Objective Assessment of Temporal Bone Dissection

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Introduction

Objective assessment of surgeon competence is recently surfacing as an area of high interest due to changes in patient expectations and a few high-profile surgical cases. Progress has been made by several otolaryngology training programs to create standardized criteria to rate their Trainees' performance in temporal bone dissection.
These include:

- Welling Scale (WS1) – The Ohio State University (1)
- Task Based Checklist (TBC) -University of Toronto (2)
- Global Rating Scale (GRS) -University of Toronto
- Final Product Analysis (FPA) -University of Toronto
- 20 metrics for assessment of simulated temporal bone dissection –Stanford (3).

While each scale requires the completion of similar basic components integral to temporal bone dissection, some listed criteria diverge in regard to each institution's preferred approach. **The goal of this study is to create a more universal scale for temporal bone dissection assessment that reduces cross-institutional partialities in terms of the idiosyncratic surgical approaches specific to each training program.**

Methods

The WS1 from The Ohio State University, the TBL, GRS, and FPA from the University of Toronto, and the 20 metrics from Stanford were compiled into an all-encompassing grading scale. This scale was formatted as an online survey and sent out through email to 190 members of the American Neurotology Society (ANS). Instructions were given for the survey participants to rate each criterion on the scale as either 'Very Important' , 'Important' , 'Moderately Important' , 'Of Little Importance' , or 'Unimportant' to the successful completion of temporal bone dissection.

To create the new, cross-institutional scale for the objective assessment of temporal bone dissections, we included all criteria that were ranked by >70% of respondents as either 'Very Important' or 'Important' . A cut-of of 70% was chosen because it was the lowest percentage that adequately excluded most (but not all) criteria that were repeatedly commented to be vague, unnecessary, or arbitrary, dependent on the specific case or temporal bone anatomy.

Results

61 responses were attained from 190 ANS members for a response rate of 32%. To rank each criterion's importance to temporal bone dissection, we took the sum of the percentage of responders that ranked the criterion as either 'Very Important' or 'Important' .

Grading Criteria and Importance to Assessment of Temporal Bone Dissection

Criteria ranked by 100-90% as 'Very Important' or Important'	Criteria ranked by 89.9-80% as 'Very Important' or Important'	Criteria ranked by 79.9-70% as 'Very Important' or Important'
Maintains visibility while removing bone: 100%	Canal wall up (EAC): 89.8%	Identifies the facial nerve at the external genu: 79.3%
Selects appropriate burr type and size; Drills with smooth and deliberate strokes: 98.4%	Identifies the facial nerve at the cochlearform process: 88.1%	Low frequency of drill 'jumps' (drill 'jump' = drilling>1cm away from the previously removed bone): 77%
Antrum entered: 98.4%	Appropriate depth of cavity (Cortex): 88%	No holes in tegmen: 73.8%
No violation of facial nerve sheath: 98.3%	Drills with broad strokes: 86.9%	Use of diamond burr within 2mm of facial nerve: 73.3%
Sigmoid sinus is not entered: 96.7%	No holes in the EAC: 86.4%	No cells remain on sinodural angle: 72.5%
Identifies tympanic segment of the facial nerve: 96.6%	Complete saucerization (Cortex): 83.3%	Sinodural angle sharply defined: 71.2%
Does not drill on ossicle: 91.8%	Posterior canal wall thinned: 81.4%	
Firm, low, good hand position and grip on drill: 91.8%	Facial recess completely exposed (overlying bone sufficiently thinned so nerve can be seen, located, and safely avoided): 80.4%	
Does not use excessive drill force near critical structures: 91.8%		
Identifies the chorda tympani or stump: 91.7%		
Drills in best direction (clear understanding of cutting edge): 90.2%		

New Cross-Institutional Temporal Bone Dissection Grading Scale:

Cortex
Complete saucerization (Cortex): **83.3%**
Appropriate depth of cavity (Cortex): **88%**

Tegmen/Dura
No holes in tegmen: **73.8%**

Sigmoid Sinus
Sigmoid sinus is not entered: **96.7%**

Facial Nerve
No violation of facial nerve sheath: **98.3%**
Use of diamond burr within 2mm of facial nerve: **73.3%**
Facial recess completely exposed (overlying bone sufficiently thinned so nerve can be seen, located, and safely avoided): **80.4%**

Semicircular Canals
No criterion met the 70% cut-off in this section, though inclusion of the criterion, 'Horizontal semicircular canal skeletonized: **69%**' *may be considered*

External Auditory Canal
Canal wall up (EAC): **89.8%**
No holes in the EAC: **86.4%**
Posterior canal wall thinned: **81.4%**

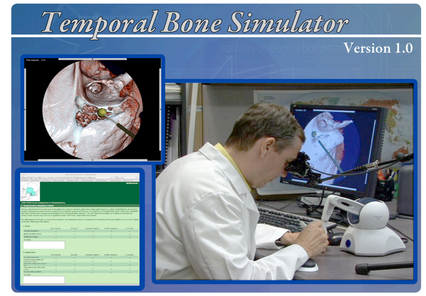
Sinodural Angle
No cells remain on sinodural angle: **72.5%**
Sinodural angle sharply defined: **71.2%**

Other
Antrum entered: **98.4%**
Does not drill on ossicle: **91.8%**

Procedural/Drilling Technique
Maintains visibility while removing bone: **100%**
Selects appropriate burr type and size--drills with smooth and deliberate strokes: **98.4%**
Drills with broad strokes: **86.9%**
Drills in best direction (clear understanding of cutting edge): **90.2%**
Low frequency of drill 'jumps' (drill 'jump' defined as when one drills >1cm away from the previously removed bone): **77%**
Firm, low, good hand position and grip on drill: **91.8%**
Does not use excessive drill force near critical structures: **91.8%**

Cognitive
Identifies the facial nerve at the external genu: **79.3%**
Identifies tympanic segment of the facial nerve: **96.6%**
Identifies the facial nerve at the cochlearform process: **88.1%**
Identifies the chorda tympani or stump: **91.7%**

Conclusion



The newly proposed temporal bone dissection scale enhances the objectivity of the currently existing grading scales for temporal bone dissections by accounting for differences in surgical training across institutions. Eventually, we would like to translate the elements of this newly compiled scale into automated evaluation metrics in our temporal bone simulator. With this, the new scale can be used as a stepping stone to attain even more objective scoring of temporal bone dissections by transforming it into a set of automated metrics that can objectively quantify surgical performance on a simulator without the input of an expert rater. In addition to providing an objective evaluation of surgical readiness that can be applied across different training institutions, the grading scale integrated into the surgical simulator can also be used by novice surgeons to obtain active feedback on their performance in the context of a more standardized and universal assessment criteria.

Acknowledgements

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