Creation of Scleral Lens from Virtual Eye Model

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PURPOSE

Highly irregular eyes often elude optical correction, require costly contact lens fitting, have limited comfortable wearing time and require frequent visits to major medical centers and numerous revisions. We set out to design a completely custom scleral lens which matches the exact contours of the globe and made with highly oxygen transmissible material to increase fitting accuracy, comfort and vision, while decreasing cost and chair time.

Using a low viscosity, addition polymerizing polyvinyl siloxane precision impression material with hydrophilic properties, an impression mold is obtained of the globe. The concave surface of the mold is scanned using a 3-D scanner. EyePrintPRO Designer software automatically computes the four zone back surface of the lens: First, a 3D sphere cap defines the optic zone. Secondly, the transition zone is defined by Elevation-Specific Technology™ coordinated to the surface of the impression. The landing zone is defined as a surface that covers the mold with a minimum clearance. Eventually, the lens back surface is completed by an Edge Lift zone. The user can manually tune each zone clearance and diameter, and see the changes in real time in the 3D viewer. The software lets the user visualize the lens in the 3D space, in all directions. The software is capable of raising warnings when the contact lens hits the impression in one or more points. The software is also capable of outputting files that are compatible with a DAC lathe.

OCT Analyses shows the EyePrintPRO follows the contour of the globe with consistent vault over the cornea and limbus with no impingement of scleral blood vessels.

We hypothesize the EyePrint process creates highly customizable scleral lenses with minimal revisions.

METHODS

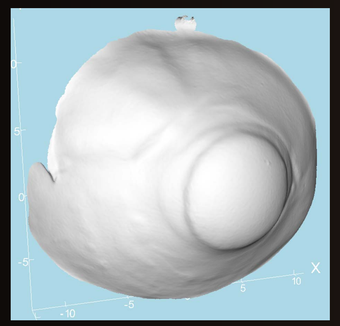
Lens manufacturing information from 1/2014 to 1/2015 was analyzed for orders, remakes and cancellations. Only spherical and toric optics were included. Multifocal and prism patients were excluded from calculations

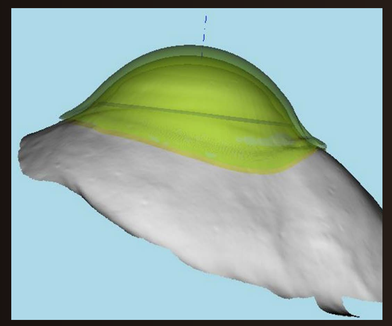
RESULTS

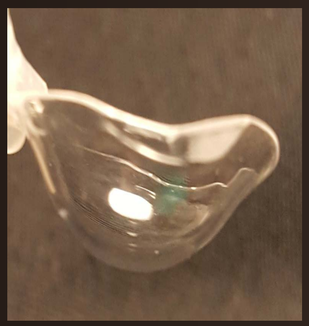
Ordering information from 144 eyes of 98 patients from 18 doctors from 1/2014 to 1/2015 were analysed for revisions and cancellations. The reason for revisions was further subdivided into fit and power. No eyes required more than 2 revisions. 50 eyes (34.7% of the total eyes) required revisions. Of those requiring revisions, 35 (70%) were for power, while 15 (30%) required a fit change. Of the eyes requiring a 1st revision, 8 (16%) required a 2nd revision, 6 (75%) were for power and 2 (25%) were for fit. Therefore 65.3% of eyes achieved first lens success. The majority of lens revisions were for power only and achieved success with the second lens.

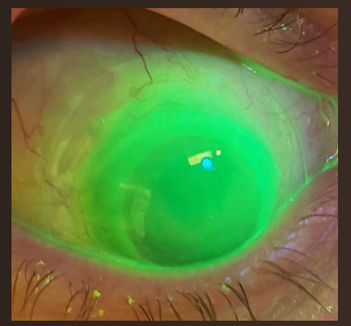
Cancellations: 7 patients, 10 eyes

There was one cancellation due to fitting concerns. Reasons for cancellation included: lens depositing, dementia, retinal disease, death and previously existing graft endothelial cell loss.









CONCLUSIONS

Low tech and cost affordable molding techniques allow for ocular contour capture done in local communities anywhere in the world, with high tech software in a central location providing highly customized lenses with high success and minimal revisions. Indications may include, but are not limited to, extreme cases of deformed eyes and fornices, trauma, keratoconus, pellucid marginal degeneration, chemical burns, post surgical malformations, ocular surface disease and irregular astigmatism.