Knowledge is Reflected in Clinical Skills and Attitudes in Medical Education: Relationships Between CBT/Graduation Examination and OSCE/Advanced OSCE

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Objective: The present study examined whether Objective Structured Clinical Examination (OSCE) scores are related to Computer-Based Test (CBT) and graduation examination scores, and considered the OSCE's application to undergraduate medical education.

Study design: The subjects were 282 students who underwent a common achievement examination and a graduation examination at Juntendo University. The subjects were divided into four (A to D) groups according to their ranking on academic-year-specific CBT and graduation examination scores. Correct answer rates and global rating scores were compared among the four ranks.

Results: The correct answer rate on the OSCE was 89.06 ± 3.86 , and the global rating score was 4.67 ± 0.36 . The correct answer rate on the Advanced OSCE was 80.13 ± 9.85 , and the global rating score was 4.50 ± 0.74 . The top-ranked group also scored highest on the OSCE and Advanced OSCE. The correct answer rates and global rating scores of both OSCE and Advanced OSCE decreased as rank decreased from Rank A to Rank D.

Conclusions: The correct answer rates for the OSCE and Advanced OSCE in students who received low CBT and graduation examination scores were lower than those of the high-score group. It is necessary to encourage students to develop and improve their skills based on knowledge that will facilitate smooth postgraduate clinical training.

Key words: OSCE, CBT, knowledge, skills, attitudes

Objective

A common achievement examination is conducted by the Common Achievement Tests Organization (CATO) in medical faculties and colleges across Japan to evaluate the knowledge, skills, and attitudes of students, and determine whether they are ready to participate in clinical training (<http://www.cato.umin.jp/>).

The examination consists of the Computer Based Test (CBT), designed to “evaluate knowledge”,

and the Objective Structured Clinical Examination (OSCE), for the “assessment of skills and attitudes”. The CBT, a test to evaluate the basic knowledge of students prior to clinical training, asks questions in the fields of basic, clinical, and social medicine. The OSCE is a practical examination to determine “whether medical students have developed minimum levels of clinical skills and attitudes required to participate in clinical training”.

Students who have passed the common achieve-

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ment examination and undergone clinical training for approximately one and a half years will be administered a multiple-choice questionnaire and a practical examination, in the autumn term of the sixth year as a graduation examination.

The “Advanced OSCE”, an advanced version of the OSCE, is a practical examination designed to assess the level of achievement following clinical training, and it has been adopted as part of the graduation examination by a large number of medical faculties and colleges (http://www.cato.umin.jp/cbt_navi.htm).

The OSCE is usually used to assess clinical skills and attitudes. The present study examined whether OSCE scores correlate with results from the CBT, designed to assess knowledge levels, and graduation examination (using multiple-choice questions) scores, as well as considered the OSCE’s application to undergraduate medical education.

Study design

The subjects were 282 students (196 males and 86 females) who underwent a common achievement examination between 2008 and 2010 in the fourth year and a graduation examination between 2010 and 2012 in the sixth year at Juntendo University, Faculty of Medicine.

Prior to clinical training, fourth-year students underwent the OSCE, which consisted of the following: 1) medical interview, 2) craniocervical examination, 3) chest examination and checking of vital signs, 4) abdominal examination, 5) neurological examination, and 6) suture techniques (six basic stations), as well as emergency cardiopulmonary resuscitation, gown, venipuncture, and bandage techniques (four stations) – a total of ten stations.

The Advanced OSCE was conducted for sixth-year students following the graduation examination, which consisted of multiple-choice questions. In the assessment, the students described their diagnoses and treatments based on findings obtained from “medical interviews and physical examinations”, and their basic surgical techniques were evaluated (a total of two stations).

Regarding the techniques mentioned above, which involve the performance of a task at each station, the mean rate of correct answers (%) and comprehensive score on a global rating scale (1 to 6 points: 1 to 2 = fail, 3 to 4 = pass, 5 = high pass, 6 =

honor) were calculated (mean $\pm$ SD).

