Effect of Distractions on Operative Performance and Ability to Multitask-A Case for Deliberate Practice

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ABSTRACT

Objectives: To measure the effect of distractions on the operative performance and analyze if practice and experience are the factors which can help to overcome the distractions.

Methods: Ten PGY2-6 residents and 2 faculty members from Johns Hopkins otolaryngology department were recruited and asked to deepen the dissection at sinusoidal angle on Voxel-man mastoidectomy simulator. They were asked to perform the task under four conditions; 1) no distractors, 2) distraction, 3) simultaneous performance of simple arithmetic task of moderate difficulty, 4) simultaneous performance of the task with both sets of distractors combined.

Results: Time taken for the task (p=0.02) and error scores (p=0.002) increased under third and fourth conditions. The ability to multitask and response to surgical and cognitive task improved with increasing level of experience of the participants.

Conclusions: Distractions lead to impaired dexterity and an increase in the incidence of errors. However, experience and deliberate practice can help achieve the ability to multitask without compromising the operative performance.

INTRODUCTION

It is imperative for a surgeon to focus all his attention to the surgical procedure for a successful outcome. However, operating rooms inherently have stressors and distractions which can compromise surgical performance and hence patient safety.

These distractions are mostly unavoidable; therefore it is important for the surgeons to learn to avoid any negative effect of the distractions on their operative performance. This requires them to do the parallel processing and respond competently to both the surgical and the cognitive task as both are likely to be important. Because it is not feasible to measure the effect and the ability to deal with these distractions in real environment, studies have been conducted on laparoscopic surgical simulators. However, to our knowledge, this is the first study to evaluate the effects of distraction on operative performance of any otological procedure.

Drilling on temporal bone during mastoidectomy requires precision and lapse in focus may result in injury to the underlying structures. The aim of this study was to examine the effects of auditory and cognitive distractors on mastoidectomy in relation to the experience of the surgeon. We hypothesized that experienced surgeons would be relatively immune to cognitive overloading and without any negative effects on the surgical task. The decreased ability of novices would suggest need of strategies to prepare them early in their training to minimize the effects of distractions allowing safe completion of tasks.

METHODS AND MATERIALS

Ten otolaryngology residents from PGY level 2-6 and two faculty members volunteered to take part in the study. The study was approved by the institutional review board of our hospital. The participants were given the task of deepening the dissection at sinusoidal angle on previously validated Voxel-man mastoid simulator. One of the authors (HF) already drilled the bone up to this task, making it standardized starting point for all the participants. This task has previously shown to be a valid predictor of overall surgical performance of mastoidectomy. To reduce any ‘learning curve’ effect, we asked the participants to practice the task before the experiment till they reached a plateau and minimal difference in duration was observed.

The participants were asked to perform the task under four different scenarios:

Scenario 1: Baseline performance was recorded without any distractor.

Scenario 2: Different kinds of background alarm beeps were played with subjects asked to differentiate and count one specific kind of beep while performing the task. Participants were made familiar with the sounds before the experiment.

Scenario 3: Participants were given simple mental arithmetic tasks (for e.g. 162-89). They were given as many calculations as they were able to answer during the primary task.

Scenario 4: Participants were exposed to both beeps and calculations for the fourth time.

Comparison of the performance under distractors with the baseline performance was assessed using Wilcoxon signed ranks test. The Kruskal-Wallis test was used to compare the performance with an increasing level of experience. For all statistical purposes, p<0.05 was considered statistically significant.

RESULTS

It took an average of 3.7 minutes to complete the task without any distractor. There was no significant difference in the time to complete the task under the sound distractor condition (mean time=4 min, p=0.9). There was, however, a significant increase in the time to task completion under calculation (mean time=5.4 min, p=0.02) and combined distraction (mean time= 5.6 min, p=0.02). The total error score was also increased with distractions as shown in figure 1 but was largest and significant only with calculation distraction (z=-3.0, p=0.002) and combined distraction (z=-3.6, p=0.002).

Figure 2 represents error scores based on experience level. It shows that junior residents (PGY-2-4) were more distracted and their error scores were higher than the experienced group under distraction conditions. Table 1 shows a significant increase of error scores by junior residents when baseline performance was compared with the performance under calculation and combined distractions. Senior residents showed an increase of error scores under distractions but it was not statistically significant. Faculty performance showed no significant decline under distraction conditions. Similarly, there was an increasing percentage of correct answers on arithmetic calculations with increasing level of experience; however it was significant only under combined distraction (p=0.01). No participant was able to identify the correct number of beeps.

DISCUSSION

Distractions in the operating room put an additional load on the cognitive abilities of a surgeon while thinking about the present case and performing the motor tasks. The study has shown an objective effect of the mental stress on the performance of the surgical task depending on the experience of the surgeon. Participants were able to mask the sound distraction in isolation and it did not affect their surgical performance in terms of errors and duration. However, the cognitive distraction superimposed by arithmetic calculations in isolation and in combination with sound affected both time and the surgical performance significantly which can be explained by the theories of attention. In a dual task situation, attention is divided between the two tasks which can affect the performance of the primary task.

The enhanced ability of the senior residents and faculty in coping successfully with both cognitive and surgical task simultaneously can be attributed to the reduction of psychological refractory period (PRP). The PRP effect was first explained by Welford as a delay in response to the second stimulus while the first stimulus is still being processed. This inability of the brain to process both tasks simultaneously creates a division of attention which may produce a negative effect especially when a cognitive response is needed. Studies have shown that practicing the primary task can significantly reduce this PRP effect which can be attributed to the superior performance of senior surgeons. Ericsson has shown that experience can be safely transferred to learners with the use of deliberate training methods on representative tasks in the laboratory. Ericsson describes deliberate practice as a repetitive practice of a task which is aimed towards improvement of the skill while continuously evaluating and receiving feedback on the performance. This allows them to make intentional adjustments under unexpected situations without any errors. Incorporating a deliberate practice model within residency training can enhance learner’s ability to cope with unexpected situations like distractions; however further research with a third group of novices with deliberate training and a large sample size would allow further objectification of the effect.

CONCLUSIONS

Distractions lead to an increased error score and operating time. However, experienced surgeons show a superior ability to multitask which emphasizes need for training strategies such as deliberate practice to prepare learners for real life challenges.

REFERENCES


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