COMPARATIVE PERFORMANCE OF UNDERGRADUATE STUDENTS IN OBJECTIVELY STRUCTURED PRACTICAL EXAMINATIONS AND CONVENTIONAL ORTHODONTIC PRACTICAL EXAMINATIONS

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ABSTRACT

This study was conducted on 52 final year BDS students of Lahore Medical and Dental College, Lahore to compare their performance in Objectively structured practical examinations (OSPE) and Conventional Orthodontic practical examination (CPE). A mock examination, comprising of CPE and OSPE was conducted in the Orthodontic department for summative assessment before the final professional university examination. In CPE, students were evaluated by different examiners and it comprised of a practical component and viva voce. The practical component included a Cephalometric tracing, analysis and diagnosis along with the fabrication of removable appliance. This was followed by a long viva. CPE comprised of total 40 marks. There were eight OSPE stations where Orthodontic appliances, data (Cephalograms, OPG, dental cast) and case scenarios were placed. Each station required 5 minutes of time. Different sets of questions were given for each of these stations. Answer keys were prepared before hand. For each station, 05 marks were allocated and eight stations had total 40 marks. Pass marks for both examinations were set at 50%. A comparison of the results of two methods was done by applying “chi square” test. Cross tabulation was done to evaluate that a student performing well in one mode is also performing well in other or not. In the OSPE examination 46 candidates were declared as successful (33 females and 13 males) while 6 were declared unsuccessful (4 females and 2 males). In CPE 50 were successful (36 females and 14 male) and 2 failed to satisfy the examiners. (1 female and 1 male).

There was a noteworthy difference in the result generated by both assessment tools as the p-value (p=0.007) is statistically significant. Although more candidates were successful through CPE but the performance (marks obtained) of students was better in OSPE then CPE. As OSPE is more objective and reliable tool, it can supplement the time-tested Conventional assessment methods in undergraduate Orthodontic examinations.

Key Words: Orthodontics; OSPE; assessment; student performance

INTRODUCTION

Bloom has defined three main domains of learning i.e cognitive (knowledge), psychomotor (skills) and affective (attitude).1 The learning cycle is a triad of educational objectives, instructional methodology, and assessment. Amongst these, assessment is a critical issue. From the perspective of the student, assessment is the process by which teachers judge that whether the ‘learning objectives’ that are set at the inception of the educational program, are met and to what extent.2 Assessments are also thought to influence learning strategies of students.3

Effective assessment tools for each domain of learning should be able to judge students’ performance and progress through the course in a fair and objective manner.4 The other criterion includes validity, reliability, practicability, relevance, promotion of learning, power to discriminate between students, relaxed environment and a positive student feedback.5 A diverse number of student assessment methods are...
Comparative performance of undergraduate students

Currently been used worldwide to assess students in an Orthodontic undergraduate programme. If the assessment methods are inappropriate, there may be unfortunate consequence on the learning undertaken and on the curriculum.

Objective structured clinical examination (OSCE) was introduced in 1975 by Harden with the objective of overcoming the limitations of the conventional examination methodologies and evaluating the various facets of the student's knowledge. In recent years, the use of the OSPE in dental and other health-related professions has been growing in popularity, since it allows for some of the claimed advantages of an oral examination whilst ensuring a greater degree of equity for candidates in its administration. Many universities and fellowship boards are adopting this assessment mode. These include the National Dental Examining Board of Canada, the Royal London School of Medicine and Dentistry and Leeds Dental Institute in the United Kingdom.

In our present system of examination, the summative assessment for the subject of Orthodontics has a heavy reliance on a theory examination followed by a practical examination. The latter comprises of a practical followed by a viva, thus testing mostly the knowledge domain. Skills domain is difficult to test with either written or oral examination format. In order to provide useful information on the student's abilities as compared with the competencies being measured, and in order to be consistent with curriculum goals and objectives other examination formats should be adopted.

This study was meant to compare the results generated by the existing Conventional Practical examination to OSPE so that the present system could be replaced or supplemented in order to increase the objectivity in assessment.

