Trainee Matters

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In this issue's Trainee Matters, it's a pleasure to present a trio of excellent articles with a theme of practical training courses for otolaryngology trainees. **Miss Rachel Edmiston**, **Professor Nirmal Kumar and colleagues** have written a valuable guide to setting up and running a cadaveric dissection course in the UK; **Miss Daniela Bondin** and **Mr Raj Bhalla** offer a personal insight on the benefits of rhinology and facial plastic surgery courses for trainees; and first up, **Miss Katherine Steele** gives us a fascinating account of training in temporal bone dissection.

Training in temporal bone procedures

Methods of training novice surgeons in surgical procedures without using real patients have been increasingly sought to ensure trainees are taught skills without compromising patient safety [1]. Temporal bone surgery is no different: given the risks involved in these procedures, a simulator for trainees to practise the procedural steps in which errors can be made without causing patient harm, is valuable. There are a variety of simulators available with, perhaps, the usual method being attendance at a cadaveric temporal bone dissection course. Whilst this provides experience and training in handling tissues, the relevant anatomy and the opportunity to practise the procedural skills in a safe environment, these are often performed over an intense one-to-two-day session, with a limit to the number of bones available limiting repetition and practice.

Within London North West Healthcare NHS Trust, we have access to a virtual reality temporal bone simulator, marketed by Voxel-Man, which is available for use by the trainees in the hospital during normal working

Figure 1: Trainee using the simulator

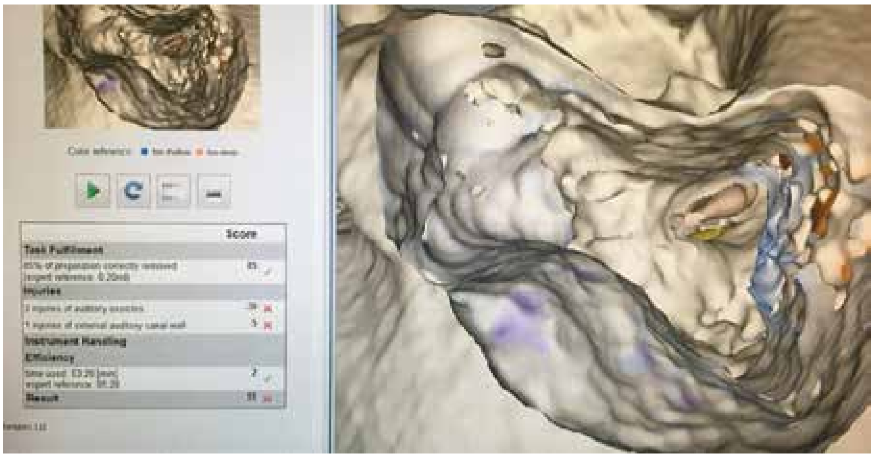

Figure 2: Example of feedback and assessment from software

hours. Use of this is designed as part of self-directed training with regular reviews with a consultant otology trainer to assess progress in the learning objectives set.

What does this involve?

Simulators for temporal bone dissection are available as computer-based programmes which use 3D-imagery and haptic instruments to confer the impression of a 3D temporal bone. The set-up requires a normal computer with 3D glasses, a 3D mouse and a pair of instruments, and requires little more space than the average modern computer desk. The computer programme arranges various steps of temporal bone surgery into short sessions to focus on the individual components with a training mode and examination mode. Both modes provide a score at the end of the session. However, the training mode also displays image guidance with three planes of corresponding cross-sectional imaging to assist the trainee in assessing the surrounding anatomy.

Assessment and feedback on the session is provided by the software which analyses and highlights onscreen, colour-coded areas where drilling was too deep or too shallow and where injuries occurred. The important structures are also colour-coded and the bone overlying these structures has a subtle hue of the colour of the structure to indicate your proximity. At the end, a score is produced, derived from the percentage correctly drilled away, with points deducted for mishandling of instruments, injuries to the dura, sigmoid sinus, ossicles or other important structures, and for the time taken over the expert time. Each session is saved with playback of the activity available for monitoring and review by a trainer.

How can this help the trainee?