The evaluators had participated in a workshop organized by the CATO and had become certified. This study was approved by Juntendo University, Faculty of Medicine, and prior to using data on score in this study, written consent was obtained from each student. Test scores and grades were processed so that individual students could not be identified.

Following this, the subjects were divided into four groups – Ranks A (1st to 25th), B (26th to 50th), C (51st to 75th), and D (76th or lower) – according to CBT scores at each school year as well as according to graduation examination scores.

An assessment was conducted to determine whether or not sixth-year students who had undergone clinical training received higher scores in the Advanced OSCE than in the OSCE in the fourth year. Correlation between CBT and OSCE scores, and that between graduation examination and Advanced OSCE scores were also examined. Correct answer rates and global rating scales were compared among the four ranks.

Paired t-tests were conducted to calculate OSCE correct answer rates and determine global rating scores, and scores received by subjects in each rank were compared using the Tukey HSD test. A correlation analysis was conducted using a scatter diagram to calculate Spearman’s rank correlation coefficients (r_s) and p-values; the criterion for a correlation was $0.6 \leq r_s < 0.8$ and that for a significant correlation was $0.8 \leq r_s$. Statistical analyses were conducted using JMP 9.0 (SAS institute Inc., Cary, NC, USA). The significance level (α) was 0.05 in all tests and analyses.

Results

1. OSCE and Advanced OSCE scores

It was examined whether or not Advanced OSCE scores received by sixth-year students after participating in clinical training were higher than fourth-year students’ OSCE scores.

The correct answer rate on the OSCE was 89.06 ± 3.86 , and the global rating score was 4.67 ± 0.36 . The correct answer rate on the Advanced OSCE was 80.13 ± 9.85 , and the global rating score was 4.50 ± 0.74 . These figures show that the correct answer rate and global rating score were higher for the OSCE, administered in the

Table-1 OSCE and Advanced OSCE scores

	Correct answer rates(%)	Global rating scales
OSCE	89.06 ± 3.86	4.67 ± 0.36
Advanced OSCE	80.13 ± 9.85	4.50 ± 0.74

* $p < 0.05$ **Figure-1** Correlation by score rankings between CBT and OSCE, and between graduation examination and Advanced OSCE **Figure-2** Correlation of correct answer rates between CBT and OSCE, and between graduation examination and Advanced OSCE

fourth year, than for the Advanced OSCE ($p < 0.05$), and the increase in Advanced OSCE scores was smaller than that in OSCE scores (Table-1).

2. CBT and OSCE scores, and graduation examination and Advanced OSCE scores

Correlations between CBT and OSCE scores, and graduation examination and Advanced OSCE scores were examined.

No correlation was noted between CBT and OSCE scores ($rs = 0.35$), nor was any noted between graduation examination and Advanced OSCE scores ($rs = 0.39$) (Figure-1).

There were no correlations between correct answer rates on the CBT and OSCE ($rs = 0.33$), and those on the graduation examination and Advanced OSCE ($rs = 0.16$) (Figure-2).

3. OSCE and Advanced OSCE scores received by subjects in different ranks

Students were divided into four groups according to the rankings of CBT and graduation examination scores, and comparisons of OSCE and Advanced OSCE scores received by students in each group were performed.

The mean OSCE correct answer rate for Rank A

Table-2 OSCE scores received by subjects at different ranks in the CBT

CBT	n	OSCE scores	
		Correct answer rates(%)	Global rating scales
A (1~25)	77	90.75 ± 3.20	4.82 ± 0.30
B (26~50)	76	89.23 ± 3.31	4.69 ± 0.29
C (51~75)	73	88.47 ± 4.19	4.61 ± 0.40
D (76~)	56	87.45 ± 4.12	4.50 ± 0.41

*p<0.05 **p<0.01

The ranking of academic-year-specific CBT scores: Ranks A (1st to 25th), B (26th to 50th), C (51st to 75th), and D (76th or lower)

