Impact of a Weekly Reading Program on Orthopedic Surgery Residents’ In-Training Examination

DANIEL G. WEGLÉN, MD; ZBIGNIEW GUGALA, MD, PhD; SUZANNE SIMPSON, BA; RONALD W. LINDSEY, MD

In response to a decline in individual residents’ performance and overall program performance on the Orthopaedic In-Training Examination (OITE), the authors’ department initiated a daily literature reading program coupled with weekly tests on the assigned material. The goal of this study was to assess the effect of the reading program on individual residents’ scores and the training program’s OITE scores. The reading program consisted of daily review articles from the Journal of the American Academy of Orthopaedic Surgeons, followed by a weekly written examination consisting of multiple-choice or fill-in-the-blank questions. All articles were selected and all questions were written by the departmental chair. A questionnaire was given to assess residents’ perceptions of the weekly tests. As a result of implementing the reading program for a 10-month period, residents’ subsequent performance on the OITE significantly improved (mean score increase, 4, \( P < .0001 \); percentile score increase, 11, \( P = .0007 \)). The difference in mean score was significant for residents in postgraduate years 3, 4, and 5. A statistically significant correlation was found between weekly test scores and performance on the OITE, with a significant correlation between weekly test scores and OITE percentile ranking. The study results also showed a positive correlation between reading test attendance and weekly test scores. Residents’ anonymous questionnaire responses also demonstrated the reading program to be a valuable addition to the residency training curriculum. In conclusion, the study strongly supports the benefits of a weekly reading and examination program in enhancing the core knowledge of orthopedic surgery residents.


---

The authors are from the Department of Orthopaedic Surgery and Rehabilitation, The University of Texas Medical Branch, Galveston, Texas. The authors have no relevant financial relationships to disclose. Correspondence should be addressed to: Zbigniew Gugala, MD, PhD, Department of Orthopaedic Surgery and Rehabilitation, The University of Texas Medical Branch, 2316 Rebecca Sealy Hospital, 301 University Blvd, Galveston, TX 77555-0165 (zgugala@utmb.edu). Received: September 27, 2013; Accepted: July 28, 2014. doi: 10.3928/01477447-20150504-55
The goal of an orthopedic residency is to provide trainees with the resources, opportunities, and experience to gain the appropriate level of knowledge and education to become competent, successful orthopedic surgeons. The Orthopaedic In-Training Examination (OITE), first administered in 1963, is a standardized annual test administered to the residents of all orthopedic surgery clinical training programs accredited by the Accreditation Council for Graduate Medical Education. The OITE provides a standardized yearly self-assessment examination of core orthopedic knowledge and competency for every resident trainee as well as information for the residency training program. This instrument offers an objective, quantitative measure of medical knowledge, proficiency, and progress for both individual orthopedic surgery residents and residency training programs. This examination also provides a quantitative measure that allows objective comparison of the academic progress of residents or of training programs. The OITE has become a principal indicator of the proficiency of residents and residency training programs.

Currently, there is no widely accepted preparatory program for achieving resident or training program success on the OITE. The literature suggests an association between successful performance on the OITE and a variety of dedicated educational activities that include the following: (1) regular review of recent peer-reviewed orthopedic journals; (2) daily orthopedic reading; (3) increased time for OITE preparation; and (4) review of previous OITE examinations. The definitive merits of these approaches have yet to be reported and/or validated in the orthopedic literature, although evidence suggests an association.

In response to a decline in individual residents’ and overall program performance on the 2008 OITE, the authors’ department initiated a daily literature reading program coupled with weekly tests on the assigned material. The goal of this study was to assess the efficacy of the program’s response to the 2008 OITE performance through correlation of residents’ participation and success in the reading curriculum and the examination with any change in individual residents’ and the training program’s subsequent 2009 OITE performance.

