Docking System To Stabilize Eyeball During Intraocular Surgery
Tech ID: 29437 / UC Case 2018-215-0

SUMMARY
UCLA researchers in the Department of Mechanical Engineering have designed a docking system to secure the eyeball relative to the imaging-system probe, allowing for the use of surgical instruments or tools, and facilitate real-time image acquisition during intraocular surgery.

BACKGROUND
Intraocular medical conditions are commonly treated with delicate microsurgical procedures that rely on good visualization of extremely delicate tissues within the small and constrained space of the eye. The optical coherence tomography (OCT) provides improved intraocular visualization than standard surgical microscopes by imaging small membranes and anatomical features to reveal features that would be otherwise invisible or difficult to perceive to the surgeon, thereby improving surgical outcomes. The OCT system is also capable of providing fast, small-scale, and accurate measurements, which allow for the possibility of real-time guidance to the surgeon.

Despite these advantages, the imaging quality obtained from OCT as well as from standard microscope systems suffers from high levels of noise and data distortion in the visualized area due to constant motion of the eyeball beneath the stationary imaging device. The OCT scan also requires continual application of fluid medium between the physical probe and the anatomy to be scanned in order to maintain a high-level scan quality. Additionally, the imaging device is located in the patient sterile field but cannot itself be sterilized, thereby limiting its use and integration into autonomous surgical robotic platforms.

INNOVATION
Researchers at UCLA have developed a novel docking system that can be used to secure an eyeball during intraocular surgery and constrain it relative to an imaging-system probe. The docking system contains a rigid support structure that not only serves as an interface between sterile and non-sterile field, but it is also designed with a flexible port that fits over the imaging system probe while securing the eyeball in place relative to the imaging device. The docking system contains a flexible cannula allowing insertion, extraction, and tangential movement of the surgical instrument during the surgical procedure. A separate fluid port allows lubricating fluid to flow into the cavity between the interface separating the sterile and non-sterile surgical field and the patient’s eyeball to maintain lubrication of the eye, as well as to improve the imaging quality of imaging systems that requires a fluid medium, such as for an OCT probe.

APPLICATIONS
- Physically stabilize the eye position and orientation during intraocular surgical procedures
- Perform intraocular surgical procedure simultaneous to the acquisition of image/scan data

ADVANTAGES
- Improve the scan quality of an integrated imaging device such as an OCT probe or surgical microscope
- Provide access to the eye through the docking system via a compliant port that accounts for the remote center of motion of tool movement
- Maintain the intraocular pressure of the eye to a stable, desired level during surgical operations
- Possibility for integration with robotic surgical platforms

STATE OF DEVELOPMENT
A device prototype is available.

PATENT STATUS
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Additional Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS
- Robotic Microsurgery System
- Laser-Assisted Intraocular Surgical Alignment
- System And Method For Automated Image Guided Robotic Intraocular Surgery