

Reconstructive Knee Surgery Literature as a Tool for the Orthopaedic In-Training Examination

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Abstract

The Orthopaedic In-Training Examination (OITE) provides a standardized measure to assess the knowledge of orthopaedic residents regarding knee reconstruction surgery. However, there currently are limited resources for residents who are preparing for the knee reconstruction questions on the OITE. The present study assessed the character of the knee reconstruction questions tested and which literature resources may be recommended for residents preparing for this examination.

Materials and Methods: All knee reconstruction-related questions found during a 5-year period (2002 to 2006) on the OITE were characterized by the diagnosis and treatment discussed. The most frequently referenced journals were identified from the OITE exam key. The character of the OITE questions was compared to the literature in terms of overall proportion of articles and questions that were related to knee reconstruction, as well as to categories of diagnosis and treatment modality.

*Results: There were 59 out of 1375 questions (4%) on the OITE over the 5 years that were related to knee reconstruction. Over half of the questions (54%) were related to primary total knee arthroplasty, with osteoarthritis being the most frequently tested diagnosis (30%). The top three referenced orthopaedic journals were *The Journal of Bone and Joint Surgery-American*, *Clinical Orthopaedics and Related Research*, and *The Journal of Arthroplasty*. Compared*

*to the OITE, these journals covered higher percentages of overall knee reconstruction-related questions (18% versus 4%). In addition, the journal literature had a greater focus on treatment modalities (65% versus 41%) and less emphasis on biomechanics, materials, and basic science (18% versus 34%) than the OITE, respectively. The two most frequently cited textbooks represented approximately 78% of the total number of provided textbook references: *Orthopaedic Knowledge Update* (39%) and *Instructional Course Lectures* (39%).*

*Discussion: The results of this study suggest that residents may benefit from using general orthopaedic journals such as *The Journal of Bone and Joint Surgery-American* in preparation for the OITE. However, residents and residency directors who are preparing their educational programs should be aware that clinical journals may not reflect the OITE in terms of the proportion of basic science and biomechanics articles and additional study resources may be necessary.*

The Orthopaedic In-Training Examination (OITE) currently attempts to provide a standardized measure to assess the knowledge of orthopaedic residents regarding associated pathologies, diagnostic evaluations, surgical techniques, and treatment options.¹ Hip and knee reconstructive surgery is the third most frequently tested specialty area over a recent 5-year period (behind trauma and pediatrics) and represents nearly one out of every 10 questions on the OITE. A recent study by Risner and colleagues² suggested that resident performance on these hip and knee questions has not met an acceptable level for a cohort of residents at their institution. Furthermore, they reported a negative trend line at the national level for residence performance on this subject matter. One tool that may be useful in improving resident knowledge and performance in this area may be recommended literature resources. Recent studies have shown that the material tested on the OITE is similar

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in content to recent scientific literature for some content domains and that the use of current literature is correlated with higher scores on the OITE.^{3,4}

The purposes of this study were to determine answers to the following questions: 1. What is the content of the knee reconstruction-related OITE questions? 2. What journals are the most frequently recommended resources in the exam key for the OITE? 3. Are the knee reconstruction OITE questions and the content in high-impact clinical orthopaedic journals similar in terms of the overall proportion and content? 4. Is the knee reconstruction-related content in the orthopaedic journals similar? and 5. What textbooks are most frequently recommended for OITE knee reconstruction-related content?

Materials and Methods

A systematic review of the OITE was conducted over a 5-year period (2002 to 2006). All knee reconstruction-related questions were identified. An initial review of educational textbooks and OITE review courses, as well as curriculum for sessions supported by The Knee Society (KS) and American Association of Knee and Hip Surgeons (AAKHS), was conducted by two of the investigators (DRM, MAM) in order to determine initial appropriate categories of diagnosis and treatment. These categories were subsequently reviewed at a meeting of all of the other study investigators to reach consensus. Any suggested changes were discussed and had to have the approval of all before proceeding with the diagnostic and treatment categories. Groups were constructed using appropriate diagnoses: 1. osteoarthritis, 2. rheumatoid arthritis, 3. osteonecrosis, 4. fractures, 5. infections, 6. complications (other than infection), 7. arthritis general-nonspecified, and 8. other diagnosis. Similarly, treatments were appropriately put into categories: 1. standard total knee arthroplasty, 2. revision total knee arthroplasty, 3. unicompartmental knee arthroplasty, 4. arthrodesis, 5. joint preservation (osteotomy, cartilage restoration), 6. physical therapy-rehabilitation, and 7. other treatment. We also determined an overall focus category for each question according to the required next behavior: 1. recall of pathology, etiology, or anatomy; 2. diagnosing a condition or knowledge of appropriate diagnostic modalities; 3. determining appropriate treatment or prognosis following treatment; or 4. knowledge of biomechanics, materials, or basic science. Each question was included in only one focus category but could be categorized by more than one diagnosis or treatment category. To further characterize the questions, it was noted whether each question had a corresponding clinical image and the specific type of imaging modality used.