Table-3 Advanced OSCE scores received by subjects at different ranks in the graduation examination

Graduation examination	n	Advanced OSCE scores	
		Correct answer rates(%)	Global rating scales
A (1~25)	75	83.22 ± 8.69	4.62 ± 0.69
B (26~50)	72	80.14 ± 9.53	4.52 ± 0.69
C (51~75)	74	78.97 ± 11.04	4.47 ± 0.78
D (76~)	61	77.73 ± 9.28	4.36 ± 0.77

*p<0.05 **p<0.01

The ranking of academic-year-specific granduation examination scores: Ranks A (1st to 25th), B (26th to 50th), C (51st to 75th), and D (76th or lower)

(1st to 25th in the CBT) was 90.75 ± 3.20 , the highest. There was a 1% decrease in the correct answer rate between each rank and the next lower rank; significant differences were noted between Ranks A and C ($p<0.01$), A and D ($p<0.01$), and B and D ($p<0.05$). The OSCE mean global rating score for Rank A based on the CBT was the highest (4.82 ± 0.30), and there was also a decrease as rank decreased from Rank A to Rank D; significant differences were noted between Ranks A and C ($p<0.01$), A and D ($p<0.01$), and B and D ($p<0.05$) (Table-2).

The Advanced OSCE score for Rank A (based on graduation examination score) was also the highest (83.22 ± 8.69), and there was a decrease in the correct answer rate as rank decreased from Rank A to Rank D; significant differences were noted between Ranks A and C ($p<0.05$) and A and D ($p<0.01$). Although the global rating score for Rank A (graduation examination-based) was also the highest (4.62 ± 0.69) and there was also a decrease as rank decreased from Rank A to Rank D, the differences between ranks were not statistically significant (Table-3).

Discussion

Since December 2005, a common achievement examination has been administered in medical faculties and colleges in Japan. The OSCE is designed to examine, prior to undergraduate clinical training, whether students have developed minimum levels of clinical skills and attitudes required to participate in training. Students who fail the OSCE are not allowed to participate in clinical training. Therefore, students' stance towards the common achievement examination were positive; the mean correct answer rate on the OSCE was approximately 90%, and the mean global rating score was higher than 4.5 points in the present study. The standard deviation was small for both the correct answer rate and the global rating score, which suggests that all students did their best to prepare for the examination.

On the other hand, in the Advanced OSCE, a general examination conducted following the graduation examination, students describe their diagnoses and treatments based on findings obtained from "medical interviews and physical examinations". In the present study, Advanced OSCE

scores in general were lower. The standard deviation of the scores was large and some students received global rating scores between three and four points (Table-1). Students undergo the Advanced OSCE following the summer vacation and graduation examination, which together take up two months. They received lower scores for the Advanced OSCE, presumably because a long time had passed since their last clinical training; thus they only had a short time to practice, and they lacked concentration following the graduation examination. Therefore, it is necessary to reconsider the implementation period for the Advanced OSCE. Administration of the Advanced OSCE immediately after completion of clinical training and before the graduation examination would be more appropriate.

The CBT of the common achievement examination assesses students' knowledge and the OSCE assesses their clinical skills and attitudes. Our previous study found no correlations of OSCE score rankings with CBT and graduation examination score rankings received by students at our university, suggesting a separation of clinical skills and attitudes from knowledge¹⁾. The present study also examined whether there were correlations between CBT/graduation examination (to assess knowledge) score ranking and OSCE/Advanced OSCE (for the evaluation of skills and attitudes) score rankings. There was no significant correlation to academic grade rankings at each school year (0.4 or less) (Figure-1). In addition to this relative comparison based on academic grade rankings, correlations in the correct answer rates were also examined. There were no significant correlations between the correct answer rates of the CBT and OSCE, or between those of the graduation examination and Advanced OSCE (Figure-2). However, when students were divided into four (A to D) groups according to the CBT and graduation examination scores; correct answer rates for both the OSCE and Advanced OSCE were highest among students in the Rank A group, and the lower the rank of the group, the lower the correct answer rate (Table-2, 3). This observation is consistent with the expectation that knowledge should be reflected in clinical skills, and suggested that students of higher score ranks could be expected to have higher-level OSCE skills than those in lower

score ranks.

The OSCE assesses not only students' skills, focusing on accuracy levels while performing tasks, but also their "appearance", "manners", "use of language", "attention", and "communication", as global rating scales. Although the lower the rank of the group, the lower the global rating score, this does not necessarily mean that the attitudes of students with a low global rating score were poor; while suited for assessing skills in clinical procedures²⁾, the OSCE has been acknowledged to be inadequate at assessing attitudes³⁾. However, it should be noted that students in higher score ranks received higher global rating scores than those in lower score ranks (Table-2, 3).

The ability required for the OSCE is to understand the findings obtained through physical examinations. The correct answer rate and global rating score were higher in students in higher score ranks because they had come to understand not only the clinical procedures but also the important factors in findings prior to conducting the procedures. Miller adopted four learning pyramid stages, namely "Knows", "Knows how", "Shows how", and "Does" ("Knows" is the lowest and "Does" is the highest), to represent clinical assessment levels⁴⁾. The OSCE is designed to assess "Shows how" -related clinical skills, and students must develop "Knows" - and "Knows how" -related clinical skills to improve the "Shows how" ability. Therefore, it is natural for students with expert knowledge to be able to employ accurate clinical skills, which is consistent with the results of the present study. There was also a study suggesting that students who used a "deep approach", or performed their studies with a high level of interest, received higher OSCE scores than those who adopted a "surface approach"⁵⁾. Furthermore, in the Advanced OSCE, which is designed to assess "case-oriented skills", students describe their diagnoses and treatments based on information obtained from medical interviews and physical examinations, and these points were reflected in their practical skills depending on their level of knowledge, which yielded differences in the results of clinical inference. For this reason, the difference in the correct answer rate between students in higher and lower score ranks was larger. No significant differences were noted in the global rating score, presumably because the stan-

dard deviations were large.

The OSCE motivates students to learn. The correct answer rates for the OSCE/Advanced OSCE were lower in students who received low CBT and graduation examination scores, which suggested that, when students undergoing clinical training do not have sufficient knowledge, it may be difficult for attending physicians to improve their competence. It is important to encourage students to develop skills based on knowledge and improve the clinical skills that they learn through the OSCE so that they can apply them to postgraduate clinical training.

As the current Japanese National Examination for Medical Practitioners does not include tests for practical skills, it does not adequately assess the clinical skills and attitudes required of physicians. Canada and the United States have already adopted the OSCE as part of their national examinations for medical practitioners (<http://www.usmle.org/step-2-cs/>)⁶⁾, and Japan is also considering its introduction, although there are still several challenges to be addressed, such as the period and site of implementation, simulated patients, and recruitment of evaluators. Clinical skills education will become increasingly important.

One limitation of the present study is that assessment produces significant deviations depending on the evaluator. Although the larger the number of stations, the higher the reliability, it is difficult to increase the number of stations because this would require more human resources, a larger number of examination sites, and more time⁷⁾. Furthermore, the OSCE only assesses the “ability to conduct clinical procedures at a station”, which does not necessarily represent a student’s attitude in clinical settings. Therefore, it is necessary to

reflect on their clinical skills while closely examining the outcomes.

Conclusions

The correct answer rates for the OSCE/Advanced OSCE were lower in students who received low CBT and graduation examination scores, which suggests that, in clinical training, it may be difficult to increase the competency of students whose knowledge is inadequate. Therefore, it is necessary to provide students with education from an early stage while taking these results into account to encourage them to develop and improve their skills based on knowledge that will facilitate smooth post-graduate clinical training.

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