEC E-Shell 600 is a liquid, photo-reactive acrylate for building functional parts. It is CE certified and Class-IIa biocompatible according to ISO 10993 (Medical Product Law) for soft ear shells and tips.
- **E-Silicone** - A solution to produce soft silicone otoplastics by the additive manufacture of cocoon molds. The custom fit E-Silicone molds may be injected with medical grade silicone materials. The eggshell-like mold may then be easily broken away, leaving a soft, flexible shell. These shells can provide patients with increased comfort, better retention, better acoustic seal, more gain before feedback and improved sound quality.
- **E-Shell 3000** - Distinguished for rigidity and durability. It is CE certified and Class-IIa biocompatible according to ISO 10993 (Medical Product Law) for hearing aid shells and otoplastics.

## Partners

Thanks go to Swedish distribution partner r.a.p.s for their support in the making of this case study.

## About EnvisionTEC

EnvisionTEC is a leading global provider of professional-grade 3D printing solutions. Founded in 2002 with its pioneering commercial DLP printing technology, EnvisionTEC now sells a range of printer configurations based on six distinct technologies that build objects from digital design files. The company's premium 3D printers serve a variety of medical, professional and industrial markets, and are valued for precision, surface quality, functionality and speed.

### ENVISIONTEC, INC.

Dearborn, USA  
Phone +1-313-436-4300

### ENVISIONTEC GMBH

Gladbeck, Germany  
Phone +49 2043 9875-0

### ENVISIONTEC UK

Stoke-on-Trent, UK  
Phone +44 (0)1782 418040

### ENVISIONTEC Asia

Shanghai, China  
Phone +86 186 163 10393