

Plastic Surgery Lockdown Learning during Coronavirus Disease 2019: Are Adaptations in Education Here to Stay?

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Summary: The novel coronavirus disease 2019 has had a major impact on human life and livelihood. The unprecedented challenges have expanded beyond just social and work life, and have grown to impact resident education. In this article, we review the structure of plastic surgery education before the pandemic, the different online learning opportunities for self-directed learning. A summary of the range of platforms and approaches of online remote access delivery of conferences and education that emerged or expanded as a result of the crisis has been reported. This article highlighted the rapid initiatives and efforts of programs and national and international societies to support continuing medical education in conjunction with the guidelines to “shelter at home” and maintain social distancing, and possible future for expanding the reach of online academic initiatives, in addition to the role of developing virtual technologies. The coronavirus disease 2019 crisis has created an opportunity to analyze and advance online learning options to overcome the associated challenges and continue as a reliable platform even following the resolution of the social distancing requirements. (*Plast Reconstr Surg Glob Open* 2020;8:e3064; doi: [10.1097/GOX.0000000000003064](https://doi.org/10.1097/GOX.0000000000003064); Published online 27 July 2020.)

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) has provided unprecedented challenges to healthcare systems worldwide. With 4,805,430 confirmed cases and 318,554 deaths in May 2020, social distancing has emerged as the recommended strategy to combat the spread of the virus and “flatten the curve.”^{1–3} The challenges have expanded beyond just social and work life, and have grown to impact resident education. In accordance with the World Health Organization and Centers for Disease Control and Prevention recommendations of social distancing, in-person gatherings and educational grand rounds have been canceled.^{4,5} Moreover, with the limited supply of personal protective equipment combined with the heightened risk to both patients and physicians, elective surgeries have

been postponed.^{6,7} These changes have created significant challenges for residents’ educational experiences, which prompted medical educators to adapt to the new “status quo.”

Online learning offers a potential solution with several advantages, including easier access to information, increased flexibility for attendees, and the elimination of the need to commute to the class site. However, there are significant shortcomings that should be taken into consideration. Home online learning can result in isolation, with potential psychological consequences and a lack of defined boundaries between work and home.⁴ Moreover, there are several barriers to the widespread adoption of online learning, including cultural resistance, technical and logistic challenges, time and effort required to develop online learning tools, and lack of infrastructure for supporting such a platform.⁸ The COVID crisis has created an opportunity to analyze and advance online learning options to overcome the associated challenges and continue as a reliable platform even following the resolution of the social distancing requirements. In this article, we review the structure of plastic surgery education before the pandemic, the different online learning opportunities that emerged as a result of the crisis, and the possible near future for expanding the reach of online academic initiatives.

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LOOKING BACK: PRE-COVID-19

Educational Structure of Plastic Surgery Residency

Residency programs follow a structure that have been put together by working groups and key stakeholders to help shape the curriculum for trainees such as the Plastic Surgery Milestones project in the United States⁹ or the Intercollegiate Surgical Curriculum Programme in the United Kingdom (UK).¹⁰ The moulding of surgical education and focus on acquisition of both cognitive and competency-based assessments are highly complex. The ideal format of delivering education has not reached a consensus and generally falls upon the responsibility of individual programs.^{9,11}

In the United States, the Accreditation Council of Graduate Medical Education provides the leadership in graduate medical education and is overseen by the American Board of Plastic Surgery and the American Council for Academic Plastic Surgeons. The Plastic Surgery Resident Review Committee, a subcommittee of the Council, assumes the task to identify competencies to guide the educational curricula for residents.¹² Despite following the recommendations of Accreditation Council of Graduate Medical Education and Resident Review Committee, plastic surgery residency programs do not have a standardized curriculum and individual residency programs have different education structures.

Educational Resources Before the Pandemic

In addition to experiential learning through operating and patient care, a formal educational program is often incorporated in the training program, which often combines approaches of regular didactics, lectures that may be in the form of traditional lectures focused on specific topics, case-based teaching (Socratic approach),¹³ and journal clubs.¹¹ A combination of these teaching approaches provides a means to examine cognitive knowledge, problem-solving and critical thinking skills, and the review of current literature. However, dedicated learning may be highly variable and determined by the institutional case mix, resources, size of the program, and clinical obligations or pressures. Some programs may have the benefit of hosting visiting professors to deliver teaching or instruction in area subspecialty. This can broaden learning opportunities to residents, but also requires the commitment and availability of invited faculty from their routine clinical commitments.

