Training Novices to Perform the Head Impulse Test with a Free Smartphone Application

Samuel Westendorf, M2; Derek Versalle, DO; Jacob Lenning MD

Western Michigan University Homer Stryker M.D. School of Medicine, Department of Emergency Medicine, Kalamazoo, MI

The Head Impulse Test has potential to be taught with a free smartphone application.

Introduction

- The HINTS exam (Head Impulse, Nystagmus, and Test of Skew) can be more sensitive for early stroke detection than MRI.[1]
- The head impulse test (HIT) requires a head turn of precisely 10-20 degrees of rotation at >100 degrees per second for accuracy.[2,3]
- Expensive video-oculography devices (VOG) have been used to teach the motor skills of the head impulse test.[4]
- The purpose of this study was to determine if a free mobile phone application can be used to teach the head impulse test.
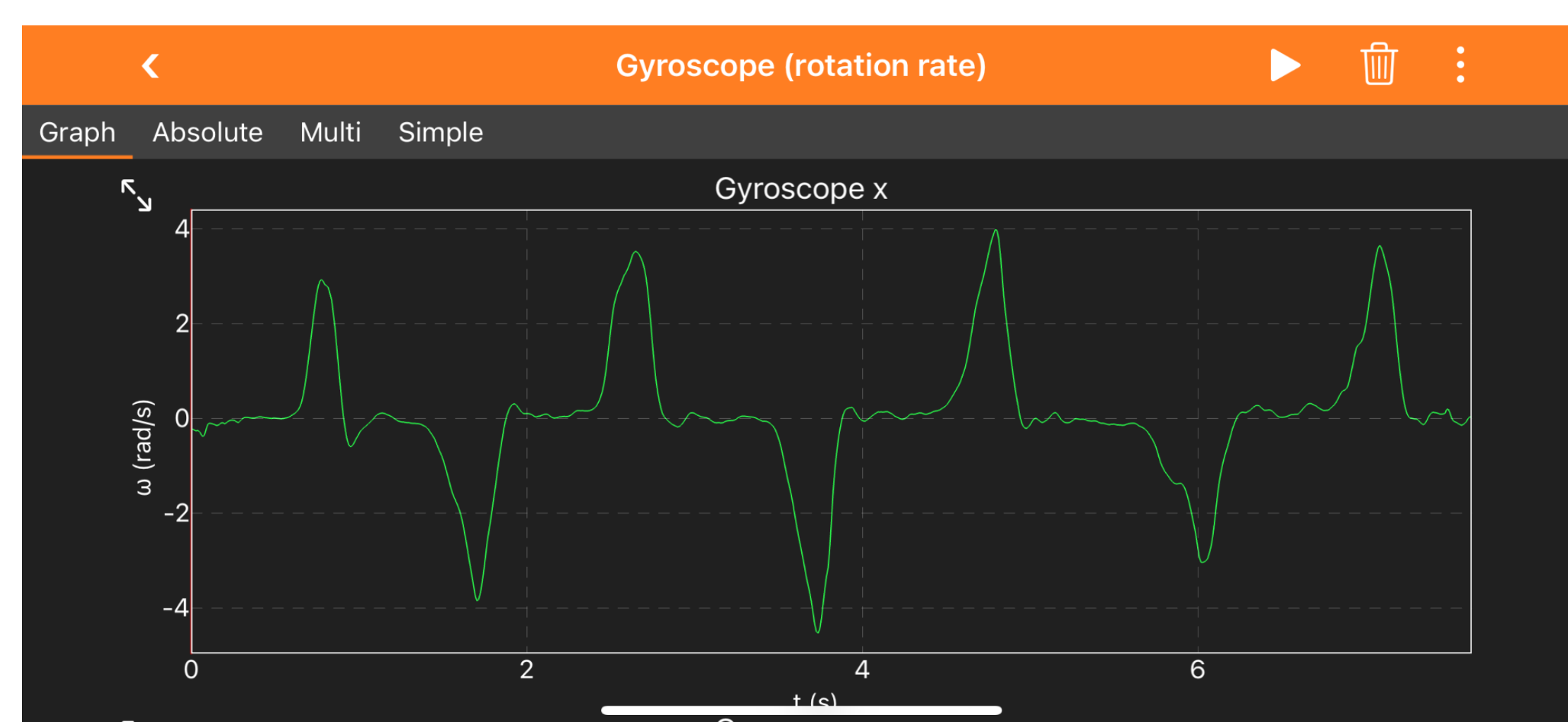

Figure 1: Phyphox smartphone application user interface.

Methods

- Ten medical student participants were shown a video demonstrating the HIT.
- Using VOG, participants were assessed on baseline ability to perform the test out of 20 attempts on a training model.
- Participants were randomly divided to perform 100 practice attempts using either VOG or the PhyPhox smartphone app.
- Aggregate learning curves were generated from each group.
- Following training, participants were reassessed on their ability to perform the HIT out of 20 attempts on the training model.
- Participants were reassessed 3 weeks later.
- Average success rates of data were compared using independent two-sample t-tests.

Results

Figure 2: HIT training testing model with smartphone and VOG device in place.