The recommended readings provided by the American Academy of Orthopaedic Surgeons (AAOS) in the score key for the five exams that were included in this study were reviewed. For each of the knee reconstruction questions, the journals listed as a recommended reference were identified and tabulated. The three most frequently referenced journals were selected for further evaluation as potential study

resources for residents who are preparing for the OITE.

For these three journals, all knee reconstruction-related articles published in the five years (2001 to 2005) that preceded each of the OITE exams were identified. The total number of articles in these journals was also determined in order to calculate the proportion of publications that were related to knee reconstruction. These proportions were compared to the proportion of OITE questions that were similarly related to knee reconstruction, stratified by year as well as by overall percentages.

The knee reconstruction articles from the top three referenced journals were then stratified, using the same categories of diagnosis, treatment, and focus area that were previously used for the OITE questions. Based on their content, some articles were included in more than one diagnosis or treatment category. Similar to the OITE, the articles were also stratified by the four focus areas. The proportions of articles and questions in each of these groupings were compared to assess whether the content of the OITE and journals was similar.

Similar to the comparison between the OITE and current literature, an analysis was conducted comparing the knee reconstruction content of each of the journals. The proportion of articles in the diagnosis and treatment categories for each journal was compared to the overall percentage for the journals combined. The AAOS score key was reviewed to identify any recommended textbooks provided as references for the hip reconstruction questions. The three most frequently referenced textbooks were identified.

All data were entered into spreadsheet format and subsequently analyzed using SPSS v13.0 software (IBM, Chicago, Illinois). Using the overall difference in the proportion of knee reconstruction OITE questions versus the corresponding percentage of published studies in the three journals, combined as the primary measure, a power analysis indicated a sufficient sample size to answer the primary research question at a power of greater than 80%. Fisher's exact statistical testing was utilized to compare all proportions. A p value less than 0.05 was considered significant.

Results

The knee reconstruction questions represented 4% of the OITE (59 out of 1375 questions) over the 5 years reviewed. The questions most frequently focused on treatment options (41%), followed by biomechanics, materials, and basic science (composition of the latter three topics, 34%). Stratification by subcategories showed that over half of the questions (54%) were related to primary total knee arthroplasty, with osteoarthritis being the most frequently tested diagnosis (30%).

The three most frequently referenced orthopaedic journals for the OITE hip reconstruction questions were clinically focused: *The Journal of Arthroplasty*, *The Journal of Bone and Joint Surgery* (American), and *Clinical Orthopaedics and Related Research*. These three journals represented

over 68% of all of the recommended journal references. The next highly cited was the *Journal of the American Academy of Orthopaedic Surgeons*. Also cited were the following journals: *The Journal of Bone and Joint Surgery* (British), *Orthopedic Clinics of North America*, *The American Journal of Sports Medicine*, *American Journal of Knee Surgery*, and *The Journal of Knee Surgery*. Rarely cited journals were the *Journal of Biomedical Material Research*, *Sports Medicine*, *Seminars in Arthroplasty*, *Orthopedics*, and the *Journal of Biomechanics*.

There were 1031 out of 5832 (18%) knee reconstruction-related articles from the 5-year review of the three most frequently referenced journals. This was statistically higher than the 4% of OITE questions that were related to knee surgery during the corresponding time ($p < 0.001$). Even when excluding *The Journal of Arthroplasty*, which had 41% of its articles related to knee reconstruction, the percentage of articles in the other two journals that was related to knee reconstruction remained significantly higher than the OITE (12%, $p < 0.001$). Stratification of the OITE and journals by year showed similar findings, with a statistically higher percentage of knee reconstruction-related articles in the three journals combined, compared to the corresponding percentage of OITE questions (Fig. 1).