Self-directed Learning and Online Resources

Self-directed learning is a concept that has been highly encouraged throughout medical school and surgical training.^{14,15} Beyond recommended textbooks, electronic learning resources have become increasingly popular and sophisticated, providing 24/7 accessibility of information to facilitate autonomous resident education in plastic surgery. The increased use of smartphones and digital technology allows residents to store and access applications for educational materials more readily with increased accessibility of learning resources globally, and there are a variety of online and technologic resources available that can complement the skills residents acquire.¹⁶ Some of the common available online resources are highlighted,

but this is not exhaustive. The American Council of American Plastic Surgeons have online resources including CoreQuest and in-service review for US residents, which is a commonly used resource for written examination preparation and includes past examination questions. Other online resources may be institution specific, including widely accessible free resources such as Orthobullets,¹⁷ Microsurgery.org,¹⁸ various YouTube channels for anatomy, or from specific surgeons or organizations. Some national societies have available content following registration; that is often free or a reduced fee for resident trainees. The American Society of Plastic Surgeons Education Network (ASPS EdNET) provides structured lectures based on the plastic surgery curriculum, including clinical board style cases, videos of techniques and case reports, and virtual courses (ASPS EDNET). In aesthetic surgery, the Aesthetic Society has the RADAR Resource, providing online lectures, selected readings, and case presentations. The *Arbeitsgemeinschaft für Osteosynthesefragen* (AO) Foundation for hand or craniomaxillofacial (CMF) trauma has multiple available resources, including reference guides in trauma management that is available on mobile and electronic devices. During COVID-19 the AO Foundation ran live educational webinars that were recorded on various topics with expert faculty. For hand surgery, the American Society for Surgery of the Hand has an available online resource, “Hand-E,” that similarly has multiple live lectures and dissections from expert faculty in various topics in upper extremity pathology and reconstruction. Publishers, such as Thieme MedOne, provide a similar variety of resources with access to online textbooks in plastic and reconstructive surgery, publications, case reports, and video content, which can be organized to tailor the needs of the individual using the platform, and make the access to specific resources more efficient.¹⁹

Journals, such as *Plastic Reconstructive Surgery* (PRs) and *PRs Global Open* and *Aesthetic Surgery Journal*, have Continuing Medical Education (CME) articles and a multitude of online video content that can be accessed through personal or institutional subscriptions. In addition, there are complimentary free podcasts to the journal editions, including PRs Global Open Keynotes (where authors of selected articles are interviewed) or the PRs Journal Club (where selected articles are reviewed and discussed). Online modules for training, simulation, and virtual learning through smart technology apps continue to rapidly expand within plastic surgery education.^{20–25}

Conferences and Meetings

Virtual forums have been created so that trainees may attend and present at conferences (local, national or international) or participate in courses such as flap dissection or trauma courses, run by expert faculty. These interactive experiences allow trainees to further their knowledge, experience, and optimize opportunities for collaboration, mentorship, and networking. However, as the events of COVID-19 world pandemic unfolded, the Spring of 2020 saw a rapid change with the enforcement of social distancing and lockdowns preventing travel, with cancellation of number of national and international meetings.

LOCKDOWN LEARNING

Global lockdowns have negatively impacted plastic surgery practices, academia, and training programs. The stay-at-home orders and sudden disruption to training programs and clinical practice led to enforcement of rapid changes and uncertain futures. However, among the chaos, there was a rise in collaboration, innovation, and coordination among colleagues and societies; this led to an accelerated transformation in the delivery of education globally. Within the United States and the United Kingdom, individual programs ushered in rapid and innovative responses to augment resident education. To comply with government regulations for social distancing, virtual learning, online conferences, and recorded procedures became mainstay.

Online Platforms

The delivery of didactic lectures was transferred onto virtual platforms such as “Zoom.”²⁶ Zoom has become one of the most popular platforms for meetings and conferences, complying with Health Insurance Portability and Accountability Act and permissions for recording.²⁷ Such platforms have allowed established residency educational activities to remain and be delivered in the form of lectures, case-based discussions, and journal clubs. Anecdotally, this also had the impact of highest attendance rates and permitted interaction of a wider faculty, which is usually impossible due to geography, commuting, or time commitment. Many training programs often extend the invites of local sessions, grand rounds, and journal clubs to other programs around the country, including visiting professor lectureships. Faculty had the ability to deliver multiple lectures to audiences around the world from the comfort of their homes and offices, and sharing their knowledge and expertise. In addition, residency programs may have highlighted the available current online resources, and emphasized greater utilization of these platforms to complement the residency curriculum, including attendance to live webinars.

