

# Blinded Randomized Control Study of a Web-Based Otoscopy Simulator in Undergraduate Medical Education

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## ABSTRACT

### OBJECTIVE

To evaluate the effectiveness of a web-based otoscopy simulator (Ototrain™), in teaching diagnostic otoscopy to novice learners.

### METHODS

Second-year medical students were invited to participate in the study. A pre-test was conducted, consisting of viewing a series of otoscopy videos followed by an open-answer format assessment pertaining to the characteristics and diagnosis of each video. Participants were randomly divided into two groups - the experimental group was given unlimited access to Ototrain™ for one week. The control group did not. Ototrain™ is a previously validated web-based otoscopy simulator. A post-test was completed using a separate set of otoscopy videos. Tests were graded based on a comprehensive marking rubric. The evaluators were blinded to which group the participants belonged.

### RESULTS

Forty one medical students were enrolled in the study. Both groups demonstrated significant improvement ( $P < .001$ ) comparing pre-test and post-test scores. However, compared to the control group, the experimental group had significantly higher post-test scores ( $P < .001$ ). Additionally, the experimental group was better able to distinguish various pathologies ( $P < .001$ ).

### CONCLUSION

The use of Ototrain™ increased the diagnostic otoscopic performance in novice learners. The use of Ototrain™ may be an effective teaching adjunct for undergraduate medical students.

## REFERENCES

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## CONTACT

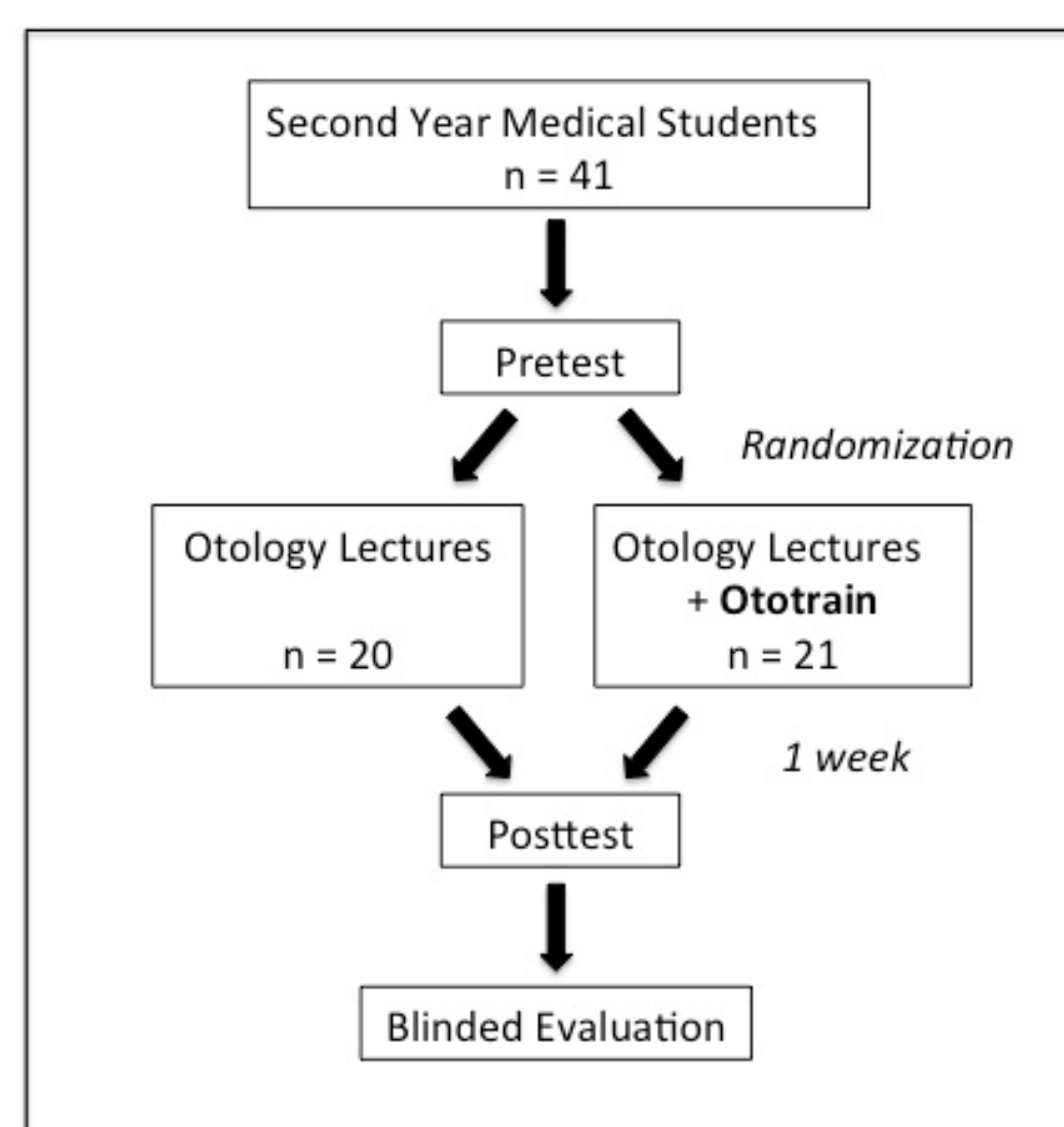
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## INTRODUCTION

