

# A Virtual Cataract Surgery Course for Ophthalmologists-in-Training

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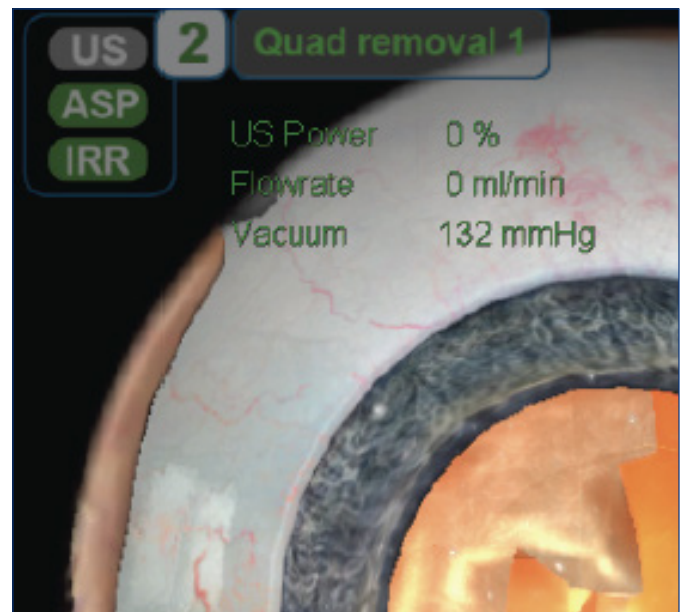
## ABSTRACT

Virtual reality (VR) surgery simulation is an emerging teaching tool to train residents in cataract surgery. The widespread adoption of virtual surgery has been limited, however, by high costs and the absence of standardized curricula and evidence demonstrating the impact of VR training on resident surgical outcomes. We outline a resident virtual cataract surgery course—freely accessible online—that we hope will contribute to the development of a standardized VR cataract surgery curriculum.

**KEYWORDS:** Resident training, virtual reality simulation, cataract surgery

## INTRODUCTION

Currently, most ophthalmology training programs in the United States use didactic and wet-lab instruction to prepare students for cataract surgery. Virtual reality (VR) surgery simulators have recently become an additional teaching tool.<sup>1</sup> Cataract surgery simulation modules have demonstrated construct validity in their ability to realistically mimic actual cataract surgery procedures and procedures.<sup>2-6</sup> These simulations have also been effective in helping to develop and to hone skills needed for the operating room (OR).<sup>2,7-11</sup> The widespread adoption of virtual surgery has been limited, however, by high costs,<sup>12</sup> and the lack of standardized curricula and studies demonstrating the impact of VR training on resident surgical outcomes (“VR-to-OR”).<sup>1</sup> We describe herein a resident virtual cataract surgery course developed in the Division of Ophthalmology at the Alpert Medical School of Brown University. It will be freely available on the Division’s website (See link below). In this way, we hope the course will be a first step toward the development of a standardized and validated VR cataract surgery curriculum: it can be regularly updated based on feedback from other users and serve as the basis for studies evaluating the VR-to-OR transition.



## The Course Manual, Components

We designed the course manual to be used alongside of the EyeSi® simulator (VRMagic, Mannheim, Germany). The course was divided into two sections: (1) a didactic section based on the America Academy of Ophthalmology (AAO) Basic and Clinical Science Course® (BCSC), “Lens and Cataract” (2011-2012) and (2) a VR section integrated into specific training modules from the virtual surgery simulator. The organization of the VR section is based on training targets for each Post Graduate Year (PGY) level (2-4).

The didactic section of the course manual provides foundational information about normal and abnormal human lens physiology. It aims to introduce residents to ocular anatomy, physiology and pathology. It also serves as a reference to be used alongside the surgery modules. Its subsections include Lens Anatomy, Lens Pathophysiology and the Preoperative Care, Procedure, Postoperative Care and Complications of Cataract Surgery. In addition to this resource, residents are encouraged to consult the AAO BCSC®, “Lens and Cataract” and the AAO Preferred Practice Pattern® guidelines, “Cataract and the Adult Eye.”<sup>13</sup>

## Simulator Training

The VR section targets cataract surgery training in the simulator: it begins with microsurgical training skills and

subsequently integrates these newly-acquired skill sets into a program designed to help residents master the key cataract surgery steps. These steps include capsulorhexis, hydrodissection, nuclear rotation, irrigation, aspiration, emulsification and nuclear disassembly. The course aims to develop skills in intraocular navigation, anti-tremor handling of targeted instrument motions, bimanual coordination involving simultaneous use of multiple handpieces, cataract cracking and chopping, forceps maneuvering, phacoemulsification machine calibration, capsulorhexis and hydrodissection maneuvers and other techniques such as divide and conquer. These learning modules are organized into three subsections—PGY 2, PGY 3 and PGY 4. Within each subsection, there are select tasks tailored to developing and/or improving specific microsurgical skills appropriate for each resident year. The manual describes each module with an introduction, goals, screenshots, instruments needed and instructions. There should be enough background information for residents to know what to expect, the purpose of the tasks and how to work on meeting these objectives.

When ophthalmology residents enter their PGY 2, they will begin their cataract surgery training by reviewing the didactic portion of the course. After gaining a firm foundation in ocular physiology and pathophysiology, they will begin training on the simulator. The manual will guide their experiences by taking them through each step, including learning how to use the machine. There are photographs and screenshots captured to provide clarity alongside descriptive instructions. The simulator modules themselves also lay out specific goals, instructions and other information that may be helpful to students following the program. As residents grow more familiar with the simulator and accomplish module tasks, the program will unlock further, more advanced modules. This progression will ideally help residents attain the skill set needed for a smooth VR-to-OR transition during the course of their training.

## SUMMARY

In summary, this virtual cataract surgery course aims to help facilitate incorporation of simulation technology into the ophthalmology residency curriculum. We also hope the VR course can be combined with wet labs to more effectively transition residents into the OR and, equally important, serve as a foundation for studies that will rigorously evaluate the impact of VR training on resident cataract surgery outcomes.

**Link to course:** <http://brown.edu/go/CataractManual.pdf>

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## Disclosures

The authors have no financial interests to disclose.

## Disclaimer

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