Society Initiatives

Online sessions have also permitted attendees to engage with each other in new ways, whether through live chat sessions or sharing screens and local content. ASPS set up twice weekly recorded webinars as part of the Educational Network “Virtual Grand Rounds” Series, and the Aesthetic Society similarly conducted a weekly webinar covering a range of topics from the plastic surgery curriculum with experts in the field targeted for resident education. Furthermore, ASPS ran additional webinar series dedicated to aesthetic topics entitled, “Aesthetic Insight in 60 Minutes.” The AO Foundation created a series for CMF trauma and AO Trauma Hand “Must Know Series-How I do it” webinars, that included case-based discussions, question and answer formats, and live debates. These series were free for most residents and included access to the recorded materials. In addition, individual companies such as Allergan and Mentor have set up webinar events with expert panels as part of continued medical education that remained free for residents. The British Association of Plastic, Reconstructive and Aesthetic Surgeons also

advertised links of international visiting professor lectureships and national lecture series or hot topic discussions organized through the Plastic Surgery Trainees Association UK or the British Society of Surgery of the Hand.

Online Conferences and Meetings

Conferences also transitioned to a virtual format. The Aesthetic Society in the United States traditionally holds their popular annual meeting in Spring, but due to the global pandemic, their team created a 1-day live event of the Aesthetic Society 20/20 at Home Meeting. This included specialized tracks and opportunities to participate in live chat, and expert panel discussions and lectures on hot topics. Concurrent sessions became available online a few weeks following the meeting with additional resources to gain CME credits. Similarly, other conferences such as the Plastic Surgery Research Council are developing online virtual abstracts and presentations in lieu of cancelling the entire program and giving residents the opportunity to present their research. Some courses have developed virtually adapted formats, including the Duke Flap Course, the American Society for Surgery of the Hand Wrist Course, and Dr. Rohrich’s live streamed rhinoplasty course with available CME credit. “The Master Series: Microsurgery for Residents,” hosted by Dr. Santamaria at Gea Gonzalez’s Hospital in Mexico, was another testament to the enthusiasm of faculty to teach and share their knowledge and experience with young aspiring microsurgeons with nearly 1000 participants from approximately 90 countries.

The international aesthetic community has also come together to deliver conferences and webinars to residents and physicians in developed and developing countries. The International Society of Aesthetic Plastic Surgeons have established a several weekly webinar series both in clinical techniques and in practice management sessions that provide guidance to navigate the current COVID-19 climate. Similarly, in aesthetic surgery, the South American Plastic Surgery Academy delivered their first World Online Plastic Surgery meeting over 2 days, with a large series of aesthetic topics, the Aesthetic Journal Global Education Meetings, and the European Society of Facial Plastic Surgeons have an ongoing schedule of international webinars that is directed to both consultant physicians and trainees.

These examples highlight how, in a limited time, the international plastic surgery community demonstrated a rapid transformation and embraced these virtual education platforms. Social media outlets appear to have also played an integral role in the exposure of these conferences, webinars, and educational resources by participants using Instagram, Facebook groups, and Twitter, but also through professional groups on these platforms, helped advertise and “spread the word” that facilitated wider participation. However, as clinical practice begins to open up slowly, initial restrictions cautiously lift, and people slowly trend toward some representation of normality in their practice, what will happen to the current trends and momentum attained in virtual education for plastic surgery trainees?

LOOKING FORWARD

The COVID-19 pandemic has had an impact across the world on clinical and surgical practice. Despite a short-term deficiency in hands-on training or operating opportunities for many, surgical specialties have strived to develop initiatives to support trainee education during this challenging time.^{5,28–33}

Online platforms for delivering a plastic surgery curriculum and resources for resident education and training have been available to provide accessibility and allow self-directed learning through lectures and video resources through a number of established platforms. Virtual online education has been well recognized to deliver accessible and equitable educational curricula and provides a valuable opportunity to extend its availability globally for trainees. Self-directed learning may create environments that facilitate flexibility of a changing information and procedural needs, and supports the need for trainees to adopt a more active learning role.³⁴ Although online learning and resources may have been available before the COVID lockdown periods, it has been shown that despite 24/7 accessibility, their utilization is seldom exploited to their maximal benefits by trainees and that there may be a positive influential role in mentored self-directed learning.¹⁵ Plastic surgery is such a diverse field that the degree of information available to learn can be overwhelming, and therefore, may be an example where guided self-directed learning can provide a framework to navigate the online resources available and increased engagement. In addition, these platforms may compliment and assist to form the foundation for the educational curricula for residency programs or trainee's own learning schedule.

