3D Printers and Customized Vitreoretinal Forceps

- David R. Chow, MD, FRCS(C)

OBJECTIVE To present the development of customized vitreoretinal forceps for retinal surgery using a 3D printing process.

PURPOSE To develop new surgeon customized Vitreoretinal forceps using 3D printing technologies.

METHODS Molds were created to obtain the optimal grip of various surgeons. The impressions created were then converted into a 3D file using a 3D scanner. This file was then adapted to allow the printing of customized vitreoretinal forceps grips for each surgeon.

RESULTS From concept to the creation of the most recent prototypes - the process of creating customized 3D forceps for VR surgeons will be presented. Various surgeons from around the world were asked to be part of the most recent prototype development and there choice in molds and their impressions validate the concept that not all grips are the same!

CONCLUSION 3D printers are a revolutionary technology that many feel are leading to the Third Industrial revolution. They are changing the way industry creates prototypes, and manufacturing processes are rapidly altering to take advantage of these technologies. This talk highlights the first usage of 3D printers in the production of customized VR forceps.

TAKE HOME MESSAGE This talk highlights the first usage of 3D printing to produce customized Vitreoretinal forceps. These forceps offer surgeons the advantages of increased comfort and likely better control for micromanipulations.

Vitrectomy Infusion Control Based on Ophthalmic Artery Perfusion Pressure: A Novel Device

- Tommaso Rossi, MD, EBOD

OBJECTIVE To report on a novel device aimed at controlling infusion bottle pressure during pars Plana Vitrectomy, based upon real time monitoring of patient ophthalmic artery perfusion pressure.

PURPOSE To develop, test and implement an integrated device capable of setting infusion pressure in course of pars plana vitrectomy as a function of actual perfusion of the ophthalmic artery. The surgical relevance is the possibility to maintain adequate perfusion pressure of ocular tissues throughout surgical procedures, minimizing the risks of intra operative ischemia and residual visual field defects.

METHODS Mean Ocular Perfusion Pressure (MOPP) can be calculated on the basis of a algorithm taking into account sistolic and diastolic pressure and intra ocular pressure. Continuous and real time MOPP calculation was performed by means of NBP armband wirelessly connected to the vitrectomy console. Customized software computed MOPP and counter-reactioned infusion fluid pressure accordingly. A double modality was deployed: one recording MOPP and signaling dangerously low MOPP, due to either exceedingly high infusion pressure or low arterial pressure and a second in which pre-set MOPP was maintained constant by automatic increase or decrease of the infusion pressure.

RESULTS A pilot study in 20 patients undergoing vitrectomy for multiple indications showed MOPP decreased under safety limits (30 mmHg) for a significant fraction of surgery. Activating the MOPP-based infusion bottle control resulted in stabilization of the perfusion pressure at the desiderered level in all tested patients with no intra- or postoperative complications.

CONCLUSION Real time intra-operative MOPP control is feasible and counter reacting the infusion pressure on the basis of actual perfusion of the ophthalmic artery pressure allow optimal optic nerve and retinal perfusion throughout the entire surgical procedure. This may help reduce unexplained post-operative visual filed loss.

TAKE HOME MESSAGE The mean ocular perfusion pressure can be reliably calculated in real time during pars Plana vitdectomy and the infusion bottle pressure kept at a safe level by counter reacting such parameter automatically.

HUMAN RESEARCH This study involves human research.
IRB Approval Status: Approved by institutional review board

Sight Recovery Project for Argus II Implanted Patients Affected by Retinitis Pigmentosa

- Fabio Patelli, MD

OBJECTIVE Restoring vision to Argus II implanted patients.

PURPOSE To optimize the Argus II potentiality in implanted blind patients affected by retinitis pigmentosa.

METHODS A modified “mini low vision working station” is used to teach the implanted blind patients to recognize printed characters of different size and colors. In a period of six weeks home and hospital training are performed with this device.

RESULTS During the six weeks period, patients trained with this device learned to read simple printed words and recognize different shapes. This device is well accepted to the patients thanks to its versatility and home use.

CONCLUSION Sight recovery project is useful for restoring vision in patients implanted with Argus II. Subjects trained with this method are able to read printed characters and words.

TAKE HOME MESSAGE Rehabilitaion is fundamental for argus II implanted blind patients.