CADCAM Technology in Prosthetics and Orthotics – A Review on Efficiency, Efficacy and Training Capability

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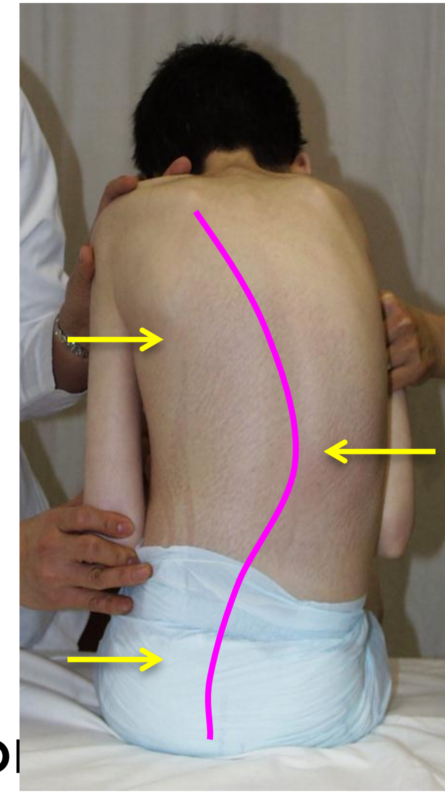
HA Convention 2014

Prosthetics & Orthotics



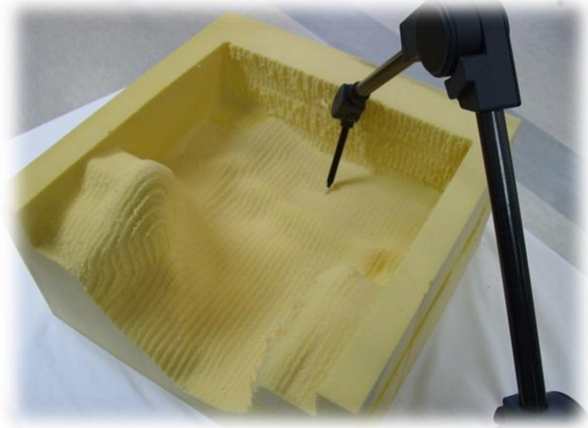
- Design and Fitting Process
  - Application of Biomechanics for treatment and restore function
- Via
  - Interface pressure, Alignment, Locatio force application & shaping
- And
  - Increase comfort

Conventional Methods of Shape Capture

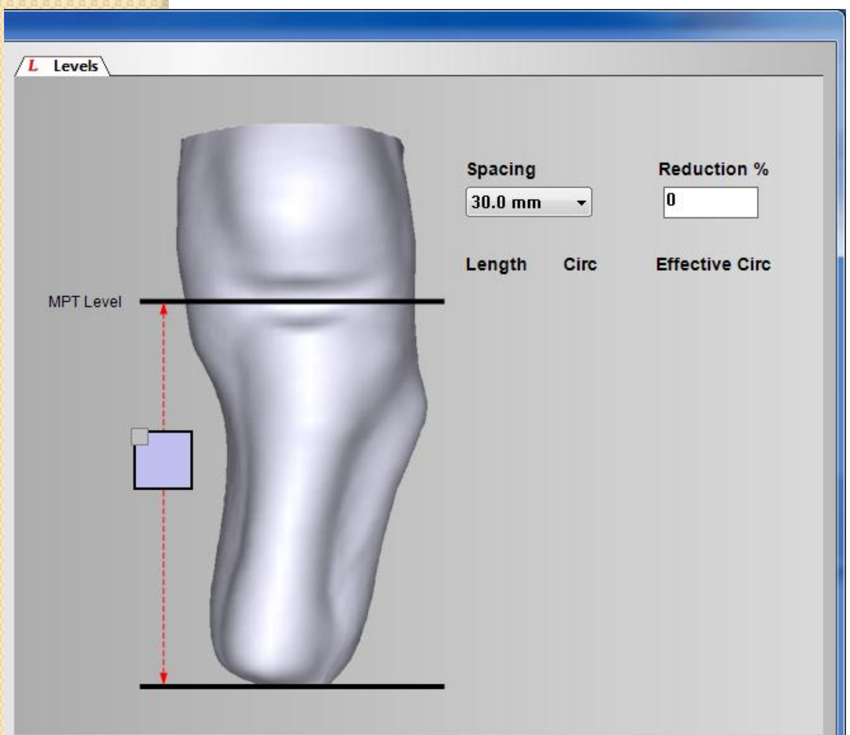
- Manual Casting

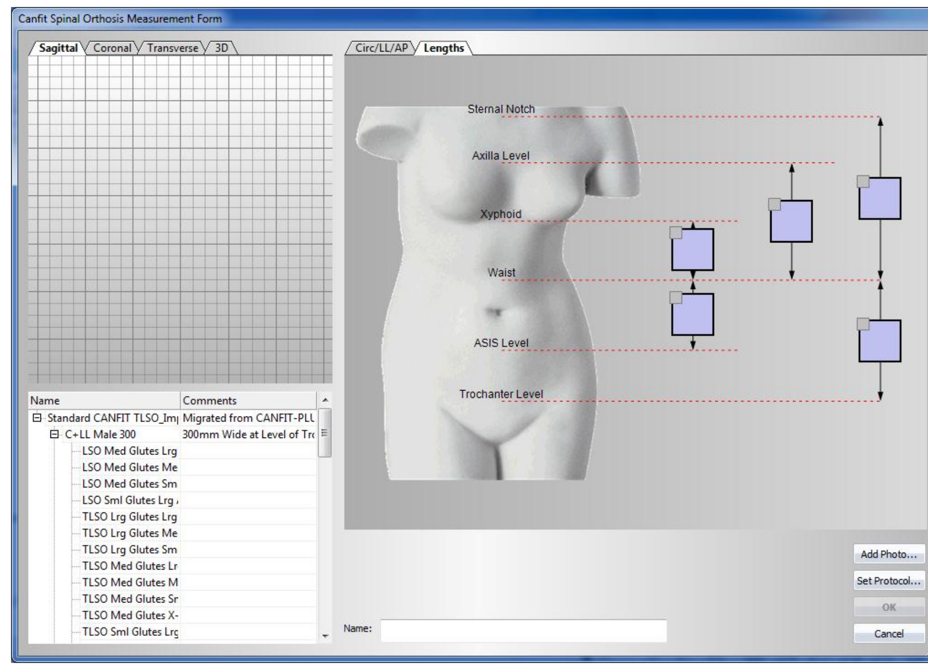
Latest Methods of Shape Capture

- Digital Imaging
  - Mechanical
  - Optical (e.g. IR scanning)