Although general trends were similar for the proportion of questions and articles when stratified by diagnosis and treatment categories, there was a statistical difference for some of the actual percentages for the categories (Table 1). In addition, the literature focused more on treatment modalities and outcomes (literature 65% vs OITE 41%, $p < 0.001$) rather than composites of pathology, etiology, and anatomy (literature 8% vs OITE 25%, $p < 0.001$) and biomechanics, biomaterials, and basic science (literature 18% vs OITE 34%, $p < 0.001$).

The content of the three most frequently referenced

journals was similar, with one exception. *The Journal of Arthroplasty* had fewer (0.3%) joint preservation articles (studies assessing treatments such as osteotomies and cartilage restoration techniques), compared to both *The Journal of Bone and Joint Surgery* (American) (13%) and *Clinical Orthopaedics and Related Research* (6%, $p < 0.001$).

Overall, textbooks represented 21% of the recommended references provided for the knee reconstruction questions reviewed over the 5-year period. The two most frequently cited textbooks represented, approximately, 78% of the total number of provided textbook references: *Orthopaedic Knowledge Update* (39%) and *Instructional Course Lectures* (39%).

Discussion

Education is essential for the continuation of high-quality health care. It is important to learn how knee reconstruction surgery can best be taught to residents. Knowledge of the content and type of questions on the OITE can guide resident educators as they focus their programs to enhance the available educational opportunities. This was the primary reason for conducting the current study. The results suggest that residents preparing for the OITE would benefit from reading the current literature and by focusing mostly on material related to biomechanics, materials, and basic science. The most frequently referenced journals were *The Journal of Arthroplasty*, *The Journal of Bone and Joint Surgery* (American), and *Clinical Orthopaedics and Related Research*. These are recommended by the current investigators as optimal literature sources for resident review.

This study provides a framework for topic areas and subcategories that can be used by residents and educators regarding knee reconstruction. Residents should have a thorough understanding of standard primary total knee arthroplasties (the most frequently tested procedure, 54%)

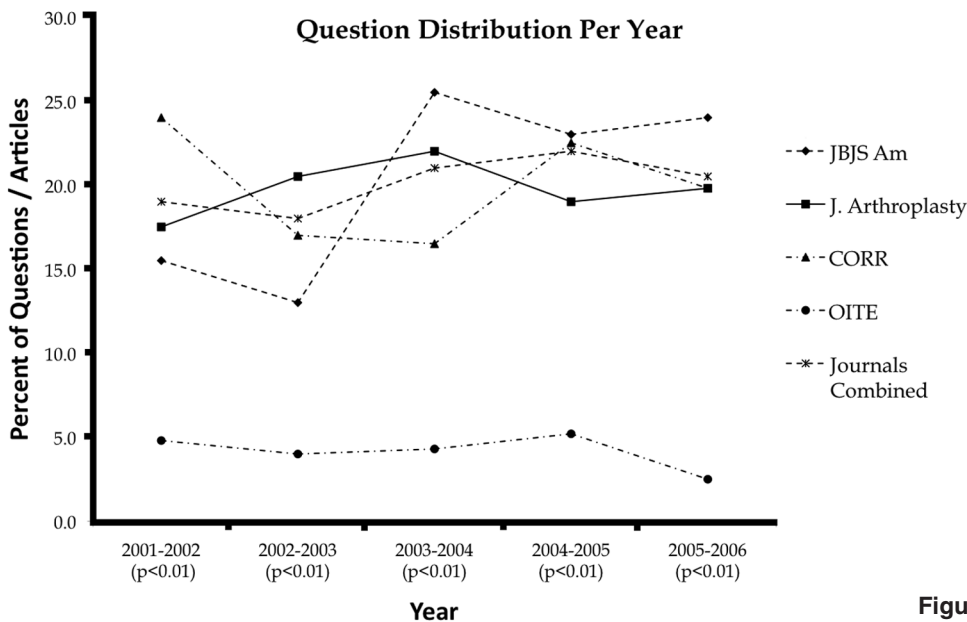


Figure 1

Table 1 Comparison of Knee Reconstruction Related Content for the OITE and Current Literature

