Journal of Taibah University Medical Sciences (2019) 14(2), 101–102

Taibah University

Journal of Taibah University Medical Sciences

www.sciencedirect.com

Editorial

Using telementoring and augmented reality in surgical specialties

Salman Y. Guraya, FRCS

Clinical Sciences Department, College of Medicine University of Sharjah, Sharjah, United Arab Emirates

Received 15 February 2019; accepted 1 March 2019; Available online 8 March 2019

In the recent past, the dynamics of teaching clinical skills, particularly surgical training and education, have substantially changed. The nature of surgical training has been predominantly influenced by enormous growth in number of surgical residency programs and surgical trainees as well as due to enforcement of several administrative and legislative policies. The European Working Time Directive (EWTD) has imposed a 30–35% reduction of clinical and operative experience during a 6-year training program.[1] Consequently, a proposed weekly working model of 48 h of working time and another 12 h for training is in place. Similar national guidelines have been recommended by the US Accreditation Council for Graduate Medical Education (ACGME) and British Medical Association.[2]

The described major modifications in residency training programs primarily aim to improve patient safety and quality of care. At the same time, owing to an escalating rise in medico-legal complaints, supervisors in surgical specialties tend to provide less opportunities to surgical trainees for hands-on training. This trend of reduced exposure to hands-on surgical training, compounded by reduction in working hours by EWTD and ACGME, has significantly undermined the quality of residency programs.[3] This necessitates an intense review of current surgical education systems for developing a balanced program that can potentially maintain patient safety and quality of health-care without jeopardizing the breadth and depth of educational programs.[4,5]

Parallel with the changing dimensions of post-graduate training working hours and more adherence to core principles of patient safety, emergence of bioengineering technologies in medical education has attempted to consolidate surgical training to some extent. Surgical telementoring is one of them. Telementoring in surgery denotes the use of information technology in providing real-time remote supervision to surgical trainees by an expert mentor surgeon.[6] Surgical trainees can complement their competencies by practicing a range of techniques in a virtual operating room (OR) environment under the guidance of a surgical mentor. In addition, established surgeons can upskill their competencies via telementoring by a remote telementor. Furthermore, robotics and minimally invasive surgery carry great promise for surgical telementoring and telesurgery due to endoscopic optics and mechanized instrument movements.

Telementoring has been used as an effective tool for disseminating skills and knowledge to surgical fraternity in remote locations in rural, civil and military locations.[7] Further technological developments have enhanced the fidelity of learning environment by 3D augmented reality applications that allow precise visualization of hidden organs and structures by endoscope.[8] Since telementoring by remote telementor needs secure and high bandwidth Internet connection, augmented reality telementoring system has added benefit of storing pre-generated videos and podcasts for surgical trainee's view in OR that can be used in case of Internet failure. The remote trainer can virtually place instruments and hands precisely on operating monitor of the trainee in OR with live audio/video conversation.[9] This technique of providing annotations during surgical telementoring by augmented reality application allows the remote mentor to recreate a high fidelity learning environment on tablets.[10] The described telementoring application contains a blend of videoconferencing, augmented reality uses telestration and haptic holograms for high definition of images and livestreaming.

Telementoring has some outright benefits. It can enhance mentor-mentee connectivity, wide training opportunities, and quality of care. Surgical telementoring can not only augment training programs by providing intense virtual

Corresponding address: Clinical Sciences Department, College of Medicine University of Sharjah, Sharjah, United Arab Emirates.
E-mail: salmanguraya@gmail.com

Peer review under responsibility of Taibah University.

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hands-on training, but can also provide guidance for a complex procedure not often performed or when a patient's critical condition does not allow his transport to a higher tertiary care center.[11] Latency and slight delay in movement and mentor feedback can have serious implications in telesurgery. However, surgical telementoring has a distinct advantage of an acceptable latency of ≤600 ms that allows an uninterrupted and direct contact between surgical trainee and mentor.[12] Another feature of surgical telementoring allows the mentor to draw and redraw anatomy on a drawing application using screen capture function of android and Apple® software. Telementoring can be an effective tool for surgical training that could enhance training, given the educed training hours and more reservations about inadequate operative experience. This can also permit mentor guidance for young surgeons from remote areas and can potentially provide an international convention for trainees in under developed areas.

A well-structured surgical telementoring program by accredited centres and health-care institutions can bridge existing gaps in surgical training.[13] Though benefits of surgical telementoring using augmented reality applications clearly outweigh disadvantages, resources, cost, expertise, and willingness to undertake such challenging technologies should be carefully considered during its application.

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How to cite this article: Guraya SY. Using telementoring and augmented reality in surgical specialties. J Taibah Univ Med Sc 2019;14(2):101–102.