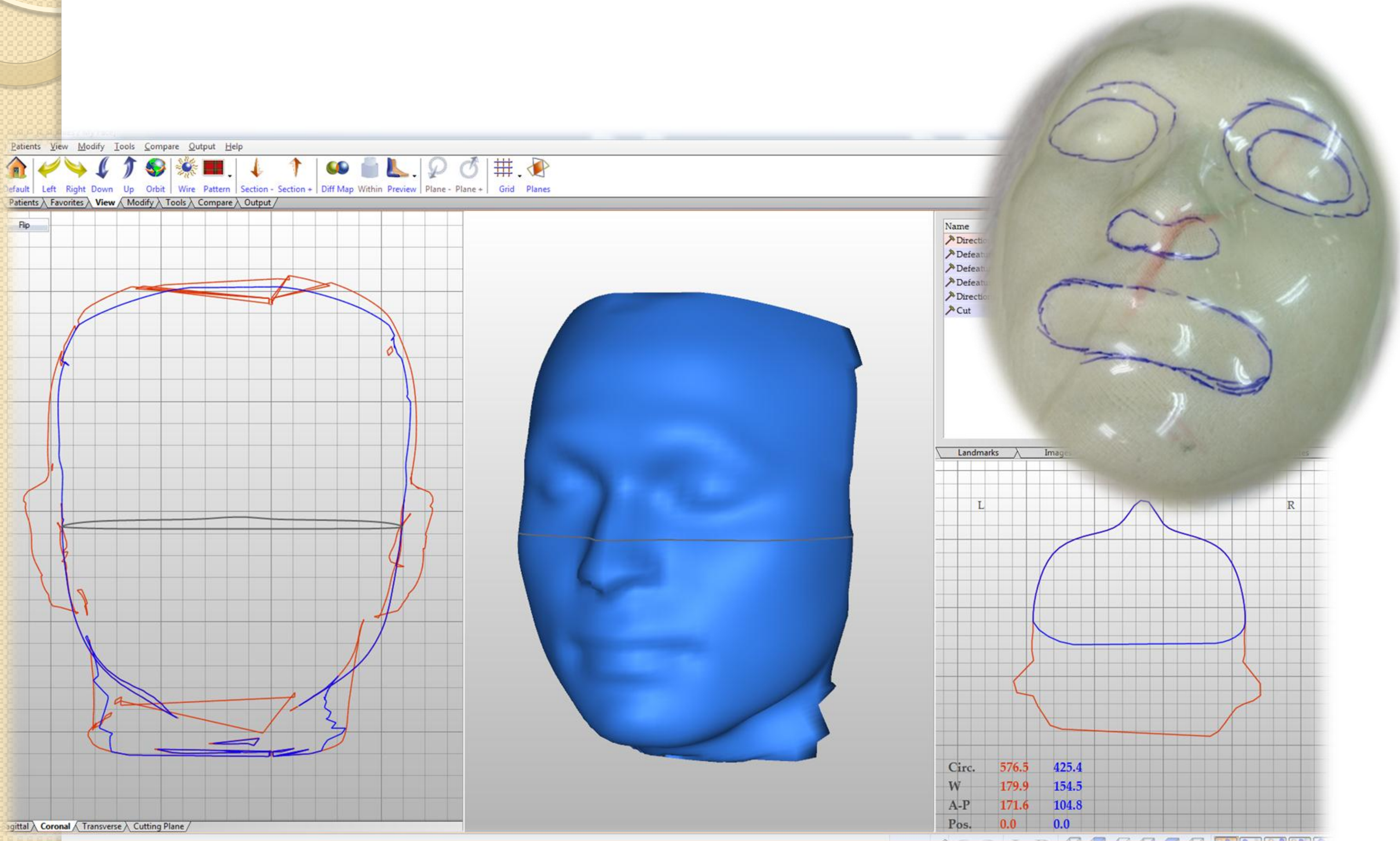


- Simple Measurement
  - Circumference, distance
  - Marking bony landmarks





- Non-contact & Non-invasive Measurement

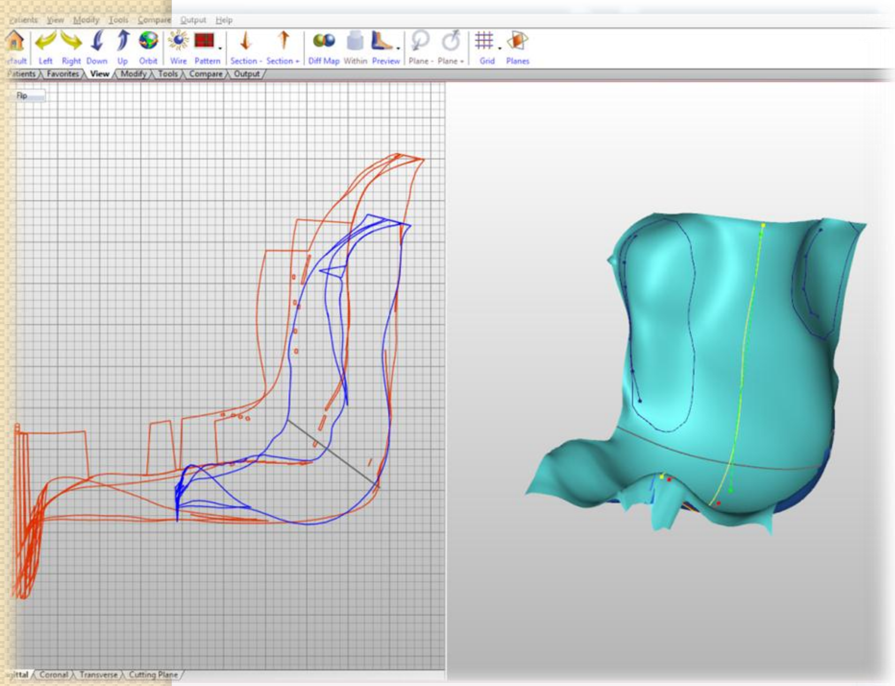


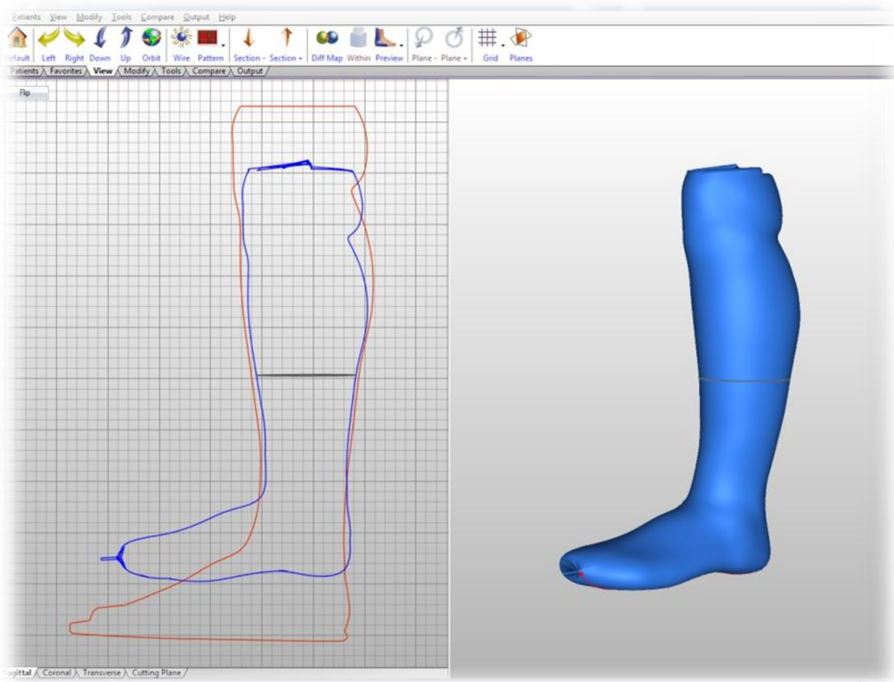
Conventional Prosthetic & Orthotic Design