- Otolgic diseases comprise over 25% of adult and 50% of pediatric visits to a primary care provider
- Proficiency in otoscopy is critical for the proper diagnosis of otologic disorders, however studies have confirmed the need for improved otoscopy education
- Traditionally, the anatomy and pathology of the ear has been taught using didactic lectures. Unfortunately, only 5% of medical students felt confident performing an adequate otoscopic exam after their third year of training
- Ototrain™ is a web-based otoscopy simulator, designed and developed at Western University in the Auditory Biophysics Laboratory, that could potentially be used as a low-cost and accessible teaching tool (Figure 1)

## METHODS AND MATERIALS

A prospective randomized controlled study was conducted to measure the effect of a web-based otoscopy simulator on diagnostic skills acquisition.



A video library was created using various otologic pathologies from 80 patients (Figure 2). Second year medical students were invited to participate. All participants completed a pretest by watching 15 videos and completing a short-answer test. Participants were then randomly divided into two groups, the experiment group was given unlimited access to Ototrain™ for one week, the control group was not. A posttest was taken by both groups with a new set of 15 videos. Results were graded based on a comprehensive marking rubric created by experts in the field. Evaluators were blinded to which group participants belonged.

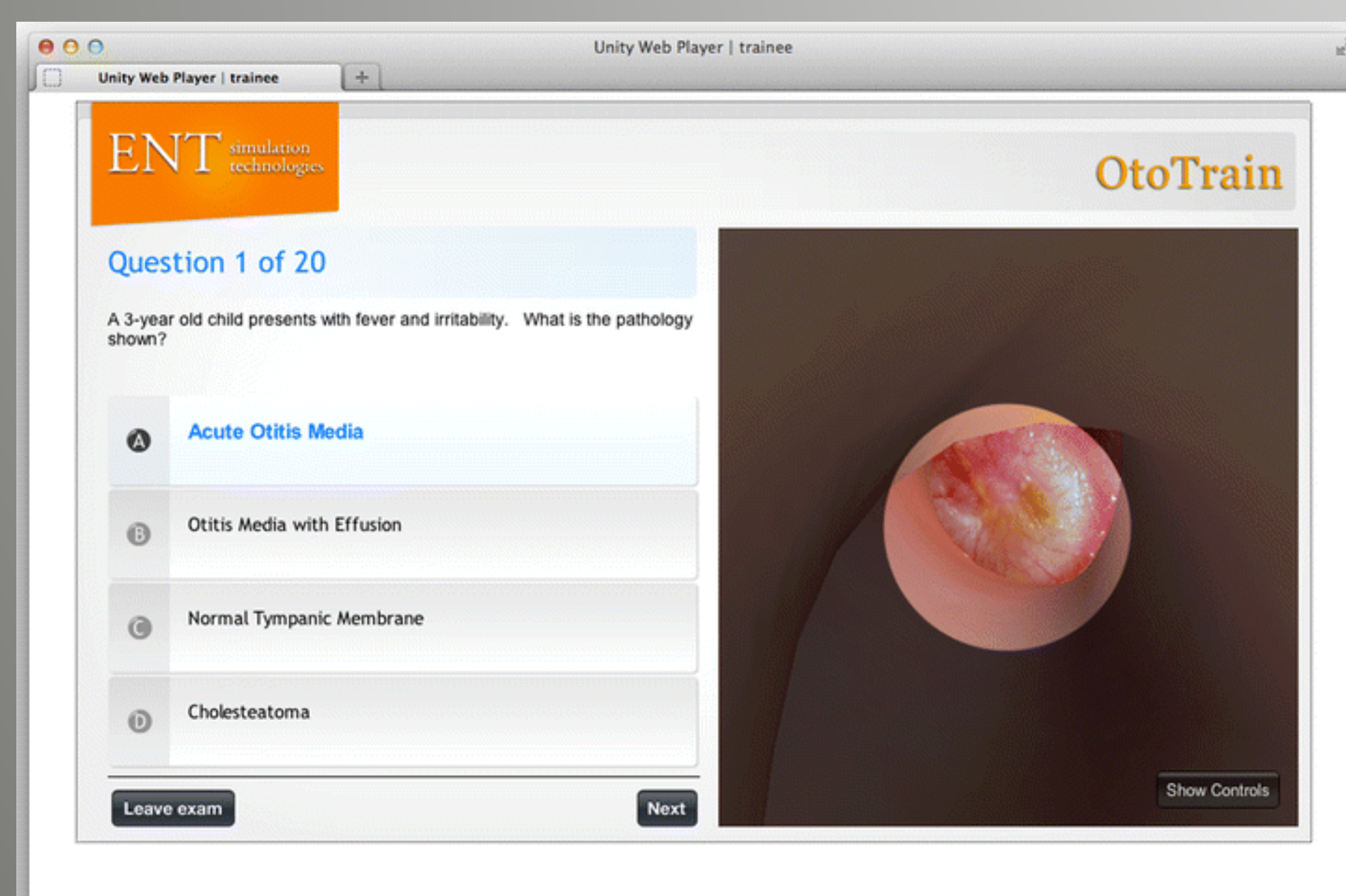


Figure 1. Screenshot of Ototrain™

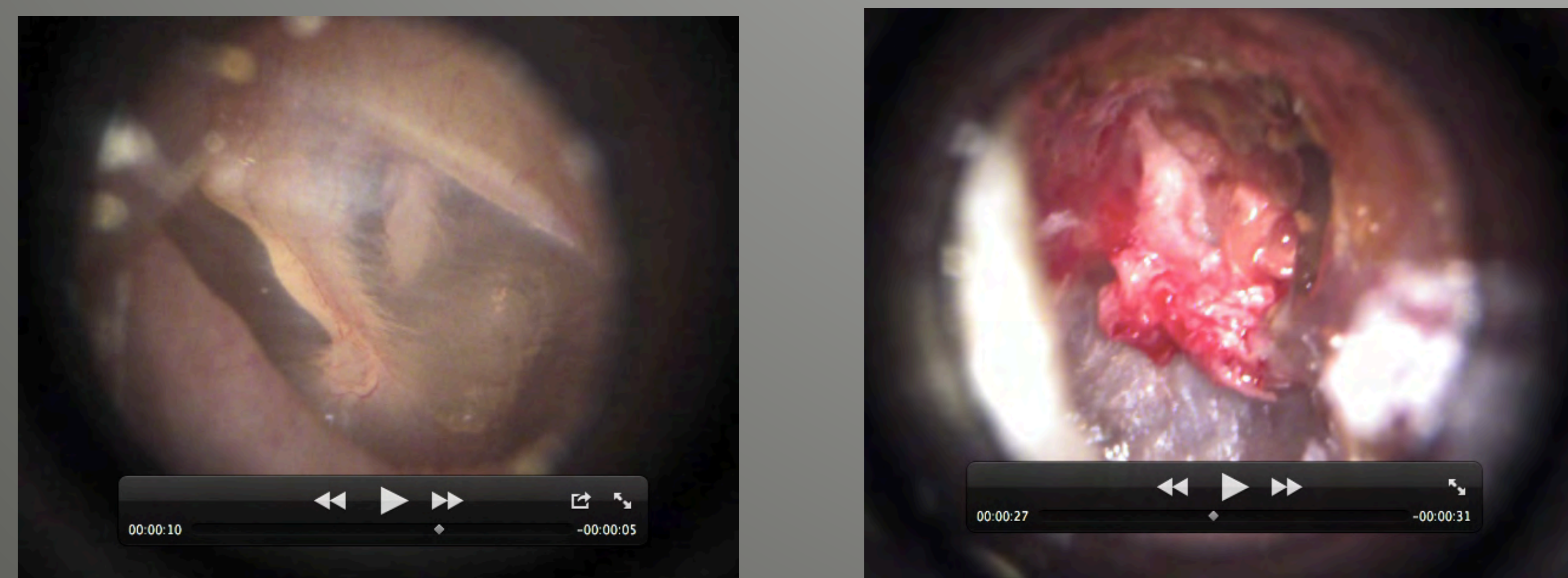


Figure 2. Screenshot of a normal ear (left) and cholesteatoma (right) on video otoscopy

## RESULTS

Forty-one students participated in the study; 21 were randomized to the experimental group and 20 to the control group

- Pretest results demonstrated equivalent performance for both groups (Chart 1)

- Both groups demonstrated significant improvement from pretest to posttest in almost all categories

- When both groups were compared, the experimental group received significantly higher total scores in the post-test ( $P < .001$ ), and showed a 24.1% score increase from pretest to posttest (Chart 2)

