ASSESSING AND IMPROVING REMOVABLE PARTIAL DENTURE LEARNING OUTCOME BY USING PROFICIENCY TESTS RESULTS

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Abstract

Background: Feedback of the weak areas of knowledge in RPD using continuous competency or other test forms is very essential to develop the student knowledge and the syllabus as well. This act should be a regular practice.

Aim: To use the outcome of competency test and the objectives structured clinical examination of removable partial denture as a reliable measure to provide a continuous feedback to the teaching system.

Method: This sectional study was performed on sixty eight, fifth year students for the period from 2009 to 2010. The experiment was divided into two parts: continuous assessment and the final examination. In the first essay; some basic removable partial denture knowledge, surveying technique, and designing of the metal framework were used to estimate the learning outcome. While in the second essay, some components of the objectives structured clinical examination were compared to the competency test to see the difference in learning outcome.

Results: The students’ performance was improved in the final assessment just in some aspects of removable partial denture. However, for the surveying, the students faced some problems.

Conclusion: the continuous and final tests can provide a simple tool to advice the teachers for more effective teaching of the RPD. So that the weakness in specific aspects of the RPD syllabus can be detected and corrected continuously from the beginning, during and at the end of the course.

Keywords: Competency test, OSCE, removable partial denture teaching.

1 INTRODUCTION

The success or failure of removable partial denture (RPD) service depends on the proficiency of the dentist in the treatment planning and attitude. Holt summarized the lack of confidence in producing designs by the dentist and insufficient exposure to clinical practice causes the delegation of responsibility[1]. This problem of designing RPD should be resolved at the level of lectures, preclinical, and later clinical teaching by increasing the number of given examples and make the students apply a complete knowledge under interactive supervision. RPD course whether preclinical or clinical should inspire its design from Fink principles for establishing good course design. These principles should challenge students to higher level learning that includes problem solving, decision-making, critical and creative thinking. The course should use a structured sequence of different activities, such that earlier classes lay the foundation for complex and higher level learning tasks in later classes and it should give frequent and immediate feedback to students on the quality of their learning at the same time has a fair system for assessing and grading the students[2].

For example, in UK and Ireland, while dental educational programmes in RPDs are of high quality, there are areas of concern make ensuring student competence in removable prosthodontics is a challenging task. The understanding of why there is weak areas of student understanding and application of design concept that respects the oral health integrity is necessary to further develop dental education programmes in RPD prosthodontics to ensure that graduating dental students are best prepared for independent clinical practice. Many variations were noted between dental schools in both the amount and content of teaching programmes. As a result, the experience gained by undergraduate students in dental schools is limited, and appears to be hampered by limited access to patients suitable for undergraduate teaching [3].

The teaching effectiveness is another issue for successful learning. It is influenced by three main factors; educator, student attitude, and environment factors. The educator should accept students’
autonomy, initiative and leadership. His lessons should be organized around students’ thinking and ask open ended questions, increase students’ wait time while questioning, give chance for students to elaborate, effective group process for students to collaborate with others. In addition, he should recognize students’ misconceptions and design lessons and focuses on subjects that are familiar to students. He should address the association between facts and particular locations, and he should teach broad concepts(4). On the other hand, the student attitude should encourages working together, have patterns of thought that lead from observations to explanations and reasonably sceptical, they should be willing to modify present beliefs and explanations, and they have desire of knowledge [4]. In addition to the environment factors that include the person’s daily routine, people around, motivation more easily prey to sensory and mental distraction, participant’s accounts-inappropriate level of task difficulty and teacher-student interpersonal relationship[5].

Assessment is another important concern in teaching because it provides information about the different learning outcome issues. For example, it is used to diagnose learner strengths and needs, and to provide feedback on teaching and learning. In addition to other advantages like granting a basis for instructional placement, informing and guiding instructions, and more such as to communicate learning expectations and to motivate and focus learner attention and effort in order to guarantee practice applying knowledge and skills, and finally to gauge programme effectiveness [6]. Test designing is an essential concern for better assessing the learner, program, and the lecturer. Therefore, well-designed tests serve to motivate and help students structure their academic efforts. Researchers reported that students study in ways that reflect how they think they will be tested. If they expect an examination focusing on facts, they will memorize details; if they expect a test that will require problem solving or integrated knowledge, they will work toward understanding and applying information [7],[8].