- Manual Rectification and modification

Latest Design Method using CADCAM

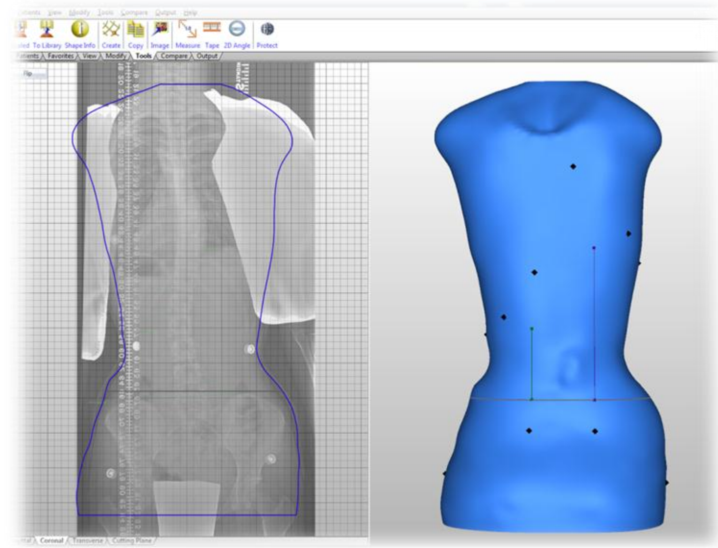
- Computer Aided Design (CAD)

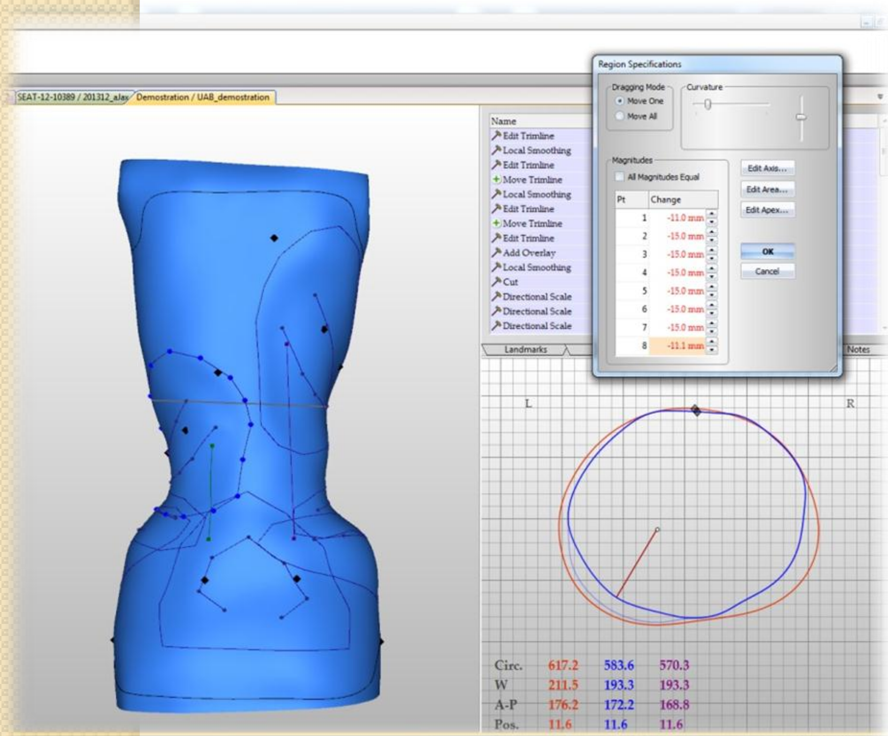


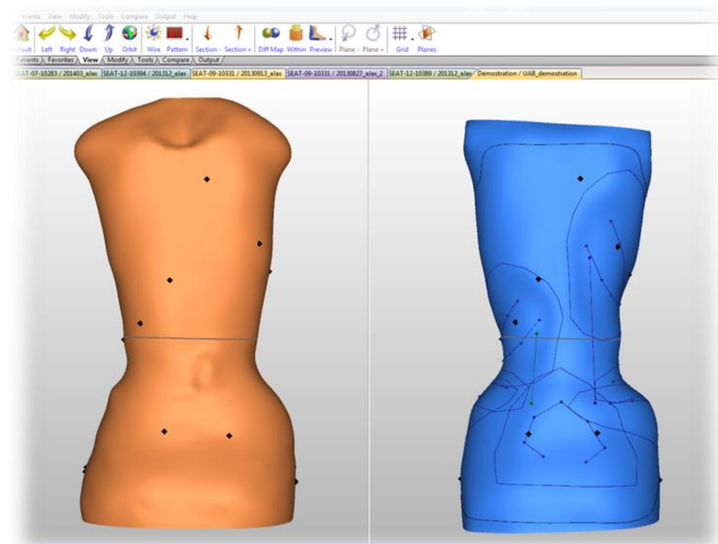


Computer Aided Design

- Compare shape with X-ray film
- Accurate force application
- Comparison of finished design