Category	JBJS Am* (%)	CORR* (%)	J Arthrop* (%)	All Journals (%)	OITE* (%)	P Value§
Overall Knee Related Questions, Articles	10.1	13.7	40.5	17.7	4.3	< 0.001 [†]
Diagnosis						
Osteoarthritis	12.6	7.2	10.5	9.8	29.9	< 0.001 [†]
Rheumatoid arthritis	3.3	1.1	1.3	1.7	0.0	0.396
Osteonecrosis	0.5	0.2	0.2	0.3	0.0	1.000
Fractures	2.8	1.7	4.3	3.1	2.6	1.000
Infections	5.1	8.3	8.3	7.7	7.8	0.821
Complications	30.8	27.3	31.4	29.9	19.5	0.105
Other	18.7	26.4	19.4	21.7	23.4	0.896
Arthritis general-nonspecified	26.2	27.6	24.6	25.9	27.3	0.550
Treatments						
Standard TKA	53.6	62.3	71.9	64.8	54.1	0.813
Revision TKA	15.5	13.0	16.1	14.9	23.0	0.233
Arthrodesis	1.2	1.0	1.4	1.2	1.3	0.513
Osteotomy	12.5	5.5	0.3	4.6	2.6	1.000
Unicompartmental-patellofemoral	6.5	8.6	6.3	7.1	5.2	0.576
Therapy-rehabilitation	1.2	0.7	0.5	0.7	1.3	0.598
Other	9.5	8.9	3.6	6.7	7.8	0.441
Primary focus						
Pathology, etiology, anatomy	7.9	6.6	9.6	8.2	25.4	< 0.001 [†]
Diagnosing cases‡	8.4	6.9	9.6	8.4	0.0	< 0.001 [†]
Treatment modalities and outcomes	69.3	63.2	64.5	65.1	40.7	< 0.001 [†]
Biomechanics, materials, basic science	14.4	23.3	16.2	18.2	33.9	< 0.001 [†]

OITE, Orthopaedic In-Training Examination; JBJS Am, *Journal of Bone and Joint Surgery* (American); CORR, *Clinical Orthopaedics and Related Research*; J Arthrop, *The Journal of Arthroplasty*; TKA, Total knee arthroplasty. *Some questions and articles were included in more than one category. †Statistically Significant. ‡OITE questions were categorized as diagnosis-related only if the resident had to determine the diagnosis. §P values are for comparison of OITE to combined journal percentages.

and the management of osteoarthritis (the most frequently tested diagnosis, 30%). In addition, they should be familiar with interpreting radiographic knee reconstruction studies to supplement their decision-making process in formulating accurate diagnoses and selecting appropriate treatment modalities.

The results of the present study were similar to a recent study that assessed hand-related content on the OITE.³ The hand OITE study suggested that general orthopaedic journals should be recommended as study resources more often than specialty journals. The present study included a specialty journal for comparison. As expected, *The Journal of Arthroplasty* had a much higher proportion of its overall

articles that were related to knee reconstruction, compared to the OITE and the other orthopaedic journals. In addition, there was one major difference in the stratification of the content of the journals, with *The Journal of Arthroplasty* having fewer joint preservation articles compared to the other two journals. With respect specifically to preparation for the OITE, the investigators recommend the use of general orthopaedic journals as study aides.

While the percentage of knee reconstruction articles in *The Journal of Arthroplasty* was expected to be higher than the percentage of corresponding OITE questions, it was also noted that the percentage of knee reconstruction articles in the other two journals was higher than the OITE. There may

be a number of explanations for this finding. The OITE may focus on material that is less frequently seen in practice, such as bone tumors rather than joint arthroplasties, because of the importance of not missing or mismanaging potentially life-threatening conditions. Another possible explanation may be that there is a greater volume of knee reconstruction research being conducted relative to other fields or that there is a higher quantity of knee reconstruction papers being submitted compared to other specialty areas, resulting in a higher number of acceptances and subsequent publications.

One of the key differences between the OITE and the literature was the larger proportion of basic science, pathology, anatomy, and biomechanics studies. Over 59% of the OITE questions were related to these areas, compared to 26% in the literature ($p < 0.001$). In general, the journals focused more on treatment options and outcomes (65%). These results suggest a discrepancy between what the OITE focuses on and that of the journals that are used for review, indicating that residents may benefit from using other resources when studying for this exam. As well, residents may currently benefit from using other resources when studying this content for the OITE.

Conclusion

Knee reconstruction material represents approximately 4% of the material tested on the OITE. Residents preparing for this exam should focus on studying articles from general or-

thopaedic journals regarding complications associated with primary total knee arthroplasty. Residents and residency directors who are preparing their educational programs should be aware that clinical journals may not reflect the OITE in terms of the proportion of basic science and biomechanics articles, and additional study resources may be necessary.

Disclosure Statement

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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