**Materials and Methods**

**Reading Program**

In January 2009, the authors’ department initiated a mandatory weekly reading curriculum for all residents in the training program. The curriculum had 2 parts: (1) a daily peer-reviewed review article (7 articles/wk) selected by the chair (R.W.L.) from the *Journal of the American Academy of Orthopaedic Surgeons* and (2) a mandatory written examination covering each set of 7 articles, composed by the chair and administered each week to the residents. The topics reflected those typically covered by the OITE. Each examination included 25 multiple-choice and/or fill-in-the-blank questions. Individual residents’ attendance at the weekly examination was documented. Graded examinations were provided to all residents for self-analysis. All residents received their recorded grades, a list of the questions that they missed, and the answers to all questions, as well as the mean, high, and low scores for the entire resident group. Quarterly, residents were given their mean scores as well as the mean, high, and low scores for the group.

**Residents**

The study subjects included 18 residents who completed the 2008 OITE (before initiation of the weekly reading curriculum) and 25 residents who completed the 2009 OITE (after participation in the weekly reading curriculum). The OITE scores of the 2 resident groups reflected their individual performance and competency compared with all other residents with a similar level of training (as determined by postgraduate year of training). Individual residents’ OITE performance scores from 2008 and 2009 were compared to identify differences. Individual residents’ differences in OITE performance between 2008 and 2009 were also compared with their respective performance on the weekly reading curriculum examination as well as the number of weekly tests completed.

**Anonymous Questionnaire**

An anonymous questionnaire (Figure) was prepared and administered in May 2010 to allow residents to subjectively appraise the effect of the weekly reading curriculum on their OITE performance. The questionnaires consisted of 10 multiple-choice questions addressing various aspects of the reading program to permit residents’ subjective assessment of the relevance of the articles and examinations to the OITE. Questionnaire responses included the number of hours dedicated weekly to the reading program (question 1) and the merits of the reading program for orthopedic training (question group I; questions 2–4); consistency of the weekly tests with the content of the articles read (question group II; questions 5–7), and the usefulness of the reading program in preparation for the OITE (question group III; questions 8–10). Questions 2 through 10 were answered with a 5-point scale as follows: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Responses were compared with the differences in the 25 residents’ OITE scores and their performance on and attendance at the weekly reading tests. All resident data (weekly test scores, attendance, OITE performance, and questionnaire answers) were coded and kept confidential from all residents, faculty, and investigators, except for the corresponding author (Z.G.). Each resident was given a legal document describing the confidential nature of the collected data.

**Data Collection**

Although the weekly reading program has been continued to date, only tests
completed through early October 2009 (before the November 2009 OITE) were considered for analysis in this study. At that time, 273 articles had been reviewed and 39 weekly examinations, including 975 questions, were completed. There was a hiatus in weekly testing for approximately 1 month in mid- and late October and early November 2009 to allow individual residents time to prepare for the OITE. During this period, an additional educational resource, the American Academy of Orthopaedic Surgeons (AAOS) Comprehensive Orthopaedic Review, was introduced and used exclusively for the final 6 weeks before the mid-November 2009 OITE. Preparatory curriculum data and OITE scores from 2008 and 2009 could be compared for 18 residents.

Data collected and analyzed in this study included: (1) OITE performance, (2) weekly test scores, (3) attendance at the weekly conference and examinations, and (4) subjective input from resident questionnaires.

Statistical Analysis

Descriptive statistics were used to analyze and compare the study variables. Effects of the reading program on OITE scores were tested with a paired t test for correct answers on the OITE and a paired signed-rank test for OITE percentile score. The associations of weekly test scores vs attendance and weekly test scores vs OITE score were tested with the Pearson correlation coefficient. Mantel-Haenszel chi-square tests were used to evaluate the association between questionnaire items and year of residency. Total scores for question group I (questions 2-4), question group II (questions 5-7), and question group III (questions 8-10) were calculated by summing the scores of the items included. The scores were assigned as follows: strongly disagree, 1; disagree, 2; neither agree nor disagree, 3; agree, 4; and strongly agree, 5. The correlation of aggregated scores with percentage of attendance and OITE scores was tested with the Pearson correlation coefficient. All tests were 2-sided, with P<.05 considered statistically significant.

RESULTS

The change in individual residents’ OITE scores (both percentage correct and postgraduate year level percentile) between 2008 and 2009 is shown in Table 1. Although OITE scores for postgraduate year 2 residents also improved, the difference was not statistically significant. Data from postgraduate year 1 residents were not analyzed because they did not participate in the 2008 OITE. In summary, a statistically significant increase was found in overall resident performance and upper-level resident performance on OITE scores and postgraduate year percentile rankings between 2008 and 2009.