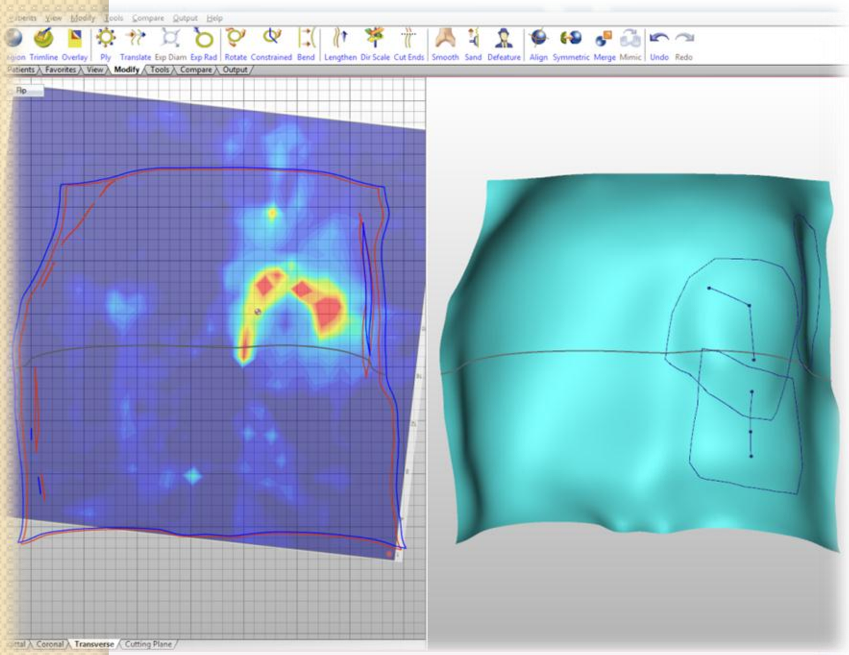


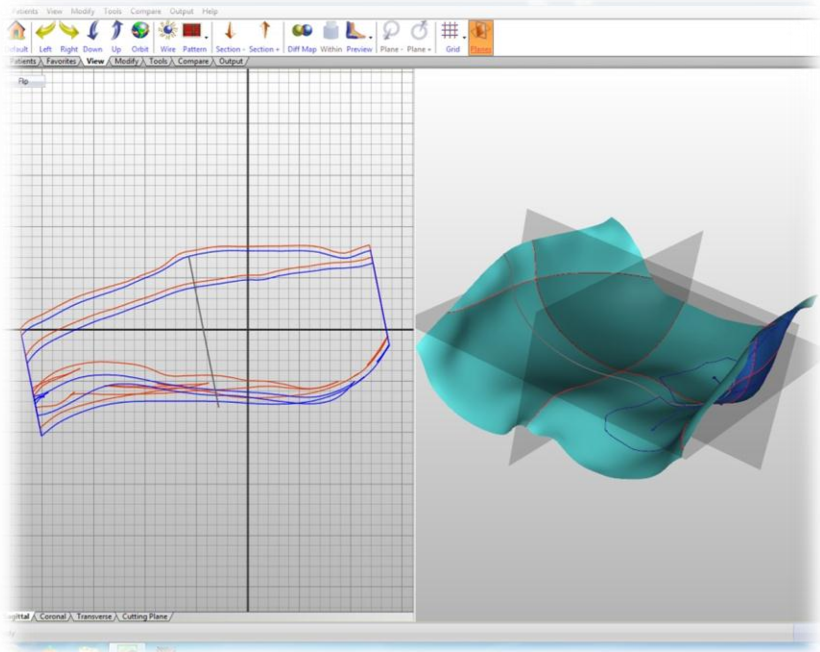




Computer Aided Design

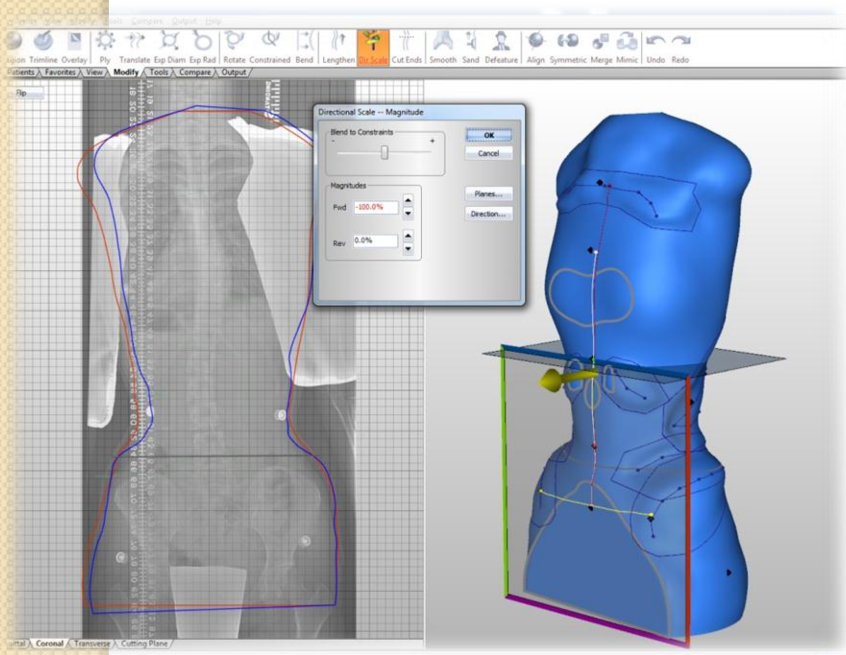
- Modification to avoid pressure

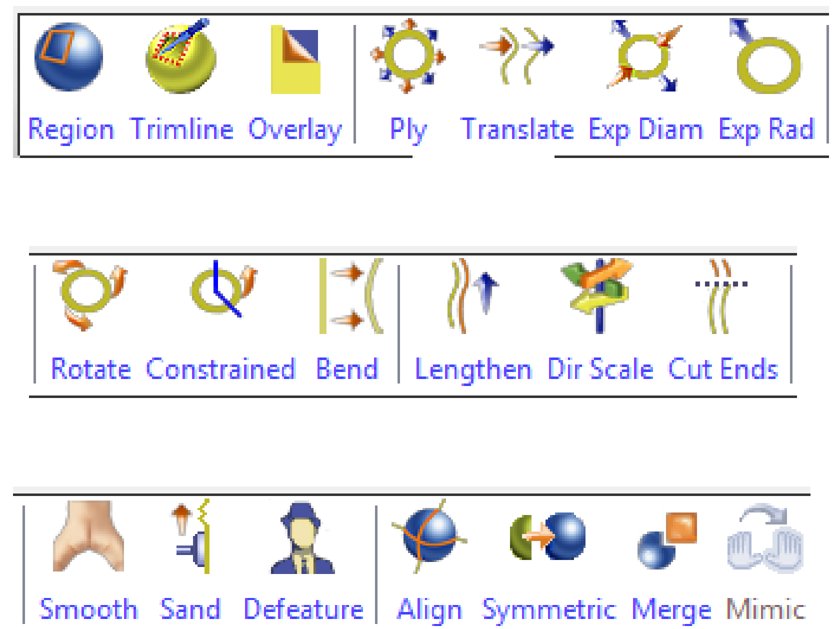




Computer Aided Design

