# Supplementary Materials

# Appendices

## Appendix A: Pre-competition and Post-competition Questionnaires

Pre-competition Questionnaire

First name:

Surname:

Please choose the grade that best describes yourself:

Medical student

F1

F2

Trust grade (post CT2/ST2, Pre-ST3)

ST3

ST4

ST5

ST6

ST7

ST8

Post-CCT

Trust grade (Registrar level)

Trust grade (Consultant level)

How many cortical mastoidectomies (excluding cadaver/simulation) have you performed total (Supervised-Trainer Scrubbed (S-TS) or above)? This includes cortical mastoidectomies which have been performed as a part of another procedure e.g. cochlear implantation.

How many mastoid explorations (excluding cadaver/simulation) have you performed in total (Supervised-Trainer Scrubbed (S-TS) or above)?

This includes mastoid explorations which have been performed as a part of another procedure.

How many cadaveric temporal bone dissection courses have you attended (in total)?

This includes any temporal bone course involving cadaveric material.

How would you currently rate your confidence with performing a cortical mastoidectomy?

Please rate your confidence 1-10, 1= extremely unconfident and 10= extremely confident.

On how many previous occasions have you used the Voxel Man Simulator?

This includes but is not limited to short training sessions at the Queen Elizabeth Hospital or elsewhere.

How many hours have you spent using the Voxel Man Simulator (in total)?

Please round this to the nearest hour

Besides the Voxel Man Simulator, have you used any other form of simulator devices for ENT procedures?

This can include any variety of simulation devices.

Yes/no

If yes, please describe them and the context in which you used them.

I believe surgical simulation improves intra-operative performance.

Please rate the extent of your agreement with this statement

1= strongly disagree

10= strongly agree

Why did you choose to attend this competition?

Please describe the reason(s) why you chose to attend this competition.

How many surgical competitions have you previously competed in?

These can be ENT or non-ENT related.

If you have previous attended a competition, please describe.

These can be ENT or non-ENT related.

Post-competition Questionnaire

First name:

Surname:

How would you currently rate your confidence with performing a cortical mastoidectomy?

Please rate your confidence 1-10, 1= extremely unconfident and 10= extremely confident.

Surgical simulation with the Voxel Man improves intra-operative performance in cortical mastoidectomy.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

The simulation tasks I have performed today will improve my intra-operative performance in mastoid surgery.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

The simulation tasks I have performed today will improve my understanding of the anatomy of the temporal bone.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

What preparation did you do for this event, if any?

To what extent was the competition a motivator to practice on the Voxel Man Simulator?

1= extremely weak motivator

10= extremely strong motivator

To what extent was the competition a motivator to read around the topic of mastoid/lateral skull base surgery?

1= extremely weak motivator

10= extremely strong motivator

To what extent was the competition a motivator to read around the topic of temporal bone anatomy?

1= extremely weak motivator

10= extremely strong motivator

I believe a competitive element motivates you to do more practice or reading compared to a non-competitive event.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

To what extent was this event fun?

1= Extremely not fun

10= Extremely fun

The competitive element made it more fun.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

Was there any other element that made the event fun?

To what extent was this event educational?

1= not educational at all

10= extremely educational

The competitive element made it more educational.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

To what extent did you believe the competitive element affected your Voxel Man drilling performance? (Compared to a non-competitive element)

1= greatly hindered

10= greatly helped

I would attend another competition similar to this.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

Competitions are useful within the ENT training programme.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

Competitions should be made essential within the ENT training programme.

Please rate the extent of your agreement

1= strongly disagree

10= strongly agree

Will you take further action as a result of this event?

e.g. reading more, practice more, check x, y, z.

Please describe the action you will take.

## Appendix B: Temporal Bone Scoring Scales

Modified Welling Score

Grade each item: 0 = incomplete/inadequate dissection, 1 = complete

Mastoidectomy margins defined at:

1. Temporal line 0 1

2. Posterior canal wall 0 1

3. Sigmoid sinus 0 1

Antrum mastoideum

4. Antrum entered 0 1

5. Lateral semicircular canal exposed 0 1

6. Lateral semicircular canal intact 0 1

Sigmoid sinus

7. Exposed, no overhang 0 1

8. No cells remain 0 1

9. No holes 0 1

Sinodural angle

10. Sharp 0 1

11. No cells remain 0 1

Tegmen mastoideum/tympani

12. Attic/tegmen tympany exposed 0 1

13. Ossicles intact (untouched) 0 1

14. Tegmen mastoideum exposed 0 1

15. No cells remain 0 1

16. No holes 0 1

Mastoid tip

17. Digastric ridge exposed 0 1

18. Digastric ridge followed towards stylomastoid foramen 0 1

19. No cells remain 0 1

External auditory canal

20. Thinning of the posterior canal wall 0 1

21. No cells remain 0 1

22. No holes 0 1

Facial nerve

23. Facial nerve identified (vertical part) 0 1

24. No exposed nerve sheath 0 1

25. Tympanic chorda exposed 0 1

Stanford score

Score each item 1-5.

1= Unable to perform, 3= Performs with minimal prompting, 5= Performs easily with good flow

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | 1 | 2 | 3 | 4 | 5 |
| Initial Bone Cuts | Placement of superior cut |   |  |  |  |  |
| Placement of canal cut |   |  |  |  |  |
| Defining Anatomic Limits | Identification/definition of tegmen  |   |  |  |  |  |
| Sharpen posterior EAC cortex |   |  |  |  |  |
| Define sigmoid sinus/SDA |   |  |  |  |  |
| Open Antrum | Deepen dissection at SDA |   |  |  |  |  |
| Open antrum  |   |  |  |  |  |
| Atraumatic exposure |   |  |  |  |  |
| Thin post EAC Cortex | View posterior EAC |   |  |  |  |  |
| Use sidefront of bur |   |  |  |  |  |
| Saucerization  |   |  |  |  |  |
| Open Facial Recess | Even removal  |   |  |  |  |  |
| Identify and preserve VII and chorda |   |  |  |  |  |
| Identity MT anatomy |   |  |  |  |  |
| Global  | Use of Drills |   |  |  |  |  |
| Respect for surgical limits |   |  |  |  |  |
| Time and motion |   |  |  |  |  |
| Knowledge |   |  |  |  |  |
| Flow of operation  |   |  |  |  |  |
| Overall  |   |  |  |  |  |

Intercollegiate Surgical Curriculum Programme (ISCP) scale

|  |  |  |
| --- | --- | --- |
|  | Satisfactory | Development required |
| Uses instruments appropriately/safely |   |   |
| Proceeds at appropriate pace |   |   |
| Anticipates/responds to variation  |   |   |
| Identified McEwans triangle |   |   |
| Saucerises mastoid |   |   |
| Enters mastoid antrum. |   |   |
| Demonstrates competent use of drill  |   |   |
| Global scale Level\*  |  Level: |   |

\*Global Scale:

|  |  |
| --- | --- |
| Level 1a | Able to assist with guidance (was not familiar with all steps of procedure) |
| Level 1b  | Able to assist without guidance (knew all steps of procedure and anticipated next move)  |
| Level 2a | Guidance required for most/all of the procedure (or part performed) |
| Level 2b | Guidance or intervention required for key steps only |
| Level 3a  | Procedure performed with minimal guidance or intervention (needed occasional help)  |
| Level 3b  | Procedure performed competently without guidance or intervention but lacked confidence  |
| Level 4a  | Procedure performed confidently to a high standard without any guidance or intervention  |
| Level 4b  | As 4a and was able to anticipate, avoid and/or deal with common problems/complications  |