Integrating Mental Practice into a COVID-19 Appropriate Virtual Reality Cataract Surgery Course for Ophthalmology Residents

John C. Lin1,2 Alfred A. Paul, MD2,3 Ingrid U. Scott, MD, MPH4 Paul B. Greenberg, MD, MPH2,3,5

1 Program in Liberal Medical Education, Brown University, Providence, Rhode Island
2 Section of Ophthalmology, Providence VA Medical Center, Providence, Rhode Island
3 Division of Ophthalmology, Alpert Medical School, Brown University, Providence, Rhode Island
4 Departments of Ophthalmology and Public Health Sciences, Penn State College of Medicine, Hershey, Pennsylvania
5 Office of Academic Affairs, US Department of Veterans Affairs, Washington, District of Columbia

Address for correspondence Paul B. Greenberg, MD, MPH, Section of Ophthalmology, Providence VA Medical Center, 830 Chalkstone Ave, Providence, Rhode Island 02980
(e-mail: paul_greenberg@brown.edu).

Abstract

Keywords
- mental practice
- cataract surgery
- virtual reality
- ophthalmology residency training
- surgical education

Mental practice (MP) is the cognitive rehearsal of a task and is grounded in symbolic learning theory and neurophysiological research.1 MP has been shown to improve operating performance and is becoming an important part of surgical residency curricula.2 We developed an MP cataract surgery training program and integrated it into a publicly available, virtual reality (VR) cataract surgery course for ophthalmology residents.3 The revised VR cataract surgery course fulfills the six core competencies of the Accreditation Council for Graduate Medical Education, and adheres to the Centers for Disease Control and Prevention educational recommendations for the coronavirus disease 2019 pandemic.

The VR course curriculum has three sections: MP, didactics, and VR training. A key component of MP is the use of mental imagery to visualize and practice a procedure, and MP scripts can greatly facilitate this goal. To this end, the methodology (►Fig. 1) described by Saab et al6 was used to develop an MP script for cataract surgery instruction. Employing modified verbal protocol analysis, a cognitive walkthrough of cataract surgery was developed by interviewing three attending cataract surgeons, all of whom have several decades of experience teaching and mentoring resident surgeons. The surgeons were instructed to mentally perform cataract surgery and recall the visual, audial, kinesthetic, and cognitive sensations they experienced; when necessary, they were prompted for further detail about the mental imagery. The interviews were transcribed and coded by cue type using emergent theme analysis. Cues were then organized according to hierarchical task analysis of the key procedural steps of cataract surgery based on the American Academy of Ophthalmology’s “Cataract in the Adult Eye: Preferred Practice Patterns.”7 The resulting nine-step MP script was then reviewed by the three surgeons, revised based on their feedback, and integrated into the VR course. The MP section can be conducted in-person or virtually in...
one-on-one video conference or phone call sessions between
the resident and attending ophthalmologist.

The didactics section is based on the 2020 to 2021 AAO
Basic and Clinical Science Course “lens and cataract” section.
There are short pre- and post-tests on the didactics that
residents can complete online each year.

The VR section consists of training modules from the EyeSi
Simulator (VRmagic, Mannheim, Germany; courseware ver-
sion 2.5, software version 3.4). The VR training can be
supervised remotely by an attending ophthalmologist
reviewing videos of the resident’s simulator performance.
A validated practical test on their VR training is adminis-
tered at the end of the second year of residency; the test also
can be evaluated remotely by a supervising ophthalmologist.

The course provides a table detailing pertinent course
sections that meet the six-core ACGME competencies
(► Table 1): patient care, medical knowledge, practice-based
learning and improvement, interpersonal and communica-
tion skills, professionalism, and systems-based practice. It
also includes a section outlining cleaning and handling of the
VR simulator that is in alignment with CDC guidelines for the
COVID-19 pandemic. Additionally, the MP and didactic
training can be conducted remotely for social distancing.

In summary, this revised VR cataract surgery course uses
MP to augment a more traditional curriculum composed of
didactics and simulation training. It meets the ACGME core
competencies, and at a time when the COVID-19 pandemic
has reduced opportunities for hands-on surgical training, it
promotes social distancing and safe, flexible surgical training
in accordance with CDC recommendations.

The VR course is available at no cost in the Brown Digital
Repository: https://doi.org/10.26300/ygj1-xc17. We hope
other ophthalmology residency programs will find the
course useful to integrate MP into their cataract surgery
educational curricula.

Note
The views expressed here are those of the authors and do
not necessarily reflect the position or policy of the U.S.
Department of Veterans Affairs or the U.S. government.

Funding
This material is the result of work supported with resour-
ces and the use of facilities at the Providence VA Medical
Center, Providence, Rhode Island, United States; JCL was
supported by a Summer Research Assistantship grant from
the Brown University Program in Liberal Medical
Education.

Conflict of Interest
None declared.

Acknowledgments
The authors thank David R. Rivera, MD; Ezra L. Galler, MD;
and Jorge J. Rivera, MD for their contributions to the
mental practice script.

References
connectivity during execution and imagination after motor
2 Rao A, Tait T, Alijani A. Systematic review and meta-analysis of the
role of mental training in the acquisition of technical skills in
3 Paul SK, Scott IU, Paul AA, Greenberg PB. A virtual reality cataract
e41–e42
Accreditation Council for Graduate Medical Education; 2020
5 Centers for Disease Control and Prevention. Considerations for
schools. Atlanta, GA: Centers for Disease Control; 2020. Available

Table 1 Accreditation Council for Graduate Medical Education
competencies

<table>
<thead>
<tr>
<th>Core competencies</th>
<th>Course content</th>
<th>Course section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient care</td>
<td>Perioperative patient care for cataract surgery</td>
<td>Didactics</td>
</tr>
<tr>
<td>Medical knowledge</td>
<td>Medical knowledge about cataracts and cataract surgery, including the key steps of cataract surgery</td>
<td>Didactics and mental skills</td>
</tr>
<tr>
<td>Professional-ism</td>
<td>Care for patients with developmental disabilities, trauma, and psychosocial considerations</td>
<td>Didactics</td>
</tr>
<tr>
<td>Communication and interpersonal skills</td>
<td>Communication with patients regarding their surgical care</td>
<td>Didactics</td>
</tr>
<tr>
<td>Practice-based learning</td>
<td>Cognitive rehearsal of cataract surgery Virtual cataract surgery</td>
<td>Mental skills virtual reality</td>
</tr>
<tr>
<td>Systems-based practice</td>
<td>Communicating preoperatively with the patient’s primary care provider</td>
<td>Didactics</td>
</tr>
</tbody>
</table>

Fig. 1 Flow chart for developing the mental practice script.