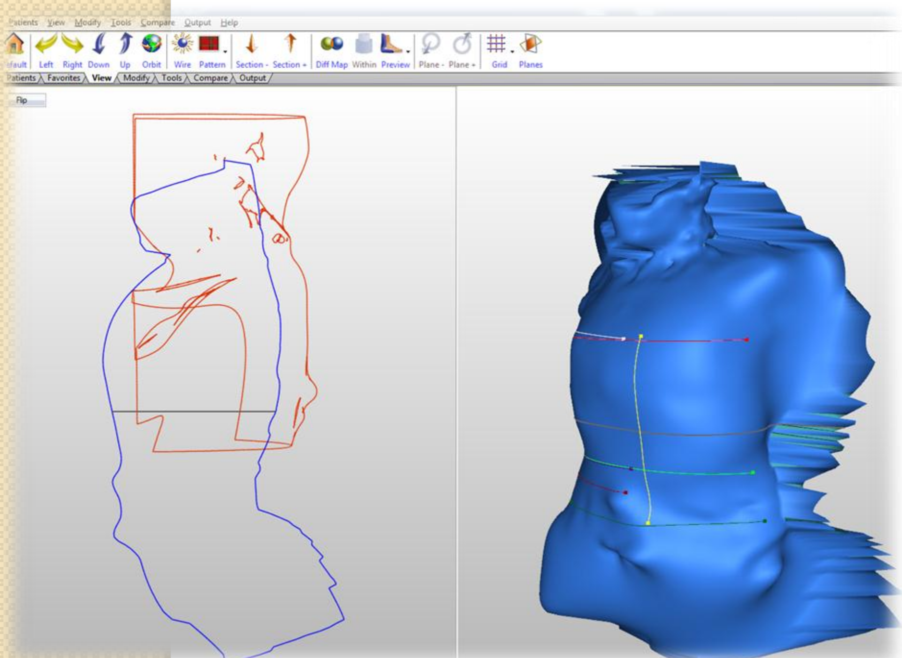
- Many different rectification tools

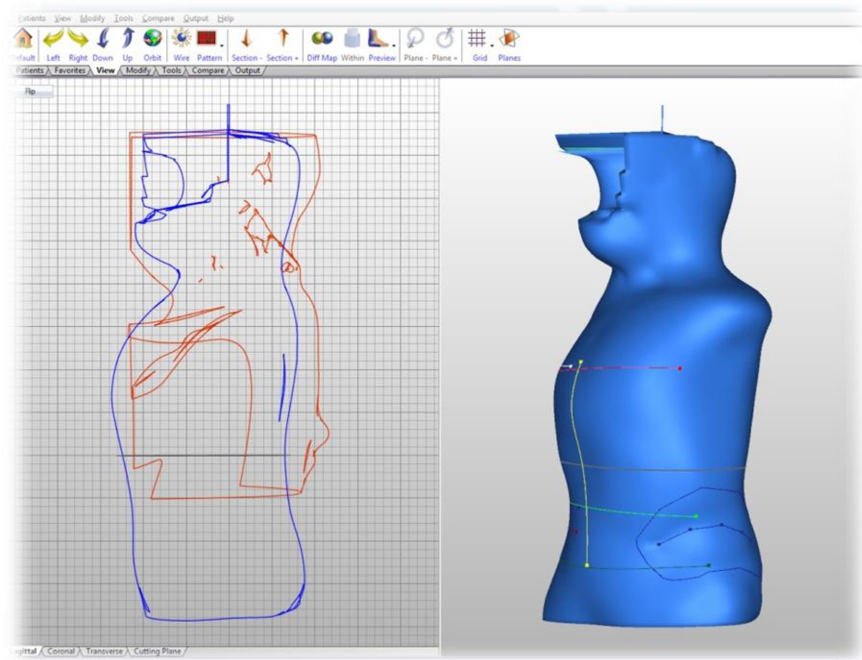




Computer Aided Design

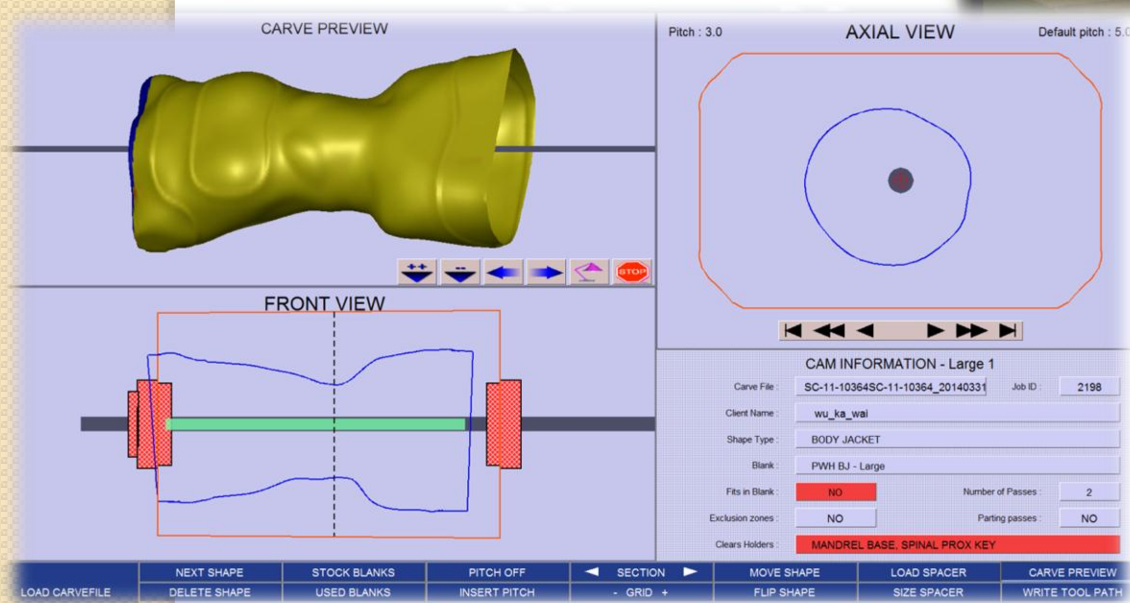
- Merge, Duplication, Expansion
  - For complex design