Assessments have many forms and objectives. For example, continuous assessment serves as a diagnostic tool to understand the areas in which students have difficulty. In addition, it allows the conscious teachers to monitor the impact of their lessons on student understanding so that they can modify their pedagogical strategies to include remediation activities for under expected work level pupils and to create enrichment activities for pupils who are working at or above the expected grade level. Hence, the continuous assessment process supports a cycle of self-evaluation and pupil-specific activities by both pupils and teachers [9]. In addition, continuous assessment becomes instructionally important when learners apply the scoring tools for peer and self-evaluation. Such involvement helps learners to internalize the elements of quality embedded in the scoring criteria [10],[11].

The OSCE examination was structured in that the questions had a well defined marking system with predetermined answers and pass/fail criteria. It was also structured in that it comprised of a series of consecutive timed stations, and was clinical in that these stations comprised scenarios to test specific clinical skills including diagnosis, interpretation and treatment planning [12]. One of the main strengths of the OSCE examination is its inherent objectivity whereby the aim is to remove patient and examiner variation so that the only variable being examined is the ability of the candidate. Other advantages of the OSCE system include the flexibility and versatility made possible by the multiple station design. This means that it is possible to examine a range of skills and disciplines and even to incorporate more than one skill or discipline simultaneously in the design of a particular station [13]. The final OSCE serves as an assessment tool to measure the clinical competency of the students in most medical and dental institutes. In fact, it represents an assessment of accumulated clinical experience of the students but in more objective way to reduce the bias of the patient and supervisor. Therefore, OSCE is already connected to the continuous competency tests as it is essential global test for the final year student that assess any clinical knowledge or skill learnt during the years of academic study.

In today's busy dental offices, RPD design is often renounced by dentists, both because of an experience lack and because of educational failure on the part of dental schools. The result is delegation of the clinical design process to the lab technician. The lack of clinical data provided to the dental technician jeopardizes the quality of care [14]. In summary, removable partial denture is an essential restorative option to the patient providing that careful diagnosis and treatment planning was establishing good periodontal health, and achieving excellent oral hygiene by using biologically protective design.

The objectives of this study was to assess and compare the competency and the final objective structured clinical examination (OSCE) of the 5th year students in removable partial denture basic
knowledge in a detailed manner and to use the outcome to enhance and update the removable partial denture curriculum and teaching methodology.

2 METHODOLOGY

This research is a cross-sectional study involving the fifth year student for the period from 2009 to 2010. The study concerned the analysis of the outcome of the competency tests of RPD metal framework design in addition to some clinical and preclinical important knowledge. 66 students were participated in this study except who repeated their study. The students were divided into six nearly-equal groups (A, B, C, groups included 10 students each one while for D, E, F, incorporated 12 students). The study was performed into the following sequences;

2.1 The Continuous Assessment Comprise

2.1.1 Primary Assessment of The RPD General Basic Knowledge

31 short questions were prepared as slide show. It covered some important basic clinical RPD knowledge. The Answer forms were distributed among the students so they can directly and easily write down their answers in organized, structured method to standardize the marking. Two minutes have been allocated for each question, as time pass by, the slide will change to the next question automatically. The components of the test are shown in Tab 1.

The answer forms were corrected by the students themselves in a special session allocated for this purpose. Therefore, another slide show to present the questions with the ideal answer format was prepared. The lecturer acted as a moderator after addressing of short briefing on how to correct the answers so that the candidates can react freely to evaluate the answering scheme in case that it contained correct information but had not been followed the ideal format. Another check up of the student correction of the answers was made by two independent examiners (after briefing and calibration of their results using reliability test as a guide to accept or to repeat the calibration procedures). The final checking was performed by the lecturer to confirm the consistency of the marks given after successful reliability test of the independent assessors. The results were regrouped under the main subject categories so that the lecturer can be advised on the weak areas in the students' knowledge and on which topic of the RPD information he should emphasised. So that, the weak areas of RPD knowledge were addressed by series of interactive extra tutorials.

<table>
<thead>
<tr>
<th>Tested Teaching Components</th>
<th>Number Of Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveying</td>
<td>5</td>
</tr>
<tr>
<td>RPD components; name, dimension, indications</td>
<td>15</td>
</tr>
<tr>
<td>RPD framework design error identification</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
</tr>
</tbody>
</table>

Tab. 1 The summary of the slide show examination

2.1.2 Secondary Assessment: Surveying and Designing the RPD Frame

This assessment included practical surveying of the cast, designing the RPD frame on the paper and transferring it to a stone cast. 11 partially edentulous casts were randomly selected from a pool containing more than 60 different casts according to the following criteria: (Fig. 1).

