Temporal Bone Simulator as a Training and Assessment Tool for Temporal Bone Dissection

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Introduction:
With increasing emphasis being given to patient safety as it relates to the assessment and training of surgical residents, surgical simulators have become an important tool in the assessment of resident education. An ideal surgical simulation tool provides realistic training of a surgical procedure as well as a reproducible objective assessment of that resident's abilities. Several temporal bone drilling simulators have been studied as potential tools for resident education. Unfortunately most rely on a virtual system that fails to recreate haptic perception of drill on bone and realistically reproduce complex 3-D anatomy of the temporal bone.

Purpose:
The objective of this study is to evaluate a new temporal bone simulator as an effective training and assessment tool in an otolaryngology training program.

Methods:

The simulator evaluated was the Karl Storz Surgical Cockpit ENT – Training System for temporal bone surgery (Processlights PHAC). The module consists of a polystyrene temporal bone that can actualize normal cutting points. These inserts of the artificial skull which are made from a universal set are mated to an offset-the-shelf laptop computer for recording. Each insert or temporal bone plug has within it color coded inserts. These contain a conductive metal alloy lining that if breeched produces an error message on the laptop computer.

Methods (continued):
6 otolaryngology residents, 3 senior level (4th and 5th year of residency) and 3 junior level (2nd and 3rd year of residency), participated in this study. Residents performed a complete mastoidectomy on the simulator. This included identification of the mastoid air cells, sigmoid sinus, Kroner septum, and antrum were felt to be anatomically accurate. Some of the shortcomings of these prototypes are shown below and it is our understanding that corrections have been made. Anatomical inaccuracies were minor and did not interfere with the results of this study. Also, there was no objective input into dissection technique, efficiency of drill strokes, and quality of dissection. Due to the electronics associated with the simulator a suction irrigator could not be used and a powerful vacuum was needed to clear the powder.

Results:

Dissection Times Pre/Post Temporal Bone Course

![Graph showing dissection times pre/post temporal bone course.]

Number of Injuries to Vital Structures Pre/Post Bone Course

![Table showing number of injuries to vital structures pre/post bone course.]

Discussion:
The simulator was successful in showing improved dissection times by an average of 23.4 min overall after temporal bone course participation. For junior level residents, an improvement was also seen in the ability to avoid vital structures. In the survey results, all residents somewhat agreed that the simulator was an effective educational and assessment tool for temporal bone dissection. They also somewhat agreed that the simulator improved their drilling efficiency and better prepared them for the temporal bone course. All were of the opinion that the synthetic plaster reproduced the feel of actual bone. The mastoid air cells, sigmoid sinus, Kroner septum, and antrum were felt to be anatomically accurate. Some of the shortcomings of these prototypes are shown below and it is our understanding that corrections have been made. Anatomical inaccuracies were minor and did not interfere with the results of this study. Also, there was no objective input into dissection technique, efficiency of drill strokes, and quality of dissection. Due to the electronics associated with the simulator a suction irrigator could not be used and a powerful vacuum was needed to clear the powder.

Conclusion:
The temporal bone simulator was successful in showing objective improvement in dissection times for all resident participants after a formal temporal bone dissection course. It was also effective in evaluating junior level residents' ability to avoid key structures. With further refinement this simulator could be a useful training and assessment tool for otolaryngology residents, and could supplant cadaveric dissection. This would be especially beneficial in programs whose access to human cadaveric temporal bones is limited.

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References:
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