**METHODOLOGY**

This descriptive study was conducted in the Orthodontic department of Lahore Medical and Dental College, Lahore. 52 students (15 males/37 females) of final year BDS participated in the study. The participants were already sensitized to the OSPE pattern of examination through the clinical tests during their academic year. Before the final professional examinations, the intradepartmental mock examinations were conducted. OSPE was conducted along with Conventional practical examination (CPE) to assess the performance of students in both modes of assessments. The later consisted of a practical component comprising of Cephalometric tracing, analysis and diagnosis (10 marks) along with the fabrication of removable appliance (10 marks). This was followed by a long viva (20 marks). The Conventional practical examination comprised of total 40 marks.

The next day OSPE was conducted. There were eight OSPE stations where Orthodontic appliances, data (Cephalograms, OPG, dental cast) and case scenarios were placed for evaluation of interpretation, decision making and problem solving skills. Each station required 5 minutes of time. All stations were capable of being completed in the same time. The students were rotated through all stations and had to move to the next station at the signal. Since the stations were generally independent, students could start at any of the procedure stations and complete the cycle. Different sets of questions were given for each of these stations. Answer keys were prepared before hand. For each station, 05 marks were allocated and five stations had total 40 marks. Pass marks for both examinations were set at 50%.

The collected data were analyzed using SPSS program version 17. Cross tabulation was done to observe the congruence of two methods. Chi square test of significance was applied to evaluate the statistical difference in the results of two methods and p value of < 0.05 was considered as the cut off point.

**RESULTS**

In the OSPE examination 46 candidates were declared as successful (33 females and 13 males) while 6 were declared unsuccessful (4 females and 2 males). In CPE 50 were successful (36 females and 14 male) and 2 failed to satisfy the examiners. (1 female and 1 male). Females performed better in both examination formats as pass percentage of females was 63.5% in OSPE and 69.2% in CPE as opposed to males which was 25% in OSCE and 26.9% in CPE.

**TABLE 1: DESCRIPTIVE STATISTICS OF MARKS OBTAINED IN CPE AND OSPE**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
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<tbody>
<tr>
<td>Marks in OSPE</td>
<td>52</td>
<td>15</td>
<td>38</td>
<td>28.17</td>
<td>6.594</td>
</tr>
<tr>
<td>Marks in CPE</td>
<td>52</td>
<td>18</td>
<td>38</td>
<td>26.55</td>
<td>5.406</td>
</tr>
</tbody>
</table>
Comparative performance of undergraduate students

The overall performance was assessed in five grades (excellent, above average, average, below average and poor) according to the marks obtained. In OSPE 8 students had excellent performance and 5 were poor. In CPE maximum number of students fell in the category of below average as shown in table 2 and table 3.

With the common perception that a good student performs well in all modes of assessments, the results of both examinations system were compared through cross tabulation to determine that if there is similar performance of students in both cases. The results of cross tabulation are shown in table 4.

Chi square test was used to determine the statistical difference of the results achieved through both methods. The calculated p value was 0.007 which is statistically significant.

**DISCUSSION**

Dentistry is a profession that requires a broad understanding of a diverse spectrum of healthcare and basic sciences together with specific education in oral sciences. It is termed as surgically based profession requiring good hand skills, well trained perceptive skills, and psychomotor mastery. In preparation for graduation, students must demonstrate a variety of acquired learning outcomes, which in turn demand variety in learning and teaching methods. In order to educate a dentist to become competent; learning and teaching methods should be based on educational need. Undergraduate dental education aims to produce safe, competent and ethical practitioners equipped with the necessary knowledge, skills, problem solving talents and behaviors (attitudes) appropriate to the safe, effective and independent practice of dentistry. In the present era of transparency and right to information, it is the duty and moral responsibility of all the teachers and medical educationalists to standardize the examination system, eliminate various biases and lacunae of the existing system and bring in place a more transparent, timely, objective and appropriate methodology of examination.