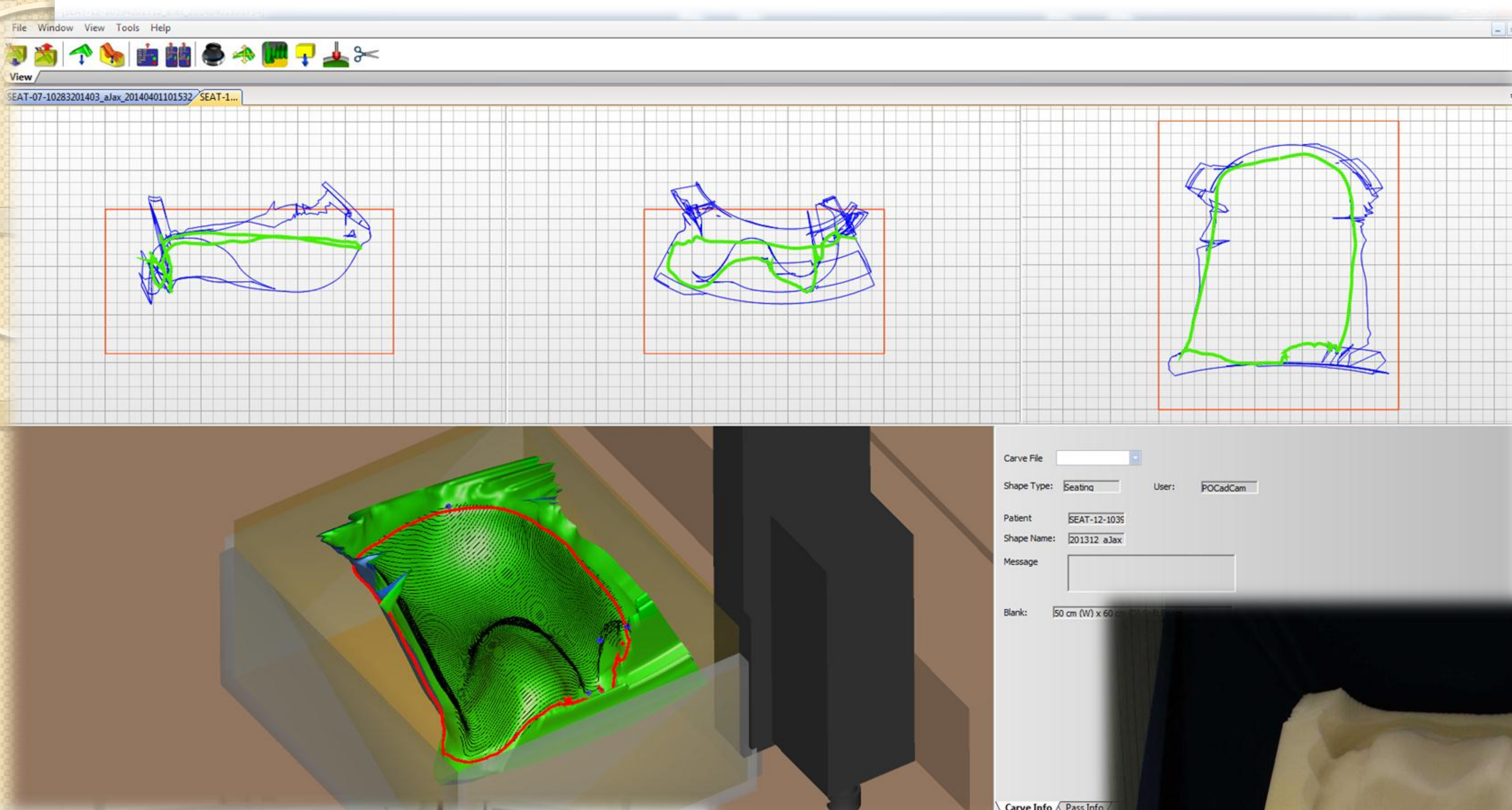




Latest Fabrication using CADCAM

- Computer Aided Manufacturing (CAM)

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SEAT-1...
Carve File
Shape Type: Seating
User: POCadCam
Patient SEAT-12-1039
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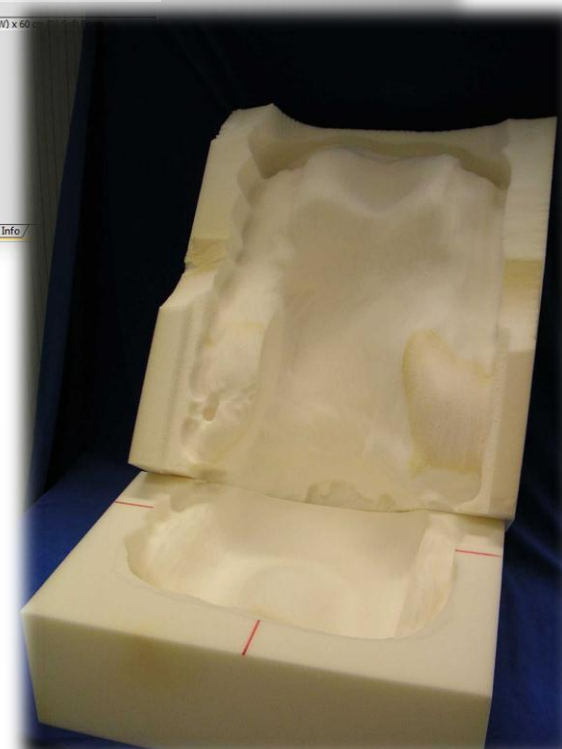
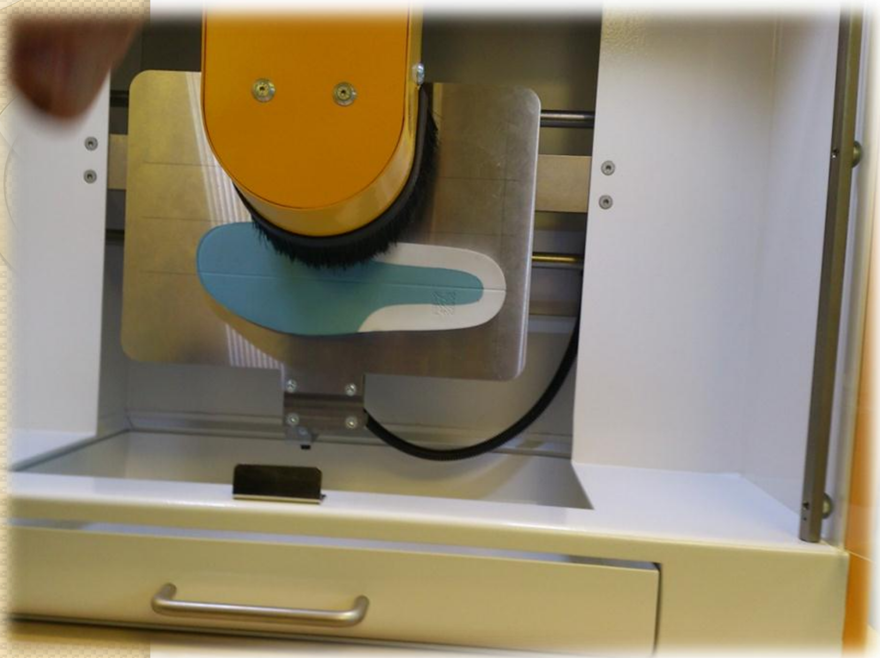
Message
Blank: 50 cm (W) x 60
Carve Info
Pass Info


Canfit





CADCAM Efficiency & Efficay

- Reduced time of manual works
- Simplified production procedures
- Increase time for patient care
- Increase efficacy by accurate force application
- Data and design comparison
- Possibility for outcome measure
- Evidence base practice
- Evaluation of treatment protocol

COMPARISON WITH SPINAL BRACE DESIGN AND FABRICATION

	Conventional	CADCAM
Casting	30mins	10mins
Orthotic Design	60mins	15mins
Positive Model Fabrication	60mins	15mins
Completed Case/ year	~180	400+
Waiting Time	4-5 months	6 weeks