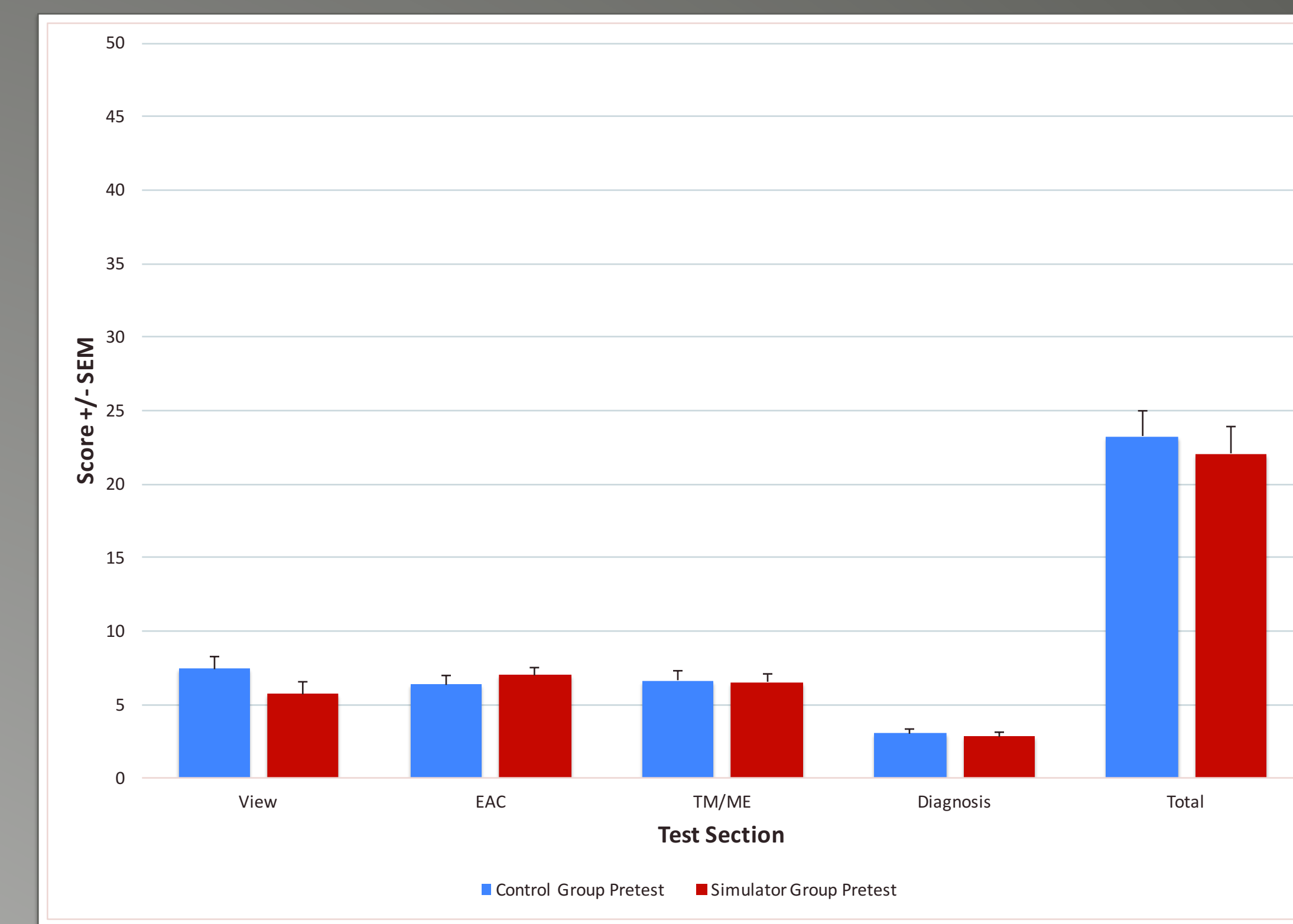


Chart 1. Mean pretest scores

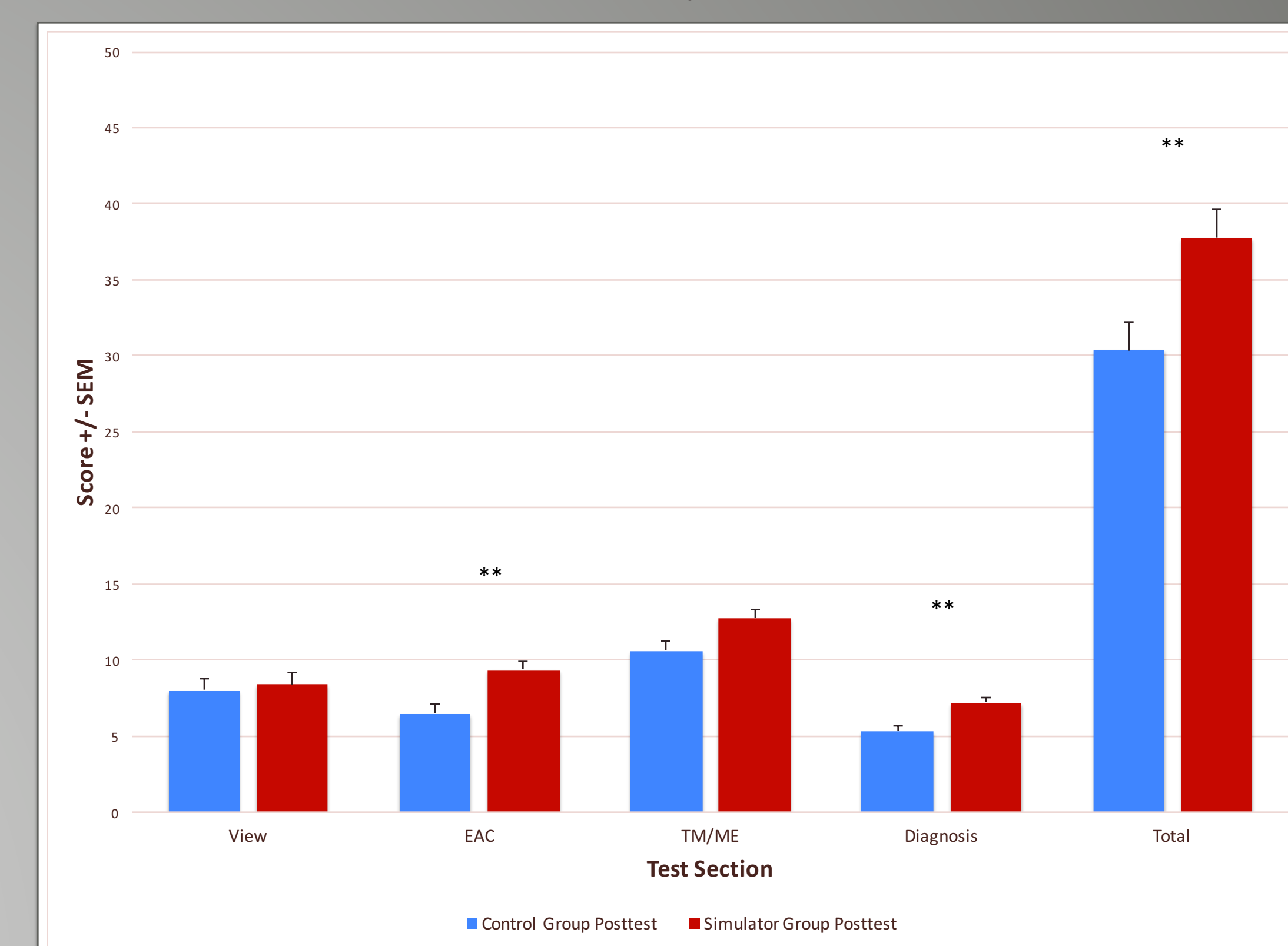


Chart 2. Mean posttest scores.

\* =  $P < .01$

## DISCUSSION

- Otoscopy is an important skill for the accurate diagnosis of ear pathology. Correct identification of common middle ear pathologies, such as acute otitis media, can have significant effects on the quality of patient care, the patterns of antibiotic prescription, and the number of appropriate referrals to specialists
- Increasing class sizes, overburdened curricula, and limited resources may provide a new role for selected technologies in teaching medical students
- The present study explores the use of the web-based simulator, Ototrain™, to teach otoscopy to novice medical students. To our knowledge, this is the first study to assess the utility of such a simulator in undergraduate medical education in teaching otoscopy
- Our study demonstrated that Ototrain™ increased the diagnostic otoscopic performance in second year medical students. This suggests Ototrain™ may be an effective adjunct in teaching ear anatomy and pathology
  - Ototrain™ provides additional benefits such as the ability for instructors to specifically tailor learning modules to the learners' training level. This may allow for resident level teaching or even distribution to physicians in practice wishing to ameliorate their knowledge of less common ear conditions
- The main limitation of our study is the uncertainty of skills transference when students are asked to use a physical otoscope. Future studies could explore whether using Ototrain™ increases diagnostic accuracy in real patients

## CONCLUSIONS

Ototrain™ is a novel web-based otoscopy simulator that is an effective adjunct in teaching otoscopy and increasing diagnostic performance in novice learners. Further refinement of the simulator is required to incorporate the physical and technical aspects of diagnostic otoscopy.