In comparison to a cadaveric dissection course, virtual reality simulation of temporal bone surgery can be performed during shorter, more frequent sessions that can be scheduled into a regular training timetable. Regular access to a temporal bone simulator can be used to maintain skills for trainees who are not currently working within otology and, therefore, not performing temporal bone surgery regularly. With the number of times I have repeated each step, I would have required 12 cadaveric temporal bone specimens, using both sides, to provide the same number of practice sessions.

Whereas an argument for cadaveric models over virtual models is the presence of soft tissue and the model consisting of real bone which will behave as in surgery, there are some inconsistencies between the cadaveric model and the living patient, such as presence of bleeding, which limit its role in simulation. In the presence of tissues that bleed, a surgeon must handle two instruments concurrently; both the suction and the drill. In our virtual simulator, bleeding and suction is simulated so appropriate handling of the instruments can be simulated, as in the actual surgery, to ensure good practice in maintaining a clear surgical field, where all areas can be visualised. Using haptic instruments, the virtual simulator provides the virtual simulator to provides tactile feedback to complement the visual simulation to impart the sensations of drilling through bone. Although this is an artificial sensation, it does give the trainee a reasonable impression of depth.

> **"Simulators for temporal bone dissection are available as computer-based programs which use 3D-imagery and haptic instruments to confer the impression of a 3D temporal bone"**

Use of a simulator can facilitate exposure to the techniques and anatomy at an earlier stage, which can help direct the trainee's focus and facilitate learning through observation in theatre. Personally, as a novice in temporal bone surgery, the virtual simulator has changed my focus when observing mastoid surgery. Since using the simulator, the learning I take from observing is with a new appreciation for the considerations made to positioning of the patient, and angling of the drill to ensure safe operating in proximity to the sigmoid sinus and the dura whilst also achieving the aim of the procedure.

Discussion with other, more senior, users of the virtual simulator suggests it benefits trainee surgeons at all stages of training as well as the consultant otologists themselves. They value the aspects of the simulator that permit practice, repetition and exploration of different techniques in a safe environment, albeit with the knowledge that the simulator is not a perfect model of a real patient.

Additionally the software allows upload of cross-sectional computed tomography imaging to generate a virtual 3D model of the temporal bone to allow practice for previous or forth coming patients. This can be of benefit to surgeons of all stages, including consultant otologists, in preparing for challenging cases.

How can this help the trainer?

The provision of a virtual simulator allows the trainer to provide a regular training programme to trainees that can be adapted, depending on the skills and experience of the trainee, to complement theatre experience. Training can be standardised between trainers as well as being able to adapt training to the needs of the trainee.

When used as a regular learning tool with the support and review with a trainer, both parties will benefit from additional feedback on the trainees' non-technical skills, including economy of movement and instrument handling. This will build the trainers' confidence in the abilities and limits of their trainees' skill set and facilitate the use of real-life surgical cases to best benefit the trainee without risking patient safety.

What are the limitations of this?

As discussed above, the virtual simulator is not a perfect model of a real temporal bone surgery patient. It lacks soft tissue and does not handle exactly as real bone does. However, to those who have used it, it is a reasonable approximation to the real scenario. In real patients, where the bone changes in feel when in proximity to other structures, this is not replicated well in the simulator.

One other user commented on the virtual simulator and scoring turning the exercises into a game. This changes the focus of practice towards using the skills of a computer game to use the prompts to maximise the score, rather than considering it in terms of surgical practice.

Although using the virtual temporal bone simulator is intuitive in many respects, the use of a 3D mouse to manipulate the model is not a device used by most of the users in other situations and therefore needs to be learnt, adding a different skill to learn to reposition the bone appropriately, and potentially distracting from the surgical skills to be learnt.

Conclusion

Simulation in surgery is a developing field, with new simulators emerging for additional procedures. Cadaveric temporal bone dissection courses exist and are readily available but can be complemented with a virtual temporal bone simulator.

If used well to complement clinical exposure, and on a regular basis with episodic review and reflection with a senior trainer, then the virtual temporal bone simulator can teach and maintain new skills with benefits for trainers and trainees at all stages of experience in temporal bone surgery.

References

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Declaration of competing interests: None declared.