The distributions of the individual residents’ reading program weekly test scores and attendance are shown in Table 2. Mean weekly test score for postgraduate
The associations between individual residents’ weekly test performance and attendance as well as associations between individual residents’ weekly examination and OITE performance are shown in Table 3. The data suggest a correlation between individual residents’ weekly examination attendance and weekly test performance and percentile. Additionally, a statistically significant correlation was seen between individual residents’ weekly test performance and subsequent OITE performance as well as weekly test percentile ranking and OITE percentile ranking. This finding validates the reading program by correlating the results with OITE performance.

The next element of analysis was the frequency of distribution of questionnaire results (Table 4). The goal of the questionnaire was to investigate any relation between individual residents’ subjective assessment of the reading program and their actual weekly examination performance and attendance as well as OITE performance. Despite the wide distribution of responses among all postgraduate year levels, most residents considered the reading program beneficial in terms of ed-
Education, overall orthopedic clinical training, and the opportunity to remain current with the literature. There was no majority in terms of the perceived efficacy of weekly tests, their relevance to the reading material covered, or residents’ assimilation of the material tested. Furthermore, there was no clear consensus on the program’s effectiveness in preparing residents for the OITE.

The associations between the distribution of questionnaire results and OITE performance, weekly examination performance, and weekly examination attendance are shown in Table 5. There was no significant statistical correlation with individual questionnaire responses and those 3 variables. This suggests that residents’ opinions of the perceived benefit of the program were independent of subsequent performance, indicating that there is likely some validity to the questionnaire responses.

**Discussion**

Academic education is a challenging and constantly evolving aspect of clinical residency training. Multiple programs in numerous fields of medicine have implemented innovative strategies that involve conferences, didactics, assigned readings, and discussion groups in an effort to formulate an ideal model for academic instruction and learning. Regular reading programs have been used by other residency programs, including various general surgery and orthopedic programs. Only a few training programs, however, have comprehensively analyzed both the content of their reading programs and their effect on the quality of resident education.

The orthopedic reading program described in the current study was initiated in response to an overall decline in performance on the 2008 OITE. The reading program was developed to provide a comprehensive, organized, peer-reviewed curriculum of review articles that covered core orthopedic topics. In addition to the daily articles (and eventually a brief period of AAOS review chapters), weekly
Correlation Between Resident (n=23) Questionnaire Answers, Reading Program Attendance, and Orthopaedic In-Training Examination Results After the 10-Month Implementation of the Reading Program

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Question Group I*</th>
<th>Question Group II*</th>
<th>Question Group III*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance, %</td>
<td>0.40 (P=.06)</td>
<td>0.07 (P=.76)</td>
<td>0.10 (P=.64)</td>
</tr>
<tr>
<td>OITE correct score</td>
<td>0.36 (P=.10)</td>
<td>-0.18 (P=.42)</td>
<td>0.001 (P=.99)</td>
</tr>
<tr>
<td>Weekly tests</td>
<td>0.30 (P=.16)</td>
<td>-0.24 (P=.26)</td>
<td>-0.03 (P=.89)</td>
</tr>
</tbody>
</table>

Abbreviation: OITE, Orthopaedic In-Training Examination.

*aTotal scores for question groups I (2-4), II (5-7), and III (8-10) were calculated by summarizing the scores of the items included. The scores of the answers were assigned as follows: strongly disagree, 1; disagree, 2; neither agree nor disagree, 3; agree, 4; and strongly agree, 5. Question group I concerns the value of the orthopedic reading program for orthopaedic residency training; question group II concerns the weekly reading tests; and question group III concerns the usefulness of the reading program in preparation for the Orthopaedic In-Training Examination.

