Simulate to elevate

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This letter calls for increased exposure to advanced techniques.

I have had the privilege of working closely with orthopaedic surgeons for most of my now-starting medical career. Observing and engaging with orthopaedic registrars as they progress through their rigorous training to become consultants has provided me with insights into the demands and challenges of this speciality. Orthopaedic surgery involves an array of skills, which include factual knowledge, motor skills, teamwork and management, attitudes and behaviours, adaptive strategies and how to interpret what is seen, heard and felt in preparation for and during surgery.[1] An essential part of an orthopaedic surgeon's training is the exposure to these haptic experiences and learning to interpret and respond appropriately.[1] Haptic sensation plays a crucial role in the way an orthopaedic surgeon evaluates orthopaedic pathology and executes the surgical treatment of patients with musculoskeletal trauma.[1] Orthopaedic surgery is a physically and mentally demanding task; one of the challenges of orthopaedics is dealing with high mental demand due to stress based on the quantity and complexity of the work. The burning question: How can we decrease *mental demand*?

According to the Job Demand-Control Model, the two fundamental aspects of workplace-related stress are 'psychological job demands' and 'job decision latitude'.[2] In orthopaedic surgery, both are contributors to workplace-related stress and mental demand. Karasek defines the 'psychological job demand' aspect as psychological stressors prevalent in the workplace, such as mentally demanding work.[3] They also further explained that executive mental demands are examples such as developing objectives and strategies, planning, etc.[3] In a nutshell, this is the normal daytime job for an orthopaedic surgeon.

Recently, three-dimensional printing (3DP) has become more affordable and accessible, garnering significant interest among orthopaedic surgeons worldwide.[4] Furthermore, surgical simulation training has become more widely used across the world for surgical skills training.[4] It is mostly used to teach surgical skills to junior doctors and surgical trainees. However, it can also be used for preoperative planning for elective surgical cases. There are numerous examples in the literature demonstrating how 3DP can be utilised to create patient models for preoperative planning.[4,5] Simulation training creates the possibility to teach real-life situations safely and efficiently without the risk of patient mortality [4,5]

The term '3D surgical simulation model' is poorly described in the literature. A 3D surgical simulation model refers to a patient-specific anatomical replica used to train surgical procedures as well as for preoperative planning.[4,5] Furthermore, 3D printing is an essential part in creating an anatomically accurate 3D surgical simulator model.[4,5] The 3D-printed anatomically accurate model, utilising CT or MRI data, together with a soft tissue simulator, can be used to create a 3D surgical simulator model.

The cost of the simulator is an important factor in the accessibility of these models, especially in developing countries.[6] In the quest to resolve this issue, researchers are encouraged to produce cost-effective surgical simulators to incorporate into their respective training programmes.[4,5] However, these surgical training models must be validated before the implementation into surgical training programmes.[7] A validated model will develop the necessary surgical skills required for surgeons to graduate.[7] Hence, an unvalidated programme will raise questions about its effectiveness in the surgical training model and could potentially lead to the opposite effect.[7]

We believe these 3D surgical simulators can be used for two separate reasons: 1) to train surgical trainees (i.e. registrars or medical officers) specific surgical skills for certain surgical procedures, and improve their surgical skills; 2) for planning purposes.[5] Previously, 3D printing was used for preoperative planning.[4,5] However, now we can manufacture a low-cost and effective 3D surgical simulator model with anatomically accurate pathology of the patient in question, and it can be used to conduct a rehearsal of the surgical procedure (for example, a 'dry run' or 'practice run' of the procedure using surgical equipment).

The concept of 'unknown unknowns' refers to unforeseen challenges that only become apparent during the execution of a task – in this case, performing the particular surgical procedure in question. These rehearsals of the procedure help unveil unforeseen obstacles, and refine surgical techniques and approaches before surgery on the patient. Theoretically, this approach may enhance preparedness and minimise intraoperative surprises.

Although little to no research has been produced on the decrease in mental demand when a 3D surgical simulator is used, we hypothesise that rehearsal of the surgical procedure on a 3D surgical simulator model that simulates the exact anatomical pathology should decrease mental demand on the surgeon and decrease stress in the working environment.

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