

REAL-TIME REMOTE SURGICAL PROCTORING MADE POSSIBLE OVER A 5G NETWORK



Digital 3D surgical visualization was transferred over a 5G network.

INTERVIEW BY S.K. STEVEN HOUSTON III, MD; WITH JOHN B. MILLER, MD

I have discussed the benefits of the Ngenuity 3D Visualization System (Alcon) in previous articles for *Retina Today*. The primary reason I converted all of my surgical cases from a standard operating microscope to the Ngenuity 3D digital platform is to transition from analog to digital.

Switching to digital surgical visualization is like going from a flip phone to a smartphone. Both make telephone calls, but the smartphone opens up endless possibilities. Digital retina surgery is in its infancy, but we are on the verge of a paradigm shift as digital provides a platform for significant advances and innovations in vitreoretinal surgery. My recent discussion with John B. Miller, MD, of Massachusetts Eye and Ear in Boston highlights how this digital transition opens up new areas of innovation.

S.K. Steven Houston III, MD: Thanks for joining me to discuss your collaborative project between Massachusetts Eye and Ear and the Verizon 5G Lab in Cambridge, Massachusetts. Tell us how this project came to be.

John B. Miller, MD: As readers of this publication may know, wireless providers have recently been rolling out 5G network capabilities across the country. Verizon has added 5G networking

in several parts of the country, and the company happens to have a 5G Lab in Cambridge, directly across the Charles River from our clinical site at Massachusetts Eye and Ear.

I was approached late last year by Mark Maire to participate in an exciting opportunity for 3D telesurgery transmitted over 5G in partnership with Verizon and Vincent S. Rapucci, MD, of New York Eye and Ear Infirmary of Mount Sinai. Mr. Maire was a founder of TrueVision 3D Surgical, the developer of the Ngenuity surgical platform; he is now National Surgical Consultant, Visualization, at Alcon.

Dr. Houston: Please give us a brief description of 5G technology.

Dr. Miller: 5G is the fifth generation of cellular network technology. 5G networks use much higher frequencies than previous networks. This offers the ability to transmit more data at faster rates, but also reduces interference with lower frequency data. 5G is also highly directional, allowing a single antenna to support far more users without compromising quality.

Dr. Houston: Tell us about your project using the Ngenuity surgical platform and the Verizon 5G network.

Dr. Miller: On April 2, we streamed live 3D video in 4K resolution from the Ngenuity device in our OR at Massachusetts Eye and Ear, Longwood, to the Verizon 5G Lab in Cambridge, where it was viewed on a second 3D monitor by Dr. Rapucci and Ashley Kras, MBBS(Hons), MBI, my research fellow.

Communicating via mobile phone, we had a live discussion between the operating retina surgeon (me) and the proctoring surgeon (Dr. Rapucci; Figure). The transfer of 3D 4K video on the 5G network allowed the observers to identify in real time the fine details of the surgery, including residual vitreous, a fine tractional membrane, and small retinal breaks.

Dr. Houston: What are the current uses of these combined technologies?

Dr. Miller: Live surgery has been used mostly for educational purposes as a teaching tool at academic meetings. Image quality and lag time have limited sessions to observation, not active participation in surgical guidance. Recently, 5G data transfer has allowed live proctoring of cardiac and gastrointestinal surgery in China and Spain. To the best of our knowledge, this is the first application of Ngenuity and Verizon 5G to transfer 3D retinal surgical videos in 4K.