The rapid growth in transformation and development in the use of these virtual platforms for discussions and sharing knowledge has provided global engagement to learn together. The experience can help trainees to gain insights and different perspectives of surgical practice around the world, while eliminating some of the barriers, they may have faced associated with study leave and costs to attend the equivalent conferences nationally or internationally. There may be new opportunities for mentorship, networking and collaborations for research, and foster relationships with our international colleagues. Furthermore, the spread of knowledge of these valuable resources through social media and other means of digital communication has raised awareness of some of the existing infrastructure and new platforms for learning.

The COVID-19 pandemic may have led to cancellation of society meetings, rotations, and visiting lectureships, but the tremendous efforts of educators, faculty, and societies around the world have been truly commendable and set a new bar in the delivery of high-quality education, bringing together international experts together, and attracting a wider participation from a global audience. Participant registration for many of the educational programs also provide future access to online lectures that can be accessed anywhere, similar to attendance to conferences and the provision of digital formats for lectures attended.

Teleconferencing case discussions and lectures have received successful feedback overall,^{30,35} despite some criticism of potential technical issues, reduced learner engagement, and participation. Live video and innovative approaches to learn in the operating room environment continue to expand.³² Although, it cannot replace true hands-on and practical training, simulation training and competency-based assessment is a fundamental and critical part of surgical training and education. With globalization of the education curricula, virtual and online platforms may provide a more central role for delivering a variety of educational tools to facilitate resident development, growth, and maintaining high-quality patient care. The trends seen in the recent weeks may allow consolidation and standardization of robust plastic surgery curricula from leading experts.

The future may also see an increased focus on ongoing development and application of virtual simulation training for procedures, and the use of immersive simulation using virtual reality (VR) and visualization technologies such as Google Glass, Oculus Rift, Magic Leap, or Microsoft Hololens.^{36–38} Virtual interactive presence and augmented reality can provide support solutions to project a remote surgeon's hands onto the display of another surgeon wearing the headset.³⁹ The use of technologies such as Google Glass may allow direct visualization of a participant and expert when performing a procedure in patients or in simulation models, and permit direct real-time feedback without in-person supervision.²³ The use of virtual simulation systems for anatomy and procedures continues to grow exponentially; their development remains in its infancy phase; and the role in plastic surgery training has yet to be established. However, the use of virtual simulators for endoscopic and laparoscopic procedures has been well established for assessment and training in general surgery, and can allow trainees the opportunity for repetitive deliberate practice of a task without direct supervision and feedback from the simulator and metrics of their performance.^{40–42} Over the last decade, there has been growing developments and innovations in plastic surgery-specific procedures ranging from educational apps to immersive VR workbenches with haptic feedback to simulate procedures and planning in CMF surgery, cleft palate simulators, simulation platforms for lower extremity defects or reconstruction of lesion defects, and microsurgery anastomoses.^{36,43,44} These platforms and technology may require additional equipment, costs, and set up based on the level of immersive and haptic feedback, but in the near future, together with ongoing restrictions and precautions to limit group didactics in the current COVID-19 pandemic, these tools may have a greater role for unsupervised deliberate practice in plastic surgery training and complement established didactics.

The first live global broadcast of the VR surgical environment was trialed successfully at the Royal London Hospital with an experience to provide a full 360 view of the operating room from the operating room table.⁴⁴ A greater number of educational meetings incorporate live surgery; because some of these VR tools grow increasingly

inexpensive, these same technologies may be the next evolution of future virtual medical conferences or live surgeries providing a more immersive “front row” seat feel at lectures, meetings, and networking events, while continuing to maintain social distancing.

CONCLUSIONS

Self-directed learning in plastic surgery residency and continued medical education is important during surgical training, and there are a variety of established online and technology resources to complement resident education. The COVID-19 pandemic led to adaptations and transformation on the focus for online delivery of educational content, and the local, national, and international plastic surgery community should be applauded for their efforts during the rapidly changing times in Spring 2020. It is vital that the inspiration and motivation to continue to build upon our experiences during these last few months will inform reshaping our curriculum to deliver excellent educational that will be sustainable for the future. It is the responsibility of key stakeholders and the wider international plastic surgery community to continue to embrace and enhance virtual education. Furthermore, prospective surveys and data collection to understand the experiences of resident education during COVID-19 and during the next 12 months will provide further understanding on the value of these platforms incorporated into the residency curriculum.

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