Limitations

The current study had several limitations. This was a retrospective review of performance on weekly examination scores and OITE performance over 1 year. The limited period of the study did not allow more comprehensive statistical evaluation of the reading program’s effect on OITE performance over multiple years. It would be optimal to assess the effect of the reading program on OITE performance over the course of an entire 5-year residency as well as to correlate its effect on subsequent ABOS examination performance, a major objective of residency education and the OITE. Additional limitations were the focus on a single training program and the limited size of the study group. A further limitation was the assumption that the weekly test questions accurately reflected the essence of the reading material and residents’ understanding of the material. Finally, extenuating circumstances (ie, Hurricane Ike in September 2008) could have contributed to a decline in OITE scores for that year. All clinical activities at the authors’ institution were closed down, and physical damage, including to many residents’ homes, was extensive. However, Hurricane Ike did not appear to uniformly affect the subsequent performance of indi-

examinations were administered for assessment of individual residents and the training program. The validity of the reading program was determined by comparing individual residents’ weekly examination scores with their corresponding OITE scores. The reading curriculum consisted of articles from the Journal of the American Academy of Orthopaedic Surgeons, a peer-reviewed journal that was established in 1993 by the AAOS to provide an objective review of the clinical diagnosis and management of common orthopedic conditions. Previous studies indicated correlations between reading the Journal of the American Academy of Orthopaedic Surgeons and the American Journal of Bone and Joint Surgery with residents’ performance on the OITE.1,2

The OITE is a well-established marker for determining orthopedic residents’ success during clinical training and subsequently in passing the American Board of Orthopaedic Surgery (ABOS) examination. Studies have suggested that the OITE score correlates well with resident training performance, general orthopedic knowledge, and successful completion of the ABOS examination. The OITE also provides a quantitative measure to allow residents to compare their academic performance and/or progress with that of other residents.3,4 Finally, the OITE allows residency programs to compare their success in developing residents’ academic proficiency with that of other programs.5

The validity of the OITE was assessed by previous studies. Buckwalter et al1 reviewed orthopedic residents’ performance in 16 programs and reported that overall performance, as evaluated by orthopedic faculty familiar with resident performance (information recall, interpretive ability, problem solving, and overall performance), showed a moderate direct relation with OITE score. The correlation showed that OITE performance was proportional to residents’ performance. In addition, OITE performance has been shown to have a direct positive relation with passing Part I of the ABOS examination for residents in postgraduate years 3, 4, and 5 and 3 as well as passing Part I of the ABOS examination on the first attempt. Herndon et al10 reported that OITE performance was an objective predictor of passing Parts I and II of the ABOS examination. These authors reviewed the files of 161 residents (all graduates) from 1 residency program from 1991 through 2005 and established that the mean percentile score on the OITE (postgraduate years 2-4) was a predictor of passing the ABOS examination.5

Table 5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Question Group I*</th>
<th>Question Group II*</th>
<th>Question Group III*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance, %</td>
<td>0.40 (P=.06)</td>
<td>0.07 (P=.76)</td>
<td>0.10 (P=.64)</td>
</tr>
<tr>
<td>OITE correct score</td>
<td>0.36 (P=.10)</td>
<td>-0.18 (P=.42)</td>
<td>0.001 (P=.99)</td>
</tr>
<tr>
<td>Weekly tests</td>
<td>0.30 (P=.16)</td>
<td>-0.24 (P=.26)</td>
<td>-0.03 (P=.89)</td>
</tr>
</tbody>
</table>

Abbreviation: OITE, Orthopaedic In-Training Examination.

*aTotal scores for question groups I (2-4), II (5-7), and III (8-10) were calculated by summarizing the scores of the items included. The scores of the answers were assigned as follows: strongly disagree, 1; disagree, 2; neither agree nor disagree, 3; agree, 4; and strongly agree, 5. Question group I concerns the value of the orthopedic reading program for orthopaedic residency training; question group II concerns the weekly reading tests; and question group III concerns the usefulness of the reading program in preparation for the Orthopaedic In-Training Examination.
vidual residents on the OITE. Therefore, it may not solely account for the overall reduction in OITE scores. Nevertheless, a program of organized year-round literature review, education, and training would mitigate the effect of a natural disaster on training and test scores.

**Conclusion**

This study strongly supports the benefits of a weekly reading and examination program in enhancing the core knowledge of orthopedic surgery residents. The data suggest a strong correlation between residents’ participation and performance on the weekly reading and test program and their performance on the OITE. This type of study provides support for the use of a literature review for optimal residency training, competency, and performance.

**References**