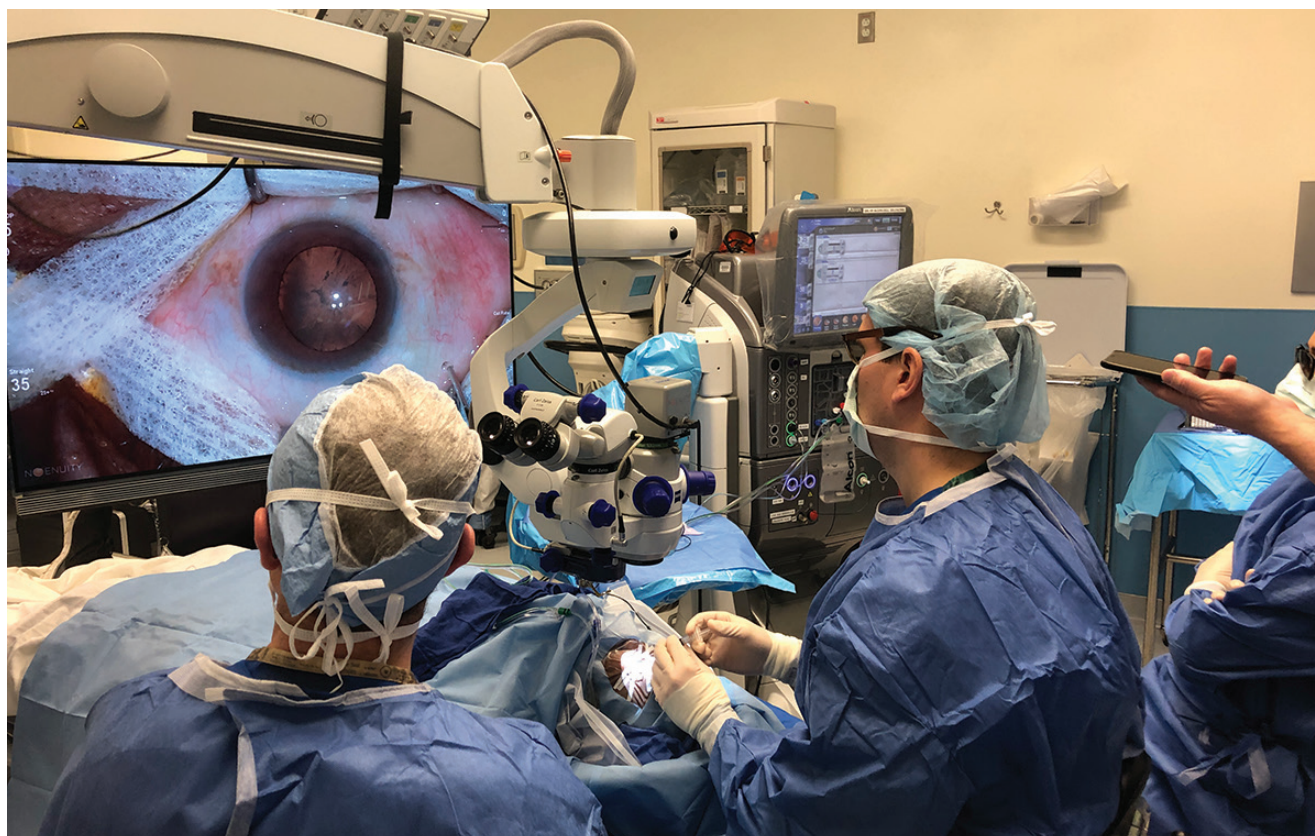


Figure. Surgical view of John B. Miller, MD, in-house along with a mobile phone (right) for direct communication with observing/proctoring surgeon, Vincent S. Rapucci, MD.

Dr. Houston: How do you see these technologies changing the ways vitreo-retinal surgery and other ophthalmic surgeries are performed in the future?

Dr. Miller: I anticipate that this combination will provide a platform for telesurgery in retina and in ophthalmology generally. Like telescreening programs, it may initially be most helpful in remote and low socioeconomic locations where access to clinical expertise may be limited. Such a system could allow an experienced surgeon to guide a less experienced operator through the specific steps of a procedure to improve patient outcomes. Similarly, this modality may be of particular benefit to the military, when subspecialty surgeons may not be available close to a war zone with injured personnel.

Dr. Houston: What additional innovations do you see these technologies leading to?

Dr. Miller: Further advances in robotic surgery could allow truly remote vitreo-retinal surgery by expert surgeons in consolidated locations. Even without robotics, this capability may lead to a pyramid care team structure, whereby expert surgeons are on call for proctoring of the most complex surgical cases.

Ultimately, the adoption of any of the aspects of this technology should improve both patient outcomes and patient access.

A FINAL NOTE FROM DR. HOUSTON

Dr. Miller touched on a novel, innovative possibility of a 3D digital platform in ophthalmic surgery that occurs only after switching from analog to digital. Using the improved data transmission of 5G networks, real-time remote mentoring was successfully performed. This innovation alone opens numerous opportunities, as mentioned above, including expert

surgical guidance or consultation, remote mentoring of trainees, and even the potential for remote robotic surgery in the future. We urge other early adopters of heads-up 3D digital platforms to continue innovating and advancing this new technology. ■

S.K. STEVEN HOUSTON III, MD

- Vitreoretinal Surgeon, Florida Retina Institute, Orlando, Florida
- Editorial Advisory Board Member, *Retina Today*
- shouston3@gmail.com
- Financial disclosure: Advisor, Consultant (Alcon)

JOHN B. MILLER, MD

- Assistant Professor of Ophthalmology, Harvard Medical School, Boston
- Director of Retinal Imaging, Massachusetts Eye and Ear, Harvard Medical School, Boston
- John_Miller@meei.harvard.edu
- Financial disclosure: Advisor, Consultant (Alcon)