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Psychomotor Testing for Orthopedic Residency Applicants: A Pilot Study

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OBJECTIVE: The purpose of this study was to develop an objective motor skills testing system to aid in the evaluation of potential orthopedic residents.

DESIGN: Participants attempted a battery of 5 motor skills tests (4 novel tests and the Grooved Pegboard [GPT] Test) in one 10-minute session. A percentile-based scoring system was created for each test based on raw scores. One-way analysis of variance was used to compare testing scores among 3 cohorts. Each novel test and overall scores were compared with GPT scores as a relative measure of validity.

SETTING: The 2015 orthopedic surgery residency interview season at an academic institution.

PARTICIPANTS: Thirty orthopedic residents and 72 non-residents (15 community volunteers and 57 orthopedic surgery residency applicants).

RESULTS: Overall, residents performed better than non-residents ($p < 0.0001$) and applicants performed worse than residents or volunteers ($p < 0.0001$). There were positive correlations between the GPT score and overall battery score ($r = 0.63$), screw and nut test ($r = 0.40$), and mimic a structure test ($r = 0.26$). The fracture reduction test and drilling test scores did not correlate to performance on the GPT.

CONCLUSIONS: Psychomotor testing for surgical applicants is an area in need of study. This investigation successfully piloted a novel battery of tests, which is easily reproducible and thus may be feasible for use in the orthopedic surgery residency interview setting. Longitudinal evaluation is required to explore correlation with future operative skill. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2017 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: orthopedic, residency, interview, motor skills, surgical skill, skills testing

COMPETENCIES: Practice-Based Learning and Improvement, Systems-Based Practice, Medical Knowledge

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INTRODUCTION

Resident selection is increasingly demanding, as the ratio of applicants to orthopedic residency positions continues to rise.[1] Prior studies have attempted to determine which applicant characteristics are most likely to predict future success.[2-7] In 2006, the AOA's Steering Committee on resident selection highlighted motor ability as a potential area to predict future resident performance.[5] High USMLE Step 1 scores and involvement in fine motor activities have both been correlated with better surgical skill evaluations from faculty.[2,5] Currently, psychomotor ability is largely assessed under direct observation during surgical rotations.[2,4,7] Unfortunately, these evaluations may be subjective and not adequately compare applicants of different training curricula. Objective psychomotor evaluation during the interview process is a potential solution.

Psychomotor assessment has been explored in various avenues outside the interview setting. Surgical simulation is increasingly used as a training modality and has been validated as both a teaching and an evaluation tool.[8-15] Simulation of laparoscopic surgery is well established,[16] and psychomotor performance using this model has been shown to correlate with operative skill.[17] Van Heest et al.[9] demonstrated in a cadaveric carpal tunnel release model that technical proficiency increased with year of training. In their study, fund of knowledge was not necessarily predictive of procedural success, thus emphasizing the need for both technical and scholastic assessment. Gallagher et al.[18] advocate that without a fundamental amount of technical ability, individuals should not embark into a surgical training program. They further liken surgical training to

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the aviation industry, where candidates must demonstrate proficiency in basic skills before training initiation.

Objective psychomotor testing has been piloted in general and neurosurgery,[18-20] but no similar testing has yet been described for orthopedics. The objective of this study was to create a cost-effective psychomotor testing protocol for the orthopedic residency interview setting. Our hypothesis was that scores would be normally distributed and that residents would perform better than nonresidents.

MATERIALS AND METHODS

Study Enrollment

Institutional review board approval was obtained before study initiation. During the 2015 interview season at a large urban orthopedic surgery residency training program, 30 current orthopedic surgery residents, 57 orthopedic residency program applicants, and 15 community volunteers participated in individual testing sessions consisting of a battery of 5 psychomotor tests. Community volunteers were acquaintances of the primary investigator and represented a wide variety of professions including childcare, business administration, engineering, corporate sales, nursing, athletic training, and full-time college students. Community volunteers were of similar age to the expected age of applicants (average 25.4 years old) and had no prior surgical experience. Residents and volunteers were tested at times of convenience, whereas applicants were tested as a routine part of their interview day. Applicants were informed of the experimental nature of the testing battery and assured that their performance would be recorded in a de-identified manner, with no role in the institution's evaluation or consideration of the applicant for a residency position. Informed consent was waived for applicants and obtained from all other participants.

Testing Protocol

The testing battery consisted of 5 (4 novel and 1 validated) motor skills tests administered in a predetermined linear order during a single 10-minute session. Each exercise was prefaced by a set of scripted instructions, which were read aloud by a trained proctor; however, printed instructions were also placed at each exercise (Figs. 1–5).

Test 1: *Fracture reduction test* : A simple fracture model was created to represent the typical deformity seen in a single bone of a displaced pediatric forearm fracture. Two interlocking segments of ¾-in (2 cm) polyvinyl chloride (PVC) piping were attached using a tensioned internal rubber band, creating a reproducible resting position of 100% displacement, and 2.5 cm of shortening. The model was enveloped by a surrogate "soft tissue sleeve" of 2 layers of TheraBand followed by 3 layers of cotton stockinette. Participants were given a maximum of 45 seconds to achieve a "closed reduction" of the fracture model. Score was recorded as time to achieve reduction (in seconds) or "NR" (not reduced). This model tested haptic feedback and

FIGURE 1. *Fracture reduction test*: (A) "Reduced" model inside of double stockinette "soft tissue" sleeve. (B) "Unreduced" model in sleeve. (C) "Reduced" model removed from soft tissue sleeve. (D) "Unreduced" model removed from soft tissue sleeve. (E) Close-up of "fracture" site with traction applied. Examinee instructions: "Reduce the fracture before you as fast as you can. Once you have achieved a perfect reduction, set it down. Your time will start once you pick it up and will stop once you set it down. You have a maximum of 50 seconds."