Mapping the Human Eye with Sclervey

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Technology description

Corneal diseases cause debilitating suffering in patients and leads to severely impaired vision or blindness. The visions of the affected patients cannot be corrected with ordinary glasses or contact lenses due to the fact that the shape of the cornea is no longer a simple, smooth surface. In order to fully restore vision to the patients suffering from complex corneal diseases, a prosthetic replacement of the ocular surface (PROSE), developed by Boston Foundation for Sight, is used. PROSE is the treatment process used to design custom fitted scleral lenses. The prosthesis forms a seal on the sclera holding a saline solution between the damaged tissues creating a , Äúnew cornea, Äù thus restoring vision. Currently, the fitting process is done by trial and error, requiring multiple sessions and trial lenses. The present invention, Sclervey, surveys the sclera quickly and without any contact. Sclervey maps the sclera to tens of micron precision and provides clinicians and technicians with the data necessary to design custom fitted lenses to seal the sclera with high precision.

Sclervey uses six LED arrays arranged on a block positioned with the eye at the center of projection in order to obtain a uniform grid of 163 light spots on the surface of the eye. Six CCD cameras (plus one in the center) mounted inside a plastic spherical shell view the dot projection such that each dot is visible to two or more cameras, and stereo geometry reduces two imaged into a 3D surface. The camera pairs are utilized to conduct stereo imaging which leads to a 3D reconstruct of the light spots on the surface of the eye. The sclera must be surveyed in sections where the patient is cued (via a blinking light) to look in four directions: straight ahead, right, up left, and down left. At each position, a little more than a third of the sclera is exposed to the projected spots and mapped. Each surveyed section overlaps with the adjacent sections and neighboring sections are stitched together using image stitching software. Sclervey will make PROSE treatment more efficient, cost effective, and will improve patient experience by reducing the number of fitting sessions.

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