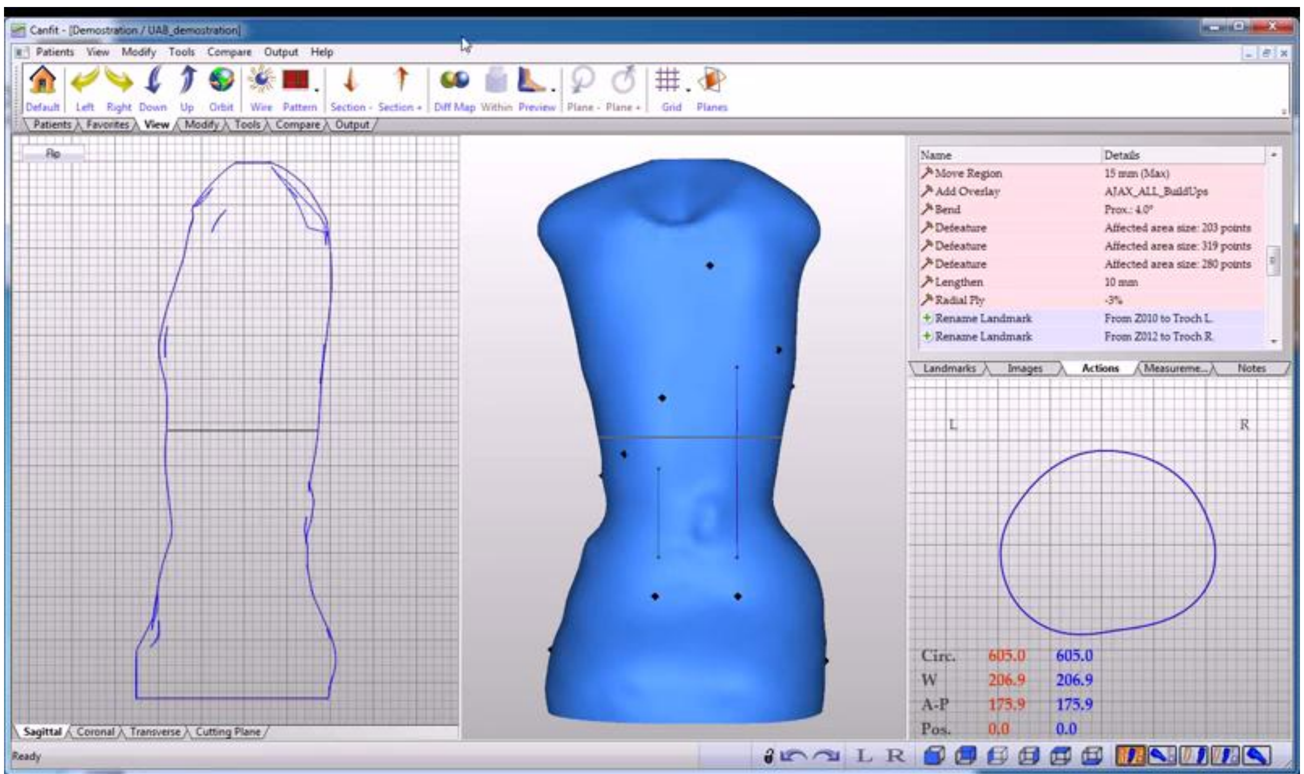
i.e. Decreased time for design and rectification process
=> increased time for pt's care, & training on the use of rehab devices

Comparison with Conventional Method

- Cost effectiveness in long run
  - Automation for design and fabrication
- Document anatomical & volumetric changes
- Provide reference for baseline and progress of treatment regimen
- Simulate final design to optimize outcome

Training Capability

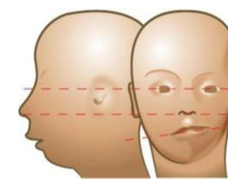
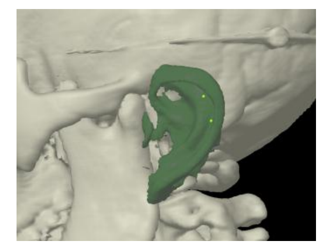
- Step-by-step virtual learning
- Data library to retrieve special case, interested case for study



Future Development

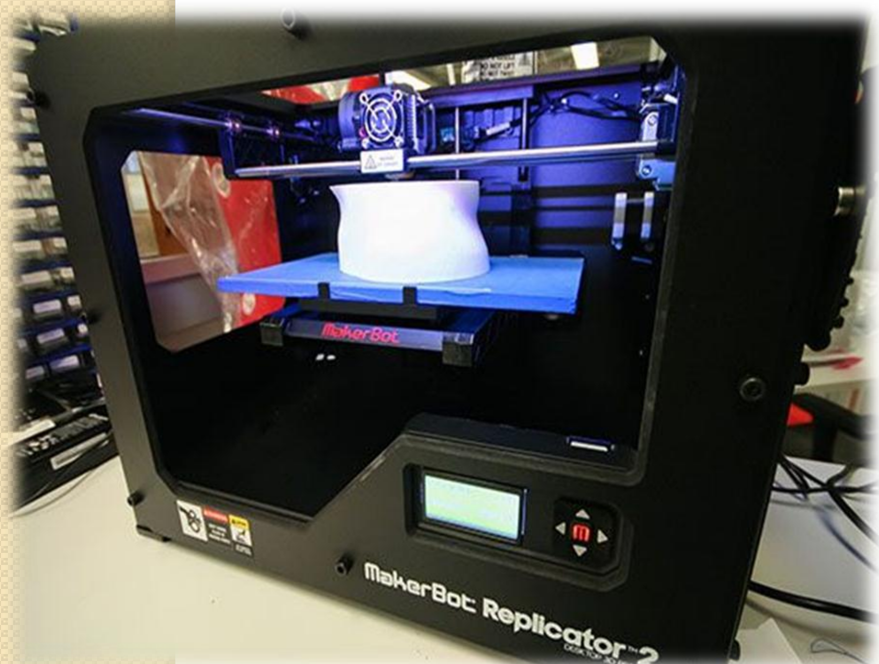
- 3D Printing (CAM)
- Orthotic Devices
- External Prosthetic Limb
- Prosthetic Implant design and fabrication

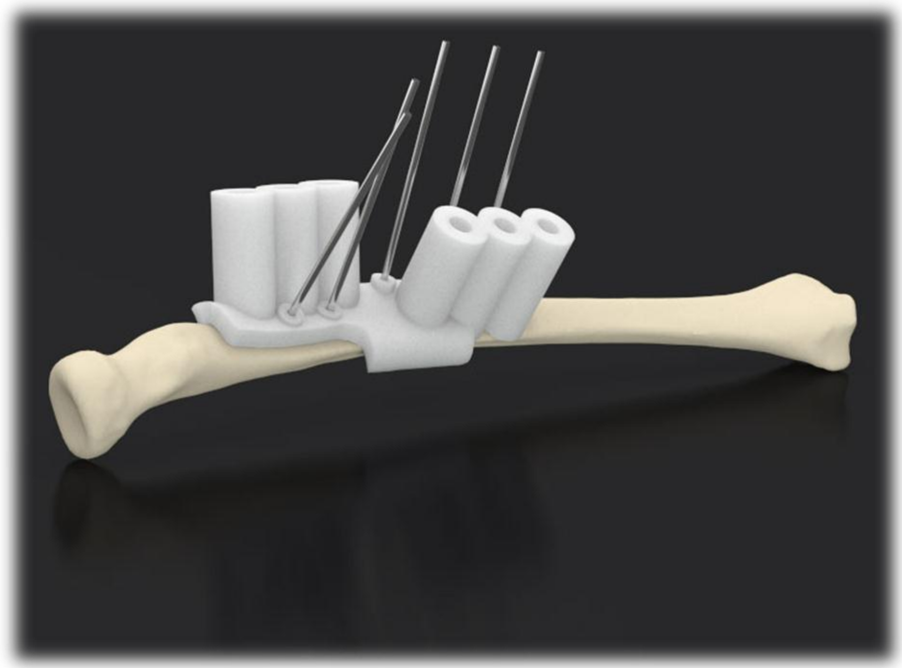



Future Development

- For surgical planning and outcome
  - Guided surgery devices





Latest Application for 3D Printing

The first transparent 3D-printed skull has been successfully implanted

By John Hewitt on March 27, 2014 at 12:00 pm | 3 Comments

Three months ago, surgeons in Holland implanted a transparent plastic skull in a woman whose skull has never stopped growing. Incredibly, the rare bone disease that was wrecking her vision and destroying her life has been been bested by a simple 3D printer. The team of surgeons, led by Dr. Bon Verweij at the University Medical Center in Utrecht, expect her new skull to last indefinitely, opening up new vistas for cranial transformation.