The most commonly encountered cases in daily practice, some difficult partially edentulous cases, equality of distribution of maxillary and mandibular casts, two cases with torus (maxillary and mandibular) should be included, and the casts should be randomly distributed to the students.
Fig. 1 The selected casts for the surveying, designing of the RPD framework.

<table>
<thead>
<tr>
<th>Class Type</th>
<th>Maxillary No.</th>
<th>Mandibular No.</th>
<th>Total Maxillary</th>
<th>Mandibular No.</th>
<th>Total Mandibular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I mod 2</td>
<td>5</td>
<td></td>
<td>30</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Class IV</td>
<td>5</td>
<td></td>
<td>30</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Class IV mod 1</td>
<td>11</td>
<td></td>
<td>14</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Class II mod 1</td>
<td>6</td>
<td></td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Class II mod 2</td>
<td>7</td>
<td></td>
<td>7</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

2.1.2.1 The Evaluation Checklist of Surveying Technique:

The ideal surveying technique was divided into 6 steps (Fig. 2). Every step was given 1 mark and five minutes were assigned for each student to survey the cast. The surveying procedures were assessed by one examiner on the spot.

Fig. 2 Surveying technique and marking checklist

1. Zero-tilt position
2. Path of insertion
3. Surveyline
4. Undercut depth
5. Marking undercut
6. Record depth on cast

Total :6 marks
2.1.2.2 Designing Co-Cr Frame Work

Once the student finished the surveying of the cast, he started the designing of the metal framework on a special paper. Each student was given 10-15 minutes to finish the RPD framework design and to duplicate the design to the cast. The design papers were collected immediately.

2.1.2.3 Assessment Checklist of The RPD Design

The RPD design was analyzed following a simple descriptive method; The framework is composed of 8 main components. These include the rest, direct retainer, reciprocal arm, indirect retainer, guiding plane, gingival protection (clearance), major connector and the base (saddle). Each component was given (1) mark when drawn and applied correctly in the framework. On the other hand, when it was wrongly designed, used or placed, it was given (0). The amount of gingival protection or clearance was set at ≥ 6 mm for maxillary anterior teeth and premolars, ≥ 8 mm for the molars. While, for mandibular teeth, anteriorly and posteriorly ≥ 4 mm. The results were displayed as percentage of correct use (Tab 2) [15]. For each partially edentulous case, acceptable designing principles that have been approved by three lecturers were applied for analysis and marking of the student RPD designs.

<table>
<thead>
<tr>
<th>No</th>
<th>RPD Component</th>
<th>Mark For Incorrect/Correct Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rest location, use, number</td>
<td>0/1</td>
</tr>
<tr>
<td>2</td>
<td>Direct retainer use, number</td>
<td>0/1</td>
</tr>
<tr>
<td>3</td>
<td>Reciprocal arm</td>
<td>0/1</td>
</tr>
<tr>
<td>4</td>
<td>Indirect retainer</td>
<td>0/1</td>
</tr>
<tr>
<td>5</td>
<td>Guiding plane</td>
<td>0/1</td>
</tr>
<tr>
<td>6</td>
<td>Gingival protection use, amount</td>
<td>0/1</td>
</tr>
<tr>
<td>7</td>
<td>Major connector</td>
<td>0/1</td>
</tr>
<tr>
<td>8</td>
<td>Saddle or base</td>
<td>0/1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>0-8</td>
</tr>
</tbody>
</table>

Tab. 2 The check list of RPD design marking

2.2 Prosthetic Final Professional Examination

Three components of the 5th year OSCE were considered for comparison with the continuous competency assessment. These components were shown in Tab.3. Each student was given a master cast and asked to perform complete surveying within 5 minutes in the presence of the proctor. The same evaluation form of the competency tests was used for this section. The next station was designing the metal frame for a partially edentulous cast approved by the committee of the OSCE. The cast was Kennedy class IV with missing anterior teeth in addition to the right premolars and molars except the right second molar. The other exam component was to identify RPD errors in 3 frames (Fig. 3).