- Similar to previous studies[4], no participant could perform the HIT prior to training.
- The final success rate during the practice session for the smartphone app group was 47% compared to 55% for the VOG group (Figure 3, p=0.40).
- Success rates on immediate post-testing were similar to the success rates during the practice session, 47% for the smartphone app group and 52% for the VOG group (p=0.70).
- The success rate at the 3-week follow-up was significantly different from the post-testing success rate for the smartphone application group (15%, p=0.03) but similar for the VOG group (50%, p=0.91).
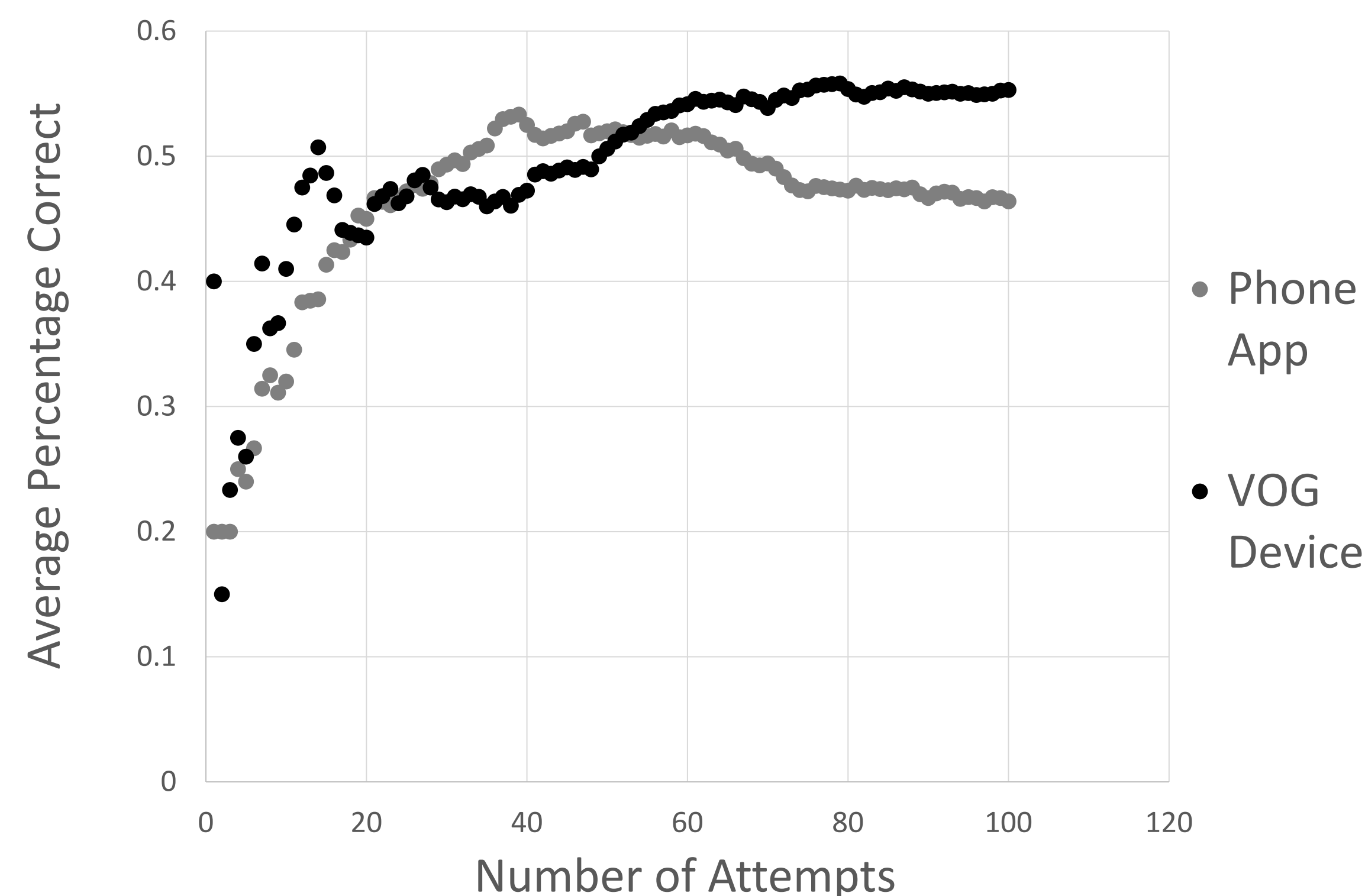

Figure 3: Plot demonstrating aggregated learning curves for participants in the PhyPhox smartphone app and VOG device groups.

Conclusion

- The smartphone app group demonstrated similar HIT skill acquisition compared to the VOG group. However, there was poor skill retention in the smartphone app group compared to the VOG group.
- The study will need to be continued with a larger sample size.
- Further investigation is needed to determine the utility of the free smartphone app as a low-cost method to teach the HIT for improved assessment of acutely dizzy patients.

Acknowledgement

References

[1] Edlow JA, Carpenter CR, Akhter M, et al. Guidelines for reasonable and appropriate care in the emergency department 3 (GRACE-3): Acute dizziness and vertigo in the emergency department. Acad Emerg Med 2023;30(5):442-486.

[2] Halmagyi GM, Curthoys IS. A clinical sign of canal paresis. Arch neurol 1988;45(7):737-739.

[3] Machner B, Erber K, Choi JH, et al. Usability of the head impulse test in routine clinical practice in the emergency department to differentiate vestibular neuritis from stroke. Eur J Neurol 2021;28(5):1737-1744.

[4] Lenning JC, Messman AM, Kline JA. Application of motor learning theory to teach the head impulse test to emergency medicine resident physicians. Acad Emerg Med. 2024 Feb 21;8(1):e10936.