The precursor to this achievement was a similar patching done last year, where 75% of a patient's skull was replaced with a 3D-printed implant made of polyetherketoneketone (PEKK, a thermoplastic). While the cost and man-hours required to bulk-machine a skull would have been prohibitive, printing to exact specification is now routine. PEKK and its larger family of related plastics are extremely strong and temperature resistant (for sterilization), however, this new implant appears to be made from some new, and rather mysterious material.

The skull, made by an Australian firm, is actually fairly transparent. Lots of plastics can be transparent — acrylics, polycarbonates, etc. — but the stringent medical requirements, and also print requirements, place limits on the possible. While the transparency may be incidental, the picture above shows the clear advantage of such transparency: one can see the underlying brain and vasculature. Not only is this a nice feedback to see how things are going macroscopically, it also entices with potential to optically image activity in the brain like never before.

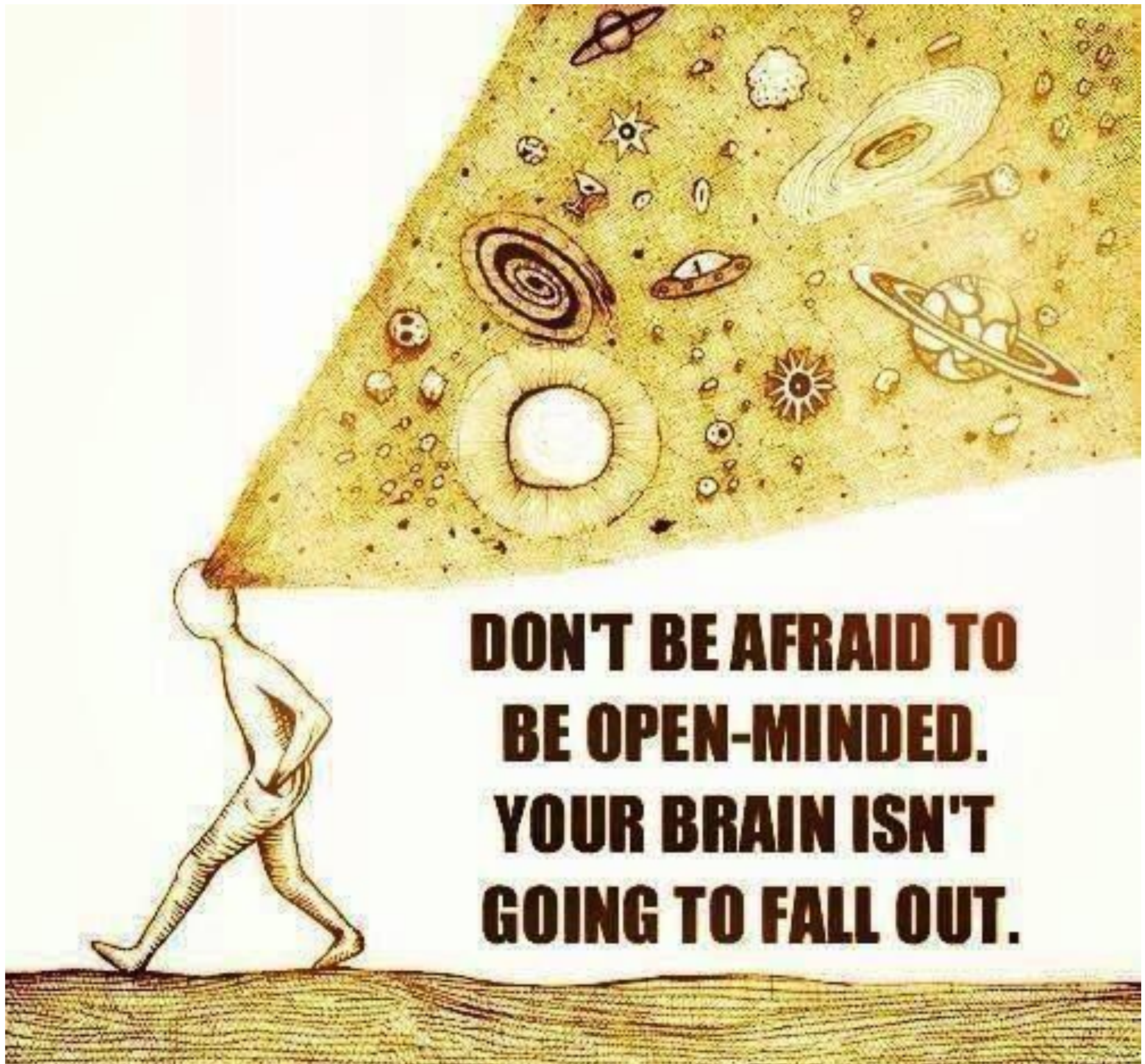
The 22-year-old woman patient may not have such things immediately in mind, and is probably just thankful to have a normal cranium. Her disorder had caused overgrowth of her old skull from a normal thickness of 1.5 centimeters to a battle-axe busting 5cm (2 inches). While the new skull appears permanent, details of attachment and integration to protective layer just beneath (known as the dura, for hard layer) are not yet publicly available. The two halves appear to be attached with standard titanium clasps which one finds in a typical "internal fixation" kit. These kits are simple erector sets from which the surgeon can select the right pieces, and then bend and shape to fit unto broken bones.

The potential to further customize these printings is huge. As a start, simple features to capture and mate the two halves against sliding motion may be of immediate advantage. Also, a more scalloped interface edge to the existing skull could be built in to later models. We previously discussed the possibility of adding provision for the kinds of implants that are now used to augment or restore hearing into replacement skulls. In particular, variant on the "BAHA" style implant system which uses bone conduction like Google Glass might be directly incorporated.

We'll be sure to update you on this story when more information is made available — this is a big one.

http://www.medgadget.com/2014/03/womans-native-skull-replaced-with-3d-printed-plastic-model.html?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+Medgadget+%28Medgadget%29

Thank You


DON'T BE AFRAID TO
BE OPEN-MINDED.
YOUR BRAIN ISN'T
GOING TO FALL OUT.