Presently, for summative assessment in undergraduate Orthodontic examination conducted by University of Health Sciences Lahore, the practical examination entails, asking the candidate to trace, analyze and diagnose a lateral Cephalogram along with fabrication of a removable appliance. It starts with a chance factor as every candidate gets a different radiograph and dental cast for wire bending. Candidates are tested on different cases of different difficulties and judged on different standards by different examiners. So validity and reliability of the results are often questionable. It also incorporates subjectively, as the

<table>
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<th>TABLE 2: PERFORMANCE OF STUDENTS IN OSPE</th>
<th>TABLE 3: PERFORMANCE OF STUDENTS IN CPE</th>
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<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td><strong>Percent</strong></td>
</tr>
<tr>
<td>Excellent (36-40)</td>
<td>8</td>
</tr>
<tr>
<td>Above av. (31-35)</td>
<td>13</td>
</tr>
<tr>
<td>Average (26-30)</td>
<td>13</td>
</tr>
<tr>
<td>Below av. (21-25)</td>
<td>13</td>
</tr>
<tr>
<td>Poor (below 20)</td>
<td>5</td>
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<th>TABLE 4: CROSS TABULATION OF RESULTS OF CPE AND OSPE</th>
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<tr>
<td><strong>CPE</strong></td>
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<tr>
<td><strong>Excellent</strong></td>
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<tr>
<td>Excellent</td>
</tr>
<tr>
<td>Above av.</td>
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<tr>
<td>Average</td>
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<tr>
<td>Below av.</td>
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<td>Poor</td>
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<td>Total</td>
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student is evaluated later on the basis of few orally asked questions, some of which may even not be relevant to the practical component performed earlier. Also, variability in examiners and selection of Cephalograms for tracing affects grading in conventional system.

This Conventional form of assessment that entails a practical exam followed by viva voce is “norm referenced” where more emphasis is given on comparison between students rather than individual achievements. The marks awarded, reflect only the general performance of the candidate without evaluating the individual competencies. Outcome does not match with the purpose of examination due to problems of non-objectivity in the whole procedure, lacking the test of attitudes as well. The examiners stress on the correctness of the final result and do not judge or concentrate on the student’s ability to perform and get the observations/result of the practical component.

In order to encourage deep learning, students should be encouraged to relate ideas to their previous knowledge and experience, checking the evidence and relating it to conclusions. They should use logical arguments to support their assertions and it is hoped that the viva-voce, as described here, is a suitable forum to test these skills.

On the other hand viva voce, having maximum marks, in our Conventional system of assessment are prone to many errors. These include errors relating to the halo effect (judgment of one attribute influences judgments of others), errors of central tendency and general tendency towards leniency, and errors of contrast (judgments of a candidate influenced by impressions of preceding candidates). It is, moreover, difficult to establish in any formal way the validity of an oral examination. When the orthodontic undergraduate education was assessed in modern curriculum, viva-voce was pointed out to be the most controversial method of assessment. Hence it provides a unique programmatic evaluation.

Main benefit of OSPE is that both the examination process and the examinee are evaluated by giving importance to the individual competencies and the standard to check the competencies are made earlier with agreed check lists. The students are tested from wider sphere of cognitive, psychomotor and communication competency skills as compared to Conventional practical examination. It has got increased validity and reliability. Other benefits include removal of variability, more student interest, evaluation of large no of students in short time, easy modifications as per institutional circumstances, use of simulations and scope for immediate feedback. Hence it provides a unique programmatic evaluation.

In the present study when these two assessment modes were compared, our first observation was a significant variation in the marks obtained by the same student in both assessments. It is generally expected that good students would do well in any form of evaluation. Since this was not observed we presume that the various assessment methods assess different capabilities of the students. OSCE categorically differentiates excellent students from poor performers as it is a pure performance based mode of assessment which is uniform for all students. This can be appreciated by the fact that it labeled 8 students as excellent and 5 poor while CPE labeled 3 excellent and 2 poor. When the performance of candidates was assessed on the basis of marks achieved, majority of them were in below average category, albeit successful when assessed through CPE. This disparity may be attributed to its viva component. During viva, the student performs in front of the examiner and even a good student may get stressed; affecting the overall performance. In addition to interpersonal skills, the viva voce measures personal attributes like personality, alertness, reactions to stress, confidence and self-awareness along with Orthodontic knowledge and competence. It is known that the element of personal attributes may affect the result of viva. There is interaction between examiner and candidate. The candidates’ fate is in their own hands. If they make a competent assessment and develop appropriate management strategies, the viva-voce is a very friendly exchange. However, if he/she makes errors, the examiners can challenge the...
management outlined and the candidate may get confused.7

CPE graded 11 students as above average, 16 as average and 20 as below average. On the other hand, according to OSPE average, below average and above average candidates were in equal ratio that is, 13 each. The better performance in OSPE can be attributed to the fact that Student take more interest in OSPE due to variety and keep themselves alert during the whole process of examination, which is not found in conventional one. Sometimes, after practical exam, the student has to wait for viva for his turn which adds to the element of stress and fatigue. It is also noted that during viva the student has to justify himself on one point in which he might get fail. So the viva tends to test at a low taxonomic level, factual knowledge rather than problem solving.7 The questions in viva may be of variable difficulty and the scores have an added component of subjectivity. This may be the reason of more students falling in the criteria of below average in case of CPE. The viva voce in addition, is not free of examiner bias as it lacks anonymity.7 So the OSPE splits students into a large number of groups in terms of measured competence or discriminates between different levels of competence better than the Conventional Method of Examination.

Our results have another interesting implication, that is, same students are not generating similar results when judged by different modes of assessments. This is further proved by the p value which is statistically significant. It can therefore be presumed that the grades of same students are affected if they are evaluated with different modes of assessment.

When cross tabulation was done between the results generated by both assessment tools, there was very little agreement in most of the cases and in some there was absolutely no agreement at all. This further suggests that these two modes are evaluating students on different grounds. Importantly, these results have no implication that one or both of these methods is not valid and reliable. A few questions emerge from this. Firstly, should we expect the different instruments of assessment to yield similar results? Secondly, if they do, does it mean that they are testing the same domain and in that case, should they be continued together or not?

To answer these questions we must look into the association of OSCE and other assessment tools. OSCE has shown positive correlation with other forms of assessment like ward evaluation, American Board of Surgery In training Examination (ABSITE), short answer questions and subjective rating.21,22 However basic science scores and MCQs showed no correlation to OSCE.23,24 Hence there is no generalization that all assessment tools must correlate. If there is similarity between the instruments it could be that we are testing the same skills12. If the results don’t correlate there is a possibility that these methods are testing different abilities of the students. We must however keep in mind that there is no gold standard for assessment and so we cannot say which method is better.21 Clearly no single test fulfills the criterion of a good examination and the different methods may complement each other.

Bearn and Chadwick assessed Orthodontic undergraduate learning in modern curriculum and concluded that the active learner must be assessed on their knowledge of their subject but Conventional Assessment does little to reward and encourage a variety of other skills. According to them the educators must adopt assessment strategies to ensure that cognitive knowledge is tested, but the wider aspirations of learning should not be forgotten.7

Considering the present clinical training of undergraduate students in dental institutes, incorporation of OSPE based teaching/assessment along with Conventional Methods can be strongly considered. OSPE has many attributes that advocate its acceptance and implementation for the assessment of procedural skills in orthodontics (as in impression taking, activation of removable appliances). An OSPE is not intended to be the single method for clinical evaluation. More Conventional methods such as written (essay-type or multiple choice questions) and oral exams should be used as additional modes of assessment.7 The more important point of introducing the OSPE as an assessment tool in dentistry for clinical teaching/assessment is to make use of its “steering effect” on student learning. The steering effect of examinations is well known. It means that students learn best those subjects on which they expect to be examined. This effect should be taken into account when evaluating students.20 Thus, when the student bears in mind that he/she will be expected to perform well in an OSPE, then he/she will really have to learn the necessary skills.

However, resistance may develop when changes are introduced into an organization. An explanation of the resistances to change may lie in three aspects: (i) logical, rational objections, (ii) psychological, emotional objections, and (iii) sociological factors and group
interests.\textsuperscript{11} When a change in assessment methods (e.g., an OSPE) is developed, its introduction must be carefully implemented in order to gain acceptance and to minimize the occurrence of defensive behavior from (dental) teachers and students.\textsuperscript{17}

The OSPE, if constructed properly may complement other methods of assessment as it allows us to directly observe the student, give similar questions to all students, check on minute details in order to standardize and focus our evaluation, to be more objective and unbiased in marking. On the other hand our conventional methods allow for an in-depth analysis of the subject, with more interaction between the examiner and the student. The examiner's professional judgment and experience can make the examination a learning exercise as it provides an instant feedback to the student. These advantages justify their inclusion.\textsuperscript{5}

CONCLUSIONS

There is a statistical difference in the results of same students when they were assessed through OSPE and Conventional practical examination. The OSPE can compliment the existing system of examination to take benefit in terms of objectivity and reliability. This may improve the standard of assessment.

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