<table>
<thead>
<tr>
<th>Subject</th>
<th>Procedures tested</th>
<th>Time</th>
<th>No. of station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast surveying</td>
<td>Surveying technique-same checklist (Fig. 2)</td>
<td>5 minutes</td>
<td>1</td>
</tr>
<tr>
<td>RPD design</td>
<td>Design RDP framework</td>
<td>10 minutes</td>
<td>2</td>
</tr>
<tr>
<td>RPD errors</td>
<td>List of errors in RPD</td>
<td>5 minutes</td>
<td>1</td>
</tr>
</tbody>
</table>

Tab 3 The selected components of the final OSCE for comparison with the competency test
2.3 Comparing The Results

The results of similar exam section assessment of the OSCE were compared to the competency test using simple descriptive statistics. The final outcome of the compared components regarding the two examinations was summarized and arranged under main categories and addressed as a feedback to the coordinator of RPD teaching in the department. The coordinator is responsible for accumulating the learning outcome of RPD knowledge from different resources and lecturers and arrange extra teaching sessions in the form of practical lessons, interactive tutorials or any other mode that help in amelioration of the weak areas in the RPD knowledge for the different faculty levels.

3 RESULTS

The results of the two assessors records were highly correlated (at p<0.05) (Tab 4). This indicates that each examiner opinion reflects the other in the study. So that, the two assessors can collaborate effectively to reduce the time and to increase the precision output of the result.

<table>
<thead>
<tr>
<th></th>
<th>1st observer</th>
<th>2nd observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st assessor</td>
<td>Pearson Correlation</td>
<td>.880**</td>
</tr>
<tr>
<td>N</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>2nd assessor</td>
<td>Pearson Correlation</td>
<td>.880**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

Tab 4 The inter-observer reliability

3.1 The Comparison Between The Competency Test and Final Examination

3.1.1 Surveying of the Cast

The candidates showed obvious improvement in some steps of surveying technique in the final OSCE compared to the surveying during the continuous assessment. (Fig. 4). However, the scores of achievement were still low in measuring the undercut depth, marking the undercut depth location on the cast, and recording the depth against the abutment on the cast.
3.1.2 The Designing Performance Of RPD

The student’s improvement was obvious in placing the rest correctly, performing gingival protection, indirect retainer, and forming the base. However, the indication of direct retainers as well as reciprocation and guiding planes were declined as shown in Fig. 5.

Fig. 5 The comparison of RPD design between continuous and OSCE tests

3.1.3 Error’s Identification In The RPD Frame

The students’ ability in design was dramatically improved in final examination compared to continuous assessment (Fig. 6).

Fig. 6 The comparison of RPD error’s identification between continuous and OSCE

4 DISCUSSION

In this study, the continuous assessment and the final OSCE results were used as interactive resources to identify the weak areas of RPD knowledge whether theoretic or practical. The continuous assessment is a classroom strategy implemented by teachers to ascertain the knowledge, understanding, and skills attained by students. The teachers will administer assessments in a variety of ways over time to allow them to observe multiple tasks and to collect information about what pupils know, understand, and can do. This method has been proven useful in education as it supports a cycle of self-evaluation and student-specific activities by both students and teachers[9]. The continuous assessment process is not only used to assess students’ achievement, but it enables them to understand the areas in which they have difficulty. At the same time, the teachers are able to monitor the impact of their lessons on students’ understanding, and remediation activities can be constructed accordingly[9]. In this study, a primary assessment has been carried out as an initial evaluation of students’ performance. At the end of primary test, they participated in correction, and discussion of the answers to evaluate their knowledge as well. In addition, the results were used as a feedback to emphasize on the weak areas of the student performance. The second assessment has been carried out as a process evaluation activity. The assessment is constructed to mimic the final examination question. The most relevant RPD framework design steps were evaluated systematically, starting by master cast surveying, and ending by designing the frame with explanation of each dimension components. Using this assessment, the teacher and students as well are more capable to identify the strength and weakness areas in RPD framework design. At the end of the study, the students’ knowledge was tested again during OSCE and the result was compared to see the progress or the declination.
Practical slide test (PST) is a common test used in histology, anatomy, dental material, and more areas. This is an easy and low cost method of evaluation. Using this method, the examiner is able to standardize the timing of each question and large group of students can be examined. In most cases, picture identification question is set in this test. Due to this reason, the test is useful to assess students’ basic knowledge, but not in depth. Laboratory test (LT) This is a practical test, which mainly investigates the knowledge and the fine motor skills. As the students are divided into 6 groups and all students in same group have different type of cast model, plagiarism is avoided. If this type of test is well prepared, it enables the assessor to evaluate every single step in designing RPD framework. The Objective structured clinical examination is used to test students’ skill in the clinic. OSCE is considered a valid and reliable test for students’ clinical skill assessment. However, this method requires that the students move from station to another and the time for each question need to be same. One of the disadvantages of OSCE is the limitation to cover the whole clinical areas and the students’ feedback like objections regarding the allowed timing, the need for practicing to avoid reticence in moving in-between stations, always minimize the effectiveness of this examination.

At the beginning of the study, the students’ knowledge in RPD was unsatisfied. This may due to lack of awareness regarding the importance of RPD knowledge. Besides, this is a pop quiz. Therefore, this type of assessment gave the real knowledge of the student in the daily live.

The assessment of surveying knowledge and technique showed that most of the students were able to perform cast zero-tilt, record survey line and measure undercut depth. However they failed to record the path of insertion, mark and record the undercut depth on the cast. The students start to learn surveying in their second year. During that time, they haven’t started their clinical practice, so it is hard for them to learn the importance of surveying without relating the influence inside the oral cavity. During the clinical practice, the students design RPD framework on a paper. I think that this method never help the student to imagine the 3 dimensions configuration of the framework and the complexity of this task. In the final examination, the students had shown improvement in every step of the surveying technique. However, the score of marking and recording undercut depth remained unsatisfactory. One of the reasons may be the limited time for practicing surveying in second year (2 sessions). Other reasons concern the limited teaching technical knowledge offered by the teachers (whether lecturers, or technicians) during the preclinical year. In overall, the interactive tutorials and seminars should be encouraged to improve students’ surveying knowledge and technique.

During second assessment, the students were able to design the indirect retainer and saddle satisfactorily. However, they failed in designing the rest, direct retainer, reciprocation, guide plane, gingival protection and major connector. Before the study, the teaching method was mainly in the form of lectures. This theoretic-only approach might limit the given knowledge and how to apply routinely (especially in case of frame design). No tutorial or/and seminars were given before. In the same time, the method of addressing the importance of protecting the periodontal and gingival tissues by modifying the major connector design was not updated in the basic RPD design lectures. When the syllabus organisation is considered as another cause, the components and design of RPD framework were taught in separated lectures by different back ground and experience lecturers. The result was break down of learning flow with variable or missed evidence-based teaching and the students have never been taught how to design a more biologically friendly RPD framework.

In the final exam, the students showed improvement in designing rest, indirect retainer, gingival protection and saddle. However, their score of rest, direct retainer, reciprocation, guide plane, gingival protection and major connector were remain unsatisfactory.

The students’ result in RPD framework design test may be affected due to the different assessment methods used. Laboratory test was used in continuous assessment while OSCE was used in final exam. The times provided for the framework design was less than 20 minutes. In OSCE, students need to move to next station every 5 minutes which does not happen in laboratory test. The final exam covers all topics in prosthetic subject, so the students did not solely concentrate on RPD framework design. Meanwhile, they can use the time for framework designing to answer other questions.

As the style of questions that had been tested during primary assessment was repeated in the final exam, the students’ result in RPD error identification had dramatically improved. This has shown that, students have great improvement in task they have learnt before. Therefore, past experiences are very important in RPD framework design errors identification.

The revision of the syllabus components regarding RPD especially during the preclinical stage becomes impulsive and a must. During the clinical study, the identification of fabrication and designing
errors become very important task that should be introduced as a method to assess the final knowledge of the graduated students.

The role of coordinator should be encouraged and supported by the other lecturers to provide continuous interactive flow of information so that he can do the necessary steps in enhancement of the teaching and learning effectiveness of the students by allocating new lectures, seminars, tutorials or practical sessions. This proposed assessment method can be applied each year to provide feedback information about the students and the syllabus status.

5 CONCLUSIONS

With in the specific nature of this study; the students’ knowledge in surveying was not satisfactory. However, the identification of design errors was satisfactory. In addition, their knowledge in RPD framework design was weak especially in selecting of the direct retainers.

The students’ knowledge in surveying and RPD framework design errors identification were significantly improved at the end of the study. However, the result of RPD framework design remains unsatisfactory in general.

The components of RPD framework design and the procedures of fabrication can be tested and the students’ weakness in each specific component can be identified clearly. This result is very important for future further improvement. The laboratory assessment was more effective to test students’ knowledge in RPD framework designing as the test was more specific. While OSCE is more suitable in cast surveying techniques and RPD framework design errors identification assessment.

REFERENCES


