Validation of a Temporal Bone Dissection Simulator

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Abstract

Educational Objective: To increase our understanding of the effect of temporal bone simulator training on individual’s ability to learn cadaveric temporal bone dissection.

Methods and Materials

Introduction

Training to become an otologic surgeon involves years of study and practice by various methods. Traditional methods include studying books, illustrations, and anatomical models, and assisting experienced surgeons during operations. An important part of the learning process is dissection of cadaveric temporal bone specimens. Nearly all residency training programs have access to temporal bone dissection laboratories and incorporate these dissections into resident education and training. Working with cadaveric temporal bone specimens has inherent limitations and risks. Specimens are often partial, are in short supply, and for the most part can only be dissected once. Further, working with human tissue has the potential to transmit disease. A potential solution to these issues is emerging through advancing technology and computer simulation.

Harada first introduced the concept of utilizing 3-dimensional volumetric reconstructions from computed tomography to simulate temporal bone dissections.1 Technological innovations, however, prevented real-time execution of this concept in the late 1980’s. Advancing technology has allowed surface-based computer reconstruction models2 and volumetric, physically based models.3,4,5

For the past five years our group has been developing a temporal bone dissection simulator based on volumetric data sets from computed tomography.6,7,8 The system has haptic (or touch) feedback for the user. Our group has also recently developed and validated the Welling Scale as an objective measure of temporal bone dissection quality.9 The goal of this current study is to evaluate the effectiveness of training with the temporal bone dissection simulator on subject’s proficiency dissecting a cadaveric temporal bone.

Methods and Materials

Recruitment: 12 Subjects with no previous relevant training were recruited for the study: • 6 medical students with an interest in surgery. • 6 PGY 1 or 2 residents with no experience yet in mastoid surgery.

Standardized pretest education given to all 12 study subjects. • Access to relevant pages from the Temporal Bone Surgical Dissection Manual.9,10 • 30 minute lecture on relevant anatomy. • 2 hour proctored dissection of cadaveric temporal bone. • Instruction on how to use the Temporal Bone Dissector Simulator. • 15 minute skills test on Temporal Bone Dissector Simulator – Drill a cone off a sphere.

Randomization: Subjects randomized between 2 study groups (6 each). Subjects from both groups recorded their total practice time.

- Traditional Group: Unlimited practice time with 2 new cadaveric temporal bones in the temporal bone dissection laboratory over 2 week period.
- Simulator Group: Unlimited practice time using the temporal bone dissection simulator over 2 week period.

Post test dissection: All subjects dissected 2 cadaveric temporal bones.

Data Analysis: The post test dissections were analyzed and scored by two neurotologists using the Welling Scale (Figure 1). Statistical analysis was done to compare the scores between study groups.

Results

The traditional group had a mean percent of total possible Welling Scale points of 23% (range 8.6 – 46, STD 13.9). The simulator group had a mean practice time of 3.0 hours (range 2.0 – 3.25, STD 0.56), and the simulator group did have a mean practice time of 3.3 hours (range 2.75 – 5.0, STD 1.5).

Conclusions

Subjects from both study groups performed relatively similar to each other on post test cadaveric temporal bone dissection measured by the Welling Scale. The traditional group did, however, perform slightly better. This result is consistent with the hypothesis that practice on the temporal bone dissection simulator is beneficial, but not equivalent to traditional practice with cadaveric specimens. Further studies and refinement of the research protocol are needed to continue to evaluate the role temporal bone dissection simulators will play in the future.

Bibliography