

# Orthopedic Surgery Residents' Study Habits and Performance on the Orthopedic In-Training Examination

Ryan G. Miyamoto, MD, Gregg R. Klein, MD, Michael Walsh, PhD, and Joseph D. Zuckerman, MD

## ABSTRACT

The Orthopaedic In-Training Examination (OITE) is a tool used by residency directors to evaluate a resident's fund of orthopedic knowledge. In this study, we correlated resident study habits and preparation tools with performance on the OITE. Data analysis indicated statistically significant correlations between successful OITE performance and frequent review of current orthopedic journals (*Journal of Bone and Joint Surgery—American Edition*,  $r = .6$ ,  $P < .001$ ; *Journal of the American Academy of Orthopaedic Surgeons*,  $r = .36$ ,  $P = .02$ ), daily orthopedic reading ( $r = .34$ ,  $P = .03$ ), increased preparation time for OITE ( $r = .31$ ,  $P = .04$ ), and more hours committed to studying ( $r = .37$ ,  $P = .01$ ). In addition, residents who emphasized prior OITEs and self-assessment examinations when preparing had higher scores ( $r = .53$ ,  $P < .001$ , and  $r = .64$ ,  $P < .001$ , respectively). Our study results show that several factors, including structured study habits and use of specific study materials, contribute to residents' successful OITE performance. Adaptation of these findings by current orthopedic residents may have a positive impact on OITE performance.

The Orthopaedic In-Training Examination (OITE) is an annual test given to all orthopedic surgery residents in the United States during postgraduate years (PGY) 2, 3, 4, and 5. The OITE, developed by the Evaluation Committee of the American Academy of Orthopaedic Surgeons (AAOS), consists of 275 questions representing the spectrum of clinical orthopedics, related clinical disciplines, and orthopedic basic science. The OITE was created to evaluate each orthopedic residency program and whether and how well it is attaining its educational goals. In addition, it is intended to evaluate the

Dr. Miyamoto is Orthopaedic Surgery Resident, Dr. Klein is Faculty, Hackensack University Medical Center, Division of Reconstructive and Total Joint Replacement Surgery, Dr. Walsh is Epidemiologist, and Dr. Zuckerman is Professor and Chairman, Department of Orthopaedic Surgery, New York University Hospital for Joint Diseases, New York, New York.

Requests for reprints: Ryan G. Miyamoto, MD, Department of Orthopaedic Surgery, New York University Hospital for Joint Diseases, 301 E 17th St, New York, NY 10003 (tel, 212-920-5499; fax, 212-598-2377; e-mail, miyamr01@med.nyu.edu).

*Am J Orthop.* 2007;36(12):E185-E188. Copyright Quadrant HealthCom Inc. 2007. All rights reserved.

level of knowledge of residents throughout their training. Performance on the OITE was shown to be highly predictive of success on the American Board of Orthopaedic Surgery Part 1 Examination (ABOS1).<sup>1</sup>

Studies examining the performance of residents on in-training examinations have been undertaken in other fields, including general surgery and internal medicine. In 2000, Godellas and colleagues<sup>2</sup> attempted to clarify which factors led to improvement on the American Board of Surgery In-Training Examination (ABSITE). They demonstrated that the amount of study and conference attendance correlated significantly with successful resident ABSITE performance.<sup>3</sup> Derossis and colleagues,<sup>4</sup> focusing their investigation on resident study habits and the correlation with overall ABSITE scores, found a small but significant correlation between scores on the modified Survey of Study Habits and Attitudes (a validated instrument for assessing study habits in students) and ABSITE performance ( $r = .29$ ,  $P < .05$ ).

The necessity of in-training examinations has been assessed. Hawkins and colleagues<sup>5</sup> explored use of the In-Training Examination in Internal Medicine by surveying residents' perceptions of the examination and by evaluating faculty members' ability to accurately predict resident performance. Both faculty and residents were found to be inaccurate in predicting resident performance; however, scores had an 89% positive predictive value for passing the subsequent American Board of Internal Medicine Certifying Examination.

In the present study, we wanted to determine which components of a resident's study habits and OITE preparation contribute to successful performance—with specific emphasis on home study habits, note-taking preferences, tendency to read monthly periodicals, materials used during OITE preparation, and length of preparation.

## METHODS

Forty-four orthopedic surgery residents (PGY2-PGY5) at a single residency program were administered a blinded survey (Appendix) that consisted of a broad scope of questions regarding study habits and OITE preparation materials and time. Residents completed the survey 2 weeks after being administered the OITE but before receiving their results. Questionnaire data were later paired with OITE results. Confidentiality of survey responses and OITE scores was maintained with a numerical identifier known

**Table I. Assessed Factors and Their Association With Higher Orthopaedic In-Training Examination (OITE) Scores**

Factors Associated With Higher Scores	Factors Not Associated With Higher Scores
Self-review of topics outside formal lectures*	Note taking at protected lecture time*
Routine review of <i>Journal of Bone and Joint Surgery—American Edition</i> *	Note taking while reading
Routine review of <i>Journal of the American Academy of Orthopaedic Surgeons</i> *	Personal structured reading schedules
Increased examination preparation time*	Reviewing lecture material before lecture
Focused review of prior OITEs*	Focused review of textbooks
Focused review of self-assessment examinations*	Focused review of review books ( <i>Miller's Review</i> )
Studying with other residents	Focused review of flashcards
Daily review/study of orthopedic material	Focused review of lecture notes
Focused review of <i>Orthopaedic Knowledge Update—General Knowledge</i>	Focused review of online orthopedic Web sites
Focused review of <i>Orthopaedic Knowledge Update—Specialty Series</i>	Focused review of review course material (Miller's Review Course)

\* $P < .05$ .

**Table II. Assessed Factors and Their Use by Residents**

Factor	No. of Residents Reporting Use
Textbooks	34
Review books	44
<i>Orthopaedic Knowledge Update—General Knowledge</i>	17
<i>Orthopaedic Knowledge Update—Specialty Series</i>	14
Prior Orthopaedic In-Training Examinations	43
Self-assessment examinations	23
<i>Journal of Bone and Joint Surgery—American Edition</i> and <i>Journal of the American Academy of Orthopaedic Surgeons</i>	17
Flashcards	1
Lecture notes	8
Online orthopedic Web sites	4
Review course	7

only to the education coordinator responsible for recording each resident's OITE scores for our department.

OITE scores were correlated with study habits using the Spearman correlation coefficient to assess the association between the scores and specific habits during residents' training.

### RESULTS

Higher OITE scores were associated with earlier start for examination preparation ( $r = .31, P = .04$ ) and higher total number of hours devoted to studying ( $r = .37, P = .01$ ). A significant and strong correlation ( $r = .60, P < .001$ ) was identified between higher scores and monthly review of the *Journal of Bone and Joint Surgery—American Edition (JBJS-A)*. A significant correlation ( $r = .36, P = .02$ ) was also identified between higher scores and frequent review of the *Journal of the American Academy of Orthopaedic Surgeons (JAAOS)*. Residents who indicated that they reviewed topics at home daily also tended to have higher OITE scores ( $r = .34, P = .03$ ) than residents who did not review topics at home daily.

Regarding specific study materials, higher OITE scores were found for residents who emphasized review of prior OITEs ( $r = .53, P = .0052$ ) and self-assessment examinations ( $r = .64, P < .001$ ). Although not statistically significant, a positive correlation was found between high OITE scores and 2 other study habits—routine review of topics other than those presented at weekly conferences ( $P = .11$ ) and study-

ing with other residents ( $P = .08$ ). Residents who emphasized studying *Orthopaedic Knowledge Update—General Knowledge* ( $r = .25, P = .09$ ) and *Orthopaedic Knowledge Update—Specialty Series* ( $r = .27, P = .08$ ) also tended to score higher, but statistical significance was also not achieved. These results are summarized in Table I.

No correlation was found between OITE performance and note taking during protected lecture time ( $P = .02$ ) or while reading ( $P = .32$ ). In addition, significantly better performance was not found for residents who had personal structured reading schedules ( $P = .74$ ) or who read lecture material before lecture ( $P = .6$ ).

Specific study materials that did not strongly correlate with improved OITE performance included textbooks ( $r = .08, P = .63$ ), review books ( $r = .21, P = .17$ ), self-constructed flashcards ( $r = .20, P = .20$ ), lecture notes ( $r = .16, P = .30$ ), online orthopedic Web sites ( $r = .08, P = .61$ ), and review course material syllabi ( $r = .11, P = .46$ ). See Table I. The number of residents who reported using each form of study material is displayed in Table II.

We reviewed the power required for all nonsignificant comparisons in this study and found that, for all but one, we would require a minimum sample size of 5604 residents to achieve statistical significance for the observed relationships—indicating a true lack of association for these comparisons. The exception is the habit of studying with other residents. Residents who studied with others scored almost 8.5 points higher than residents who studied alone. However,

data were highly skewed, as only 4 residents reported studying with others. We also used a nonparametric rank sum test to test the difference, and the result was the same. Nevertheless, we cannot rule out the possibility that the lack of significance for this relationship may be a result of lack of power, as a power analysis showed that only 22 residents would be required to identify a significant relationship for the observed mean difference and standard deviation.

## DISCUSSION

The importance of performing well on residency in-training examinations has been well documented in a variety of medical and surgical specialties. The significance of success on the OITE is well recognized by residency directors. A correlation between OITE scores and successful completion of the ABOS1 has been documented. The pass rate on the ABOS1 is used by the Residency Review Committee during program reviews; therefore, the effects of a program on OITE performance can have an indirect impact on the accreditation process. On an individual level, OITE scores allow a resident to assess command of his or her fund of orthopedic knowledge. Although OITE and ABOS1 clearly cannot test a resident's surgical skills, the required passing of "the Boards" for certification makes the importance of these cognitive examinations much more tangible. In the present study, we attempted to identify which study habits correlate with better OITE performance and which study materials were useful in achieving higher scores in our residency program.

Our results reinforce a basic tenet of modern medical practice: Continued reading with preparation is important. Monthly review of *JBJS-A* had a strong correlation with OITE success, as did frequent review of *JAAOS*. It is interesting that both journals had a positive correlation, as their content is different. *JBJS-A* publishes peer-reviewed manuscripts on basic and clinical research in musculoskeletal science, plus review articles in sections titled Current Concepts, Instructional Course Lectures, and Evidence-Based Medicine. By comparison, *JAAOS* publishes articles that, though also peer-reviewed, are broad overviews of topics of interest to their authors and may or may not be literature based in terms of factual coverage. Realistically, there is likely great benefit in reviewing other orthopedic journals, but *JBJS-A* and *JAAOS* are the only ones we assessed.

Reviewing topics months before taking the OITE and dedicating a significant amount of time to OITE preparation can be challenging for most orthopedic residents. Busy work schedules and other obligations can consume much of a resident's time. However, the importance of the OITE and spending sufficient time in preparation should not be underemphasized. There is clearly a link between preparation time and examination results. Daily reading and routine review of topics other than those presented during protected lectures are also likely to affect OITE performance. Undoubtedly, the day-to-day learning that occurs while residents are performing their clinical responsibilities is an important source of knowledge, but this specific factor could not be assessed as a defined variable. Our study results suggest that spe-

cific emphasis on reviewing prior OITEs, self-assessment examinations, and the *Orthopaedic Knowledge Update* may enhance OITE performance, but not with the same degree of significance as other factors identified.

The study materials assessed in our study but not linked with higher OITE scores should not be interpreted as being unhelpful. That some items (flashcards, online orthopedic Web sites) were used by only a few residents in our program clearly affected statistical analysis. In addition, junior residents are often influenced by advice and study materials "handed down" from more senior residents. These study tools and tips on preparation are likely program-specific, and surely there is variation among programs. Ultimately, individual study patterns and comfort in using specific materials determine how best to prepare for the OITE.

One study limitation is that our data were based on responses from residents at a single orthopedic surgery program (New York University Hospital for Joint Diseases). Our program has 3 hours of structured didactic conferences per week, plus conferences on individual services. Conference attendance is mandatory, and attendance is recorded and monitored every week. Data gathered from programs without dedicated lecture time may produce different results. It is unclear if the tools highlighted as improving OITE scores in our program would be the same as those used in other programs. In addition, although our study results were statistically significant, they were based on the survey responses of only 44 residents, a relatively small cross-section of residents currently training in the United States. Furthermore, listing and assessing the impact of all materials that are potentially useful in OITE preparation were beyond the scope of our analysis.

It is difficult to say with any certainty that our results would be consistent with those generated by a larger sample of residents in a broader scope of programs. Our goal was simply to identify which factors correlated with higher OITE scores in our program and to give our residents a sense of which tools are "high yield" in studying for the OITE.

## AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

## REFERENCES

1. Klein GR, Austin MS, Randolph S, Sharkey PF, Hillbrand AS. Passing the boards: can USMLE and Orthopaedic In-Training Examination scores predict passage of the ABOS Part-I Examination? *J Bone Joint Surg Am.* 2004;86(5):1092-1095.
2. Godellas CV, Hauge LS, Huang R. Factors affecting improvement on the American Board of Surgery In-Training Examination (ABSITE). *J Surg Res.* 2000;91(1):1-4.
3. Godellas CV, Huang R. Factors affecting performance on the American Board of Surgery In-Training Examination. *Am J Surg.* 2001;181(4):294-296.
4. Derossis AM, DaRosa D, Schwartz A, Hauge LS, Bordage G. Study habits of surgery residents and performance on American Board of Surgery In-Training Examinations. *Am J Surg.* 2004;188(3):230-236.
5. Hawkins RE, Sumption KF, Gaglione MM, Holmboe ES. The In-Training Examination in Internal Medicine: resident perceptions and lack of correlation between resident scores and faculty predictions of resident performance. *Am J Med.* 1999(2);106:206-210.

**Appendix.** Survey questions asked of residents to assess their preparation for the Orthopaedic In-Training Examination (OITE).

<p>1. Do you have didactic lectures? YES NO If yes, how many hours per week? _____</p> <p>2. Do you have case conferences? YES NO If yes, how many hours per week? _____</p> <p>3. Do you take notes during the protected lecture time at your program? YES NO Do you study or review these notes? YES NO</p> <p>4. Do you routinely review topics outside those presented at your lectures? YES NO</p> <p>5. Do you have a personal structured reading schedule independent of lectures given at your program? YES NO</p> <p>6. Do you read material regarding your lecture topics before lecture? YES NO If yes, do you read: The night before lecture? YES NO  In advance of the night before lecture? YES NO</p> <p>7. Do you routinely take notes when you read? YES NO Do you review them when studying? YES NO</p> <p>8. Do you study with other residents? YES NO</p> <p>9. Do you routinely read: <i>Journal of Bone and Joint Surgery</i>– <i>American Edition</i>? MONTHLY EVERY OTHER MONTH RARELY NEVER <i>Journal of the American Academy of Orthopaedic Surgeons</i>? MONTHLY EVERY OTHER MONTH RARELY NEVER</p>	<p>10. For the OITE administered last November, did you use/review the following items? (Rate their importance on a 1-to-5 scale: did not use [0], not helpful [1], moderately helpful [3], very helpful [5])</p> <table border="0"> <tbody> <tr> <td>Textbooks as a source of review</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Review books (eg, <i>Miller's Review</i>)</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td><i>Orthopaedic Knowledge Update</i>– <i>General Knowledge</i></td> <td>0 1 2 3 4 5</td> </tr> <tr> <td><i>Orthopaedic Knowledge Update</i>– <i>Specialty Series</i></td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Prior OITEs</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Self-assessment examinations</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td><i>Journal of Bone and Joint Surgery</i> –<i>American Edition</i> or <i>Journal of the American Academy of</i> <i>Orthopaedic Surgeons</i></td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Flashcards</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Lecture notes</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Online orthopedic Web sites</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Review course (Miller's Review Course)</td> <td>0 1 2 3 4 5</td> </tr> <tr> <td>Other materials _____</td> <td>0 1 2 3 4 5</td> </tr> </tbody> </table> <p>11. How often do you read/study? DAILY WEEKENDS</p> <p>12. When did you start studying for the OITE? &lt;1 MONTH BEFORE 1 MONTH BEFORE 2-3 MONTHS BEFORE &gt;3 MONTHS BEFORE</p> <p>13. How many total hours did you devote to studying? &lt;10 HOURS 10-20 HOURS 20-40 HOURS 40-60 HOURS 60-80 HOURS &gt;80 HOURS</p> <p>14. Have you had more time to read since the 405 rules were implemented? YES NO</p>	Textbooks as a source of review	0 1 2 3 4 5	Review books (eg, <i>Miller's Review</i> )	0 1 2 3 4 5	<i>Orthopaedic Knowledge Update</i> – <i>General Knowledge</i>	0 1 2 3 4 5	<i>Orthopaedic Knowledge Update</i> – <i>Specialty Series</i>	0 1 2 3 4 5	Prior OITEs	0 1 2 3 4 5	Self-assessment examinations	0 1 2 3 4 5	<i>Journal of Bone and Joint Surgery</i> – <i>American Edition</i> or <i>Journal of the American Academy of</i> <i>Orthopaedic Surgeons</i>	0 1 2 3 4 5	Flashcards	0 1 2 3 4 5	Lecture notes	0 1 2 3 4 5	Online orthopedic Web sites	0 1 2 3 4 5	Review course (Miller's Review Course)	0 1 2 3 4 5	Other materials _____	0 1 2 3 4 5
Textbooks as a source of review	0 1 2 3 4 5																								
Review books (eg, <i>Miller's Review</i> )	0 1 2 3 4 5																								
<i>Orthopaedic Knowledge Update</i> – <i>General Knowledge</i>	0 1 2 3 4 5																								
<i>Orthopaedic Knowledge Update</i> – <i>Specialty Series</i>	0 1 2 3 4 5																								
Prior OITEs	0 1 2 3 4 5																								
Self-assessment examinations	0 1 2 3 4 5																								
<i>Journal of Bone and Joint Surgery</i> – <i>American Edition</i> or <i>Journal of the American Academy of</i> <i>Orthopaedic Surgeons</i>	0 1 2 3 4 5																								
Flashcards	0 1 2 3 4 5																								
Lecture notes	0 1 2 3 4 5																								
Online orthopedic Web sites	0 1 2 3 4 5																								
Review course (Miller's Review Course)	0 1 2 3 4 5																								
Other materials _____	0 1 2 3 4 5																								

---

*This paper will be judged for the Resident Writer's Award.*

---

Beyond general orthopedic surgery, there are also practitioners who specialize in specific parts of the body, such as the spine or the foot and ankle. Others choose subspecialties like pediatrics, sports medicine, or reconstructive surgery. The title orthopedic surgeon is often used interchangeably with orthopedist. The diagnostic tools used in orthopedics include physical exams, lab tests, and imaging studies. Some of the more common include X-rays, MRI, and CT scans. The program would consist of four years of focused study on the fundamentals of orthopedic surgery. During this time, you would rotate through the major subspecialties in different hospitals to get practical exposure to the various surgical techniques and technologies. An Original Study. Orthopedic Surgery Residents' Study Habits and Performance on the Orthopedic In-Training Examination Ryan G. Miyamoto, MD, Gregg R. Klein, MD, Michael Walsh, PhD, and Joseph D. Zuckerman, MD. level of knowledge of residents throughout their training. The Orthopaedic In-Training Examination (OITE) residents' perceptions of the examination and by evaluating its ability to accurately predict resident performance in the United States during postgraduate performance. Many developments in orthopedic surgery have resulted from experiences during wartime. On the battlefields of the Middle Ages the injured were treated with bandages soaked in horses' blood which dried to form a stiff, but unsanitary, splint. Originally, the term orthopedics meant the correcting of musculoskeletal deformities in children. Nicolas Andry, a professor of medicine at the University of Paris coined the term in the first textbook written on the subject in 1741. After completion of specialty residency/registrant training, an orthopedic surgeon is then eligible for board certification by the American Board of Medical Specialties or the American Osteopathic Association Bureau of Osteopathic Specialists. Orthopedic surgery or orthopedics, also spelled orthopaedics, is the branch of surgery concerned with conditions involving the musculoskeletal system. Orthopedic surgeons use both surgical and nonsurgical means to treat musculoskeletal trauma, spine diseases, sports injuries, degenerative diseases, infections, tumors, and congenital disorders. Nicholas Andry coined the word in French as orthopédie, derived from the Ancient Greek words ὀρθός (orthos, "correct", "straight") and παιδίον (paidion, "child") The Orthopaedic In-Training Examination (OITE) is a tool used by residency directors to evaluate a resident's fund of orthopedic knowledge. In this study, we correlated resident study habits and preparation tools with performance on the OITE. Data analysis indicated statistically significant correlations between successful OITE performance and frequent review of current orthopedic journals (Journal of Bone and Joint Surgery-American Edition,  $r = .6$ ,  $P < .001$ ; Journal of the American Academy of Orthopaedic Surgeons,  $r = .36$ ,  $P = .02$ ), daily orthopedic reading ( $r = .34$ ,